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3.9 Birds

Final
Environmental Impact Statement/Overseas Environmental Impact Statement
Hawaii-Southern California Training and Testing

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3.9 BIRDS

PREFERRED ALTERNATIVE SYNOPSIS

The United States Department of the Navy (Navy) considered all potential stressors that birds could be exposed to from the Proposed Action. The following conclusions have been reached for the Preferred Alternative (Alternative 1):

- Acoustics: Navy training and testing activities have the potential to expose birds to a variety of acoustic stressors. The exposure to underwater sounds by birds depends on the species and foraging method. Pursuit divers may remain underwater for minutes, increasing the chance of underwater sound exposure. The exposure to in-air sounds by birds depends on the activity (in flight or on the water surface) and the proximity to the sound source. Because birds are less susceptible to both temporary and permanent threshold shifts than mammals, unless very close to an intense sound source, responses by birds to acoustic stressors would likely be limited to short-term behavioral responses. Some birds may be temporarily displaced and there may be temporary increases in stress levels. Although individual birds may be impacted, population level impacts are not expected.
- Explosives: Navy training and testing activities have the potential to expose birds to explosions in the water, near the water surface, and in the air. Sounds generated by most small underwater explosions are unlikely to disturb birds above the water surface. If a detonation is sufficiently large or is near the water surface, however, birds above the pressure released at the air-water interface could be injured or killed. Detonations in air could injure birds while either in flight or at the water surface; however, detonations in air during anti-air warfare training and testing would typically occur at much higher altitudes where seabirds and migrating birds are less likely to be present. Detonations may attract birds to possible fish kills, which could cause bird mortalities or injuries if there are multiple detonations in a single event. An explosive detonation would likely cause a startle reaction, as the exposure would be brief and any reactions are expected to be short-term. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected.
- Energy: The impact of energy stressors on birds is expected to be negligible based on (1) the limited geographic area in which they are used, (2) the rare chance that an individual bird would be exposed to these devices in use, and (3) the tendency of birds to temporarily avoid areas of activity when and where the devices are in use. The impacts of energy stressors would be limited to individual cases where a bird might become temporarily disoriented and change flight direction, or be injured. Although a small number of individuals may be impacted, the impact at the population level would be negligible.

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- Physical Disturbance and Strike: There is the potential for individual birds to be injured or killed by physical disturbance and strikes during training and testing. However, species or population level impacts would not occur due to the vast area over which training and testing activities occur, the comparatively small size of birds, and their ability to flee disturbance.
- Entanglement: Entanglement stressors have the potential to impact birds. However, the likelihood is low, since certain activities take place in specific locations or depth zones within the Study Area outside the range or foraging abilities of most birds. A small number of individuals may be impacted, but no direct impacts at the population level would be expected.
- Ingestion: It is possible that persistent expended materials could be accidentally ingested by birds during foraging. The likelihood of ingestion is low since (1) foraging depths of diving birds is generally restricted to the surface of the water or shallow depths, (2) the material is unlikely to be mistaken for prey, and (3) most of the material remains at or near the sea surface for a short length of time. No population-level effect to any bird species would be anticipated.
- Secondary: There would be relatively localized, temporary impacts from water quality (turbidity) which may alter foraging conditions, but no impacts on prey availability.

3.9.1 INTRODUCTION

This chapter provides the analysis of potential impacts on birds found in the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area). This section provides an introduction to the species that occur in the Study Area.

The affected environment provides the context for evaluating the effects of the Navy training and testing on birds. Because birds occur throughout the Study Area along shorelines, on the surface of the water, in water column and shallow bottom habitats, and are airborne over these habitats, Navy activities within these habitats could potentially impact many individuals and species, including members of diverse groups, Endangered Species Act (ESA)-listed species, species protected under the Migratory Bird Treaty Act, and U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern.

Following sections include Section 3.9.2 (Affected Environment), which provides a description of baseline conditions and brief introduction to the species and major taxonomic groups that occur in the Study Area; Section 3.9.3 (Environmental Consequences); and Section 3.9.4 (Summary of Potential Impacts on Birds). Throughout this chapter, particular consideration is given to ESA-listed species, species protected under the Migratory Bird Treaty Act, and the USFWS Birds of Conservation Concern.

3.9.2 AFFECTED ENVIRONMENT

Three subsections are included in this section. General background information is given in Section 3.9.2.1 (General Background), which provides brief summaries of group size, habitat use, dive behavior, hearing and vocalization, and threats that affect or have the potential to affect natural communities of birds within the Study Area. Protected species listed under the ESA are described in

Section 3.9.2.1.5.6 (Endangered Species Act-Listed Species). Section 3.9.2.3 (Species Not Listed Under the Endangered Species Act) describes birds not listed under the ESA, including major taxonomic groups and migratory birds protected under the Migratory Bird Treaty Act.

3.9.2.1 General Background

There are approximately 220 species of birds that regularly occur in the Study Area (Baird, 1993; Pyle & Pyle, 2017; Sibley, 2014). Most of these are waterbirds — birds that live in marine, estuarine, and freshwater habitats. Waterbirds include seabirds, wading birds, shorebirds, and waterfowl, as described in more detail below. The remainder of species that may be encountered in the Study Area are landbirds that are coastal resident species that live on land but forage in the adjacent coastal waters.

Seabirds – birds that forage primarily on the open ocean - are of particular interest as the group of birds with the broadest distribution and exposure to Navy activities in the Study Area. Seabirds are a diverse group that are adapted to living in aquatic environments (Enticott & Tipling, 1997) and, in the Study Area use coastal (nearshore) waters, offshore waters (continental shelf), or open ocean areas (Harrison, 1983). There are many biological, physical, and behavioral adaptations that are different for seabirds than for terrestrial birds. Seabirds typically live longer, breed later in life, and produce fewer young than other bird species (Onley & Scofield, 2007). The feeding habits of seabirds are related to their individual physical characteristics, such as body mass, bill shape, and wing area (Hertel & Ballance, 1999). Some seabirds look for food (forage) on the sea surface, whereas others dive to variable depths to obtain prey (Burger, 2001). Many seabirds spend most of their lives at sea and come to land only to breed, nest, and occasionally rest (Schreiber & Chovan, 1986). Most species nest in groups (colonies) on the ground of coastal areas or oceanic islands, where breeding colonies number from a few individuals to thousands. However, many species are distributed nesters, and some seabirds/waterbirds are cavity nesters. Typical bird behavior to be encountered within the Study Area would include breeding, foraging, roosting, and migration. Beaches and wetlands within or bordering the Study Area may also be used as molting grounds by some species.

Additional information on the biology, life history, and conservation of bird species, including species-specific descriptions, is available from the websites of these sources:

- USFWS Migratory Bird Program and Endangered Species Program
- Birdlife International
- International Union for Conservation of Nature and Natural Resources Red List of Threatened Species
- National Audubon Society
- The Waterbird Society
- Department of Defense's Partners in Flight

The following sections contain additional information on group size, habitat use, dive behavior, hearing and vocalization, and general threats.

3.9.2.1.1 Group Size

A variety of group sizes and diversity may be encountered throughout the Study Area, ranging from solitary migration of an individual bird to large concentrations of birds in single-species and mixed-species flocks. Depending on season, location, and time of day, the number of birds observed (group size) will vary and will likely fluctuate from year to year. During spring and fall periods, diurnal and nocturnal migrants would likely occur in large groups as they migrate over open water. Many

waterbirds migrate in very small groups or pairs, and then can be found in large groups at stopover areas and wintering grounds (Elphick, 2007).

Avian radar studies at sea show nocturnal migrants as well as seabirds moving across open oceans in large numbers (Desholm et al., 2006; Gauthreaux & Belser, 2003). During the winter months, large groups of ducks (rafts) could be encountered. During the nesting and breeding season, pelagic seabirds could be encountered in large groups following the currents and upwellings in pursuit of prey (Sibley, 2014). In the nearshore environments, terns, gulls, shorebirds, and plovers may occur in large groups while in their breeding and feeding areas.

Most seabird species nest in groups (colonies) on the ground of coastal areas or oceanic islands, where breeding colonies number from a few individuals to thousands. This breeding strategy is believed to have evolved in response to the limited availability of relatively predator-free nesting habitats and distance to foraging sites from breeding grounds (Siegel-Causey & Kharitonov, 1990). Outside of the breeding season, most seabirds within the Order Procellariiformes (the different orders of birds in the Study Area are described later in Section 3.9.2.3, Species not Listed Under the Endangered Species Act), such as the black-vented shearwater (*Puffinus opisthomelas*), are solitary, though they may join mixed-species flocks while foraging and can be associated with whales and dolphins (Onley & Scofield, 2007) or areas where prey density is high (U.S. Fish and Wildlife Service, 2005b). During the breeding season, these seabirds usually form large nesting colonies. Pelecaniform (birds within the Order Pelecaniformes) breeding, whether on the ground or in trees, is typically colonial and the most common species in the Study Area forage in groups, often in lines (e.g., double-crested cormorant [*Phalacrocorax auritus*]). Foraging seabirds of the order Charadriiformes (e.g., Heermann's gull [*Larus heermanni*]) can range from singles or pairs (International Union for Conservation of Nature and Natural Resources, 2010c; U.S. Fish and Wildlife Service, 2005a) and can extend upward into larger groups where juveniles accompany adults to post-breeding foraging areas, where the water is calm and the food supply is good. There are post-season dispersal sites, where adults and fledglings congregate (U.S. Fish and Wildlife Service, 2006). Large groups are occasionally observed foraging at great distances from colonies, including at inland water sources (Atwood & Minsky, 1983).

3.9.2.1.2 Habitat Use

The Hawaiian Islands are important habitat for seabirds in the North Pacific Subtropical Gyre. The shoreline, estuarine, and open ocean environments support a variety and large population of seabird species by providing important nesting and feeding habitats. The Hawaiian Islands are in the warm North Pacific water mass (U.S. Fish and Wildlife Service, 2005a). Despite low levels of localized production, recent research estimates that 15 million seabirds inhabit the Hawaiian Islands; 22 species of seabirds regularly nest in the Hawaiian Islands, and many more pass through during migration to and from their breeding grounds elsewhere in the Pacific (Birding Hawaii, 2004).

The entire world populations of Hawaiian petrels (*Pterodroma sandwichensis*) and Newell's shearwaters (*Puffinus auricularis newelli*) and more than 95 percent of the world's Laysan and black-footed albatrosses (*Phoebastria immutabilis* and *Phoebastria nigripes*, respectively) nest in the northwest Hawaiian Islands. Most of the world's ashy storm-petrels (*Oceanodroma homochroa*), western gulls (*Larus occidentalis*), and Brandt's cormorants (*Phalacrocorax penicillatus*) nest along the west coast of the United States (U.S. Fish and Wildlife Service, 2005a). In addition to breeding seabirds, millions of seabirds from more than 100 different species migrate to or through the Study Area. For example, an estimated 5.5 to 6 million seabirds representing more than 100 species are thought to occur off

California based on at-sea surveys (U.S. Fish and Wildlife Service, 2005a). Surveys around the Hawaiian Islands found 40 different species of seabirds, half of which were local breeders and the remainder were migrant species (U.S. Fish and Wildlife Service, 2005a).

The Southern California Bight, within the California Current Large Marine Ecosystem, is important for both breeding and migratory bird species. More than 195 species of birds use coastal or offshore aquatic habitats in the Southern California Bight—the area of the Pacific Ocean lying between Point Conception on the Santa Barbara County coast to a point south of the U.S.-Mexico border (Anderson et al., 2007; Baird, 1993; Bearzi et al., 2009; Hunt & Butler, 1980).

More than 300 bird species have been documented in and around San Diego Bay. The majority of these bay birds, representing 30 families, are migratory and may only stop to rest and feed, while others spend the winter or breed. Several are terrestrial birds of special concern or influence that are found about the Bay but may not directly depend upon it. Resident birds live and breed in the area year-round. Migrants that would not usually be in the area, disoriented in their travel, on the edges of their range, or simply looking for suitable habitat are regarded as vagrants. Although vagrants are not considered ordinarily dependent on the bay, a considerable number of them pass through and visit each year (U.S. Department of the Navy, 2013a).

3.9.2.1.3 Dive Behavior

Many of the seabird species found in the Study Area will dive, skim, or grasp prey at the water's surface or within the upper portion (1 to 2 meters [m]) of the water column (Cook et al., 2011; Jiménez et al., 2012; Sibley, 2014). However, numerous seabirds, including various species of diving ducks, cormorants, and alcids (the family that includes murres, murrelets, auks, auklets, shearwaters, and puffins), including the threatened Newell's shearwater are known to feed at depths greater than 100 feet (ft.) (Ehrlich et al., 1988). Some seabirds are aerial plunge divers in which they dive from above the surface and make generally shallow dives into the water column after prey (e.g., terns, gannets). Others are considered surface divers where they plunge directly from the surface underwater after prey (e.g., puffins, loons). Most diving species tend to catch the majority of their prey near the surface of the water column or on the bottom in shallow water (e.g., clams, mussels, and other invertebrates) (Cook et al., 2011), although some pursue prey to considerable depths as noted previously. Dive durations are correlated with depth and range from a few seconds in shallow divers to several minutes in alcids (Ponganis, 2015). Petrels forage both night and day; they capture prey by resting on the water surface and dipping their bill and by aerial pursuit of flying fish (International Union for Conservation of Nature and Natural Resources, 2010a). Hawaiian petrels eat mostly squid (50 to 75 percent of their diet), fish, and crustaceans (International Union for Conservation of Nature and Natural Resources, 2010a).

3.9.2.1.4 Hearing and Vocalization

Although hearing range and sensitivity has been measured for many land birds, little is known of seabird hearing. The majority of the published literature on bird hearing focuses on terrestrial birds and their ability to hear in air. A review of 32 terrestrial and marine species indicates that birds generally have greatest hearing sensitivity between 1 and 4 kilohertz (kHz) (Beason, 2004; Dooling, 2002). Very few can hear below 20 hertz (Hz), most have an upper frequency hearing limit of 10 kHz, and none exhibit hearing at frequencies higher than 15 kHz (Dooling, 2002; Dooling & Popper, 2000). Hearing capabilities have been studied for only a few seabirds (Beason, 2004; Beuter et al., 1986; Crowell et al., 2015; Johansen et al., 2016; Thiessen, 1958; Wever et al., 1969); these studies show that seabird hearing ranges and sensitivity in air are consistent with what is known about bird hearing in general.

Auditory abilities have been measured in ten diving bird species in-air using electrophysiological techniques (Crowell et al., 2015). All species tested had the best hearing sensitivity from 1 to 3 kHz. The red-throated loon (*Gavia stellata*) and northern gannet (*Morus bassanus*) (both non-duck species) had the highest thresholds of the diving birds while the lesser scaup (*Aythya affinis*) and ruddy duck (*Oxyura jamaicensis*) (both duck species) had the lowest thresholds (Crowell et al., 2015). Auditory sensitivity varied amongst the species tested, spanning over 30 decibels (dB) in the frequency range of best hearing. While electrophysiological techniques provide insight into hearing abilities, auditory sensitivity is more accurately obtained using behavioral techniques. Crowell et al. (2016) used behavioral methods to obtain an in-air audiogram of the lesser scaup. Best hearing frequency range in air was similar to other birds, with best sensitivity of 14 dB referenced to (re) 20 micropascals (µPa) at 2.86 kHz. Maxwell et al. (2017) obtained the behavioral in-air audiogram of a great cormorant (*Phalacrocorax carbo*) and the most sensitive hearing was 18 dB re 20 µPa at 2 kHz.

Crowell et al. (2015) also compared the vocalizations of the same ten diving bird species to the region of highest sensitivity of in-air hearing. Of the birds studied, vocalizations of only eight species were obtained due to the relatively silent nature of two of the species. The peak frequency of the vocalizations of seven of the eight species fell within the range of highest sensitivity of in-air hearing. Crowell et al. (2015) suggested that the colonial nesters tested had relatively reduced hearing sensitivity because they relied on individually distinctive vocalizations over short ranges. Additionally, Crowell et al. (2015) observed that the species with more sensitive hearing were those associated with freshwater habitats, which are quieter compared to marine habitats with wind and wave noise.

Although important to seabirds in air, it is unknown if seabirds use hearing or vocalizations underwater for foraging, communication, predator avoidance or navigation (Crowell, 2016; Dooling & Therrien, 2012). Some scientists suggest that birds must rely on vision rather than hearing while underwater (Hetherington, 2008), while others suggest birds must rely on an alternative sense in order to coordinate cooperative foraging and foraging in low light conditions (e.g., night, depth) (Dooling & Therrien, 2012).

There is little known about the hearing abilities of birds underwater (Dooling & Therrien, 2012). In air, the size of the bird is usually correlated with the sensitivity to sound (Johansen et al., 2016); for example, songbirds tend to be more sensitive to higher frequencies and larger non-songbirds tend to be more sensitive to lower frequencies (Dooling & Popper, 2000). Two studies have tested the ability of a single diving bird, a great cormorant (*Phalacrocorax carbo sinensis*), to respond to underwater sounds (Hansen et al., 2017; Johansen et al., 2016). These studies suggest that the cormorant's hearing in air is less sensitive than birds of similar size, and the hearing capabilities in water are better than what would be expected for a purely in-air adapted ear (Johansen et al., 2016). The frequency range of best hearing underwater was observed to be narrower than the frequency range of best hearing in air, with greatest sensitivity underwater observed around 2 kHz (about 71 dB re 1 µPa based on behavioral responses). Although results were not sufficient to be used to generate an audiogram, Therrien (2014) also examined underwater hearing sensitivity of long-tailed ducks (*Clangula hyemalis*) by examining behavioral responses. The research showed that auditory thresholds at frequencies within the expected range of best sensitivity (1, 2, and 2.86 kHz) are expected to be between 77 and 127 dB re 1 µPa.

Diving birds may not hear as well underwater, compared to other (non-avian) species, based on adaptations to protect their ears from pressure changes (Dooling & Therrien, 2012). Because reproduction and communication with conspecifics occurs in air, adaptations for diving may have evolved to protect in-air hearing ability and may contribute to reduced sensitivity underwater (Hetherington, 2008). There are many anatomical adaptations in diving birds that may reduce sensitivity

both in air and underwater. Anatomical ear adaptations are not well investigated, but include cavernous tissue in the meatus and middle ear that may fill with blood during dives to compensate for increased pressure on the tympanum, active muscular control of the meatus to prevent water entering the ear, and interlocking feathers to create a waterproof outer covering (Crowell et al., 2015; Rijke, 1970; Sade et al., 2008). The northern gannet, a plunge diver, has unique adaptations to hitting the water at high speeds, including additional air spaces in the head and neck to cushion the impact and a thicker tympanic membrane than similar sized birds (Crowell et al., 2015). All of these adaptions could explain the measured higher thresholds of diving birds.

3.9.2.1.5 General Threats

Populations of approximately half of the 346 species of seabirds that depend on ocean habitats are declining (Crowell et al., 2015; North American Bird Conservation Initiative U.S. Committee, 2009). Seabirds are some of the most threatened marine animals in the world, with 29 percent of species at risk of extinction (Spatz et al., 2014). Threats to bird populations in the Study Area include human-caused stressors (such as incidental mortality) from interactions with commercial and recreational fishing gear, predation and competition by introduced species, disturbance and degradation of nesting areas by humans and domesticated animals, noise pollution from construction and other human activities, nocturnal collisions with power lines and artificial lights, collisions with aircraft, and pollution, such as that from oil spills and plastic debris (Anderson et al., 2007; Burkett et al., 2003; California Department of Fish and Game, 2010; Carter & Kuletz, 1995; Clavero et al., 2009; International Union for Conservation of Nature and Natural Resources, 2010d; North American Bird Conservation Initiative & U.S. Committee, 2010; Onley & Scofield, 2007; Piatt & Naslund, 1995; U.S. Fish and Wildlife Service, 2005a, 2008b, 2010b; Waugh et al., 2012; Weimerskirch, 2004). Disease, volcanic eruptions, storms, and harmful algal blooms are also threats to birds (Anderson et al., 2007; Jessup et al., 2009; North American Bird Conservation Initiative & U.S. Committee, 2010; U.S. Fish and Wildlife Service, 2005a).

Beach-nesting birds are vulnerable to disturbance from people, pets, and off road vehicles that may inadvertently destroy or disturb nests (North American Bird Conservation Initiative U.S. Committee, 2009). Feral species (primarily cats [*Felis catus*] and rats [*Rattus* spp.], occasionally pigs [*Sus scrofa*], and cattle [*Bos taurus*]) may destroy nesting colonies. Seabirds are especially vulnerable to feral species on islands where nests and populations have been devastated through predation or habitat destruction. Invasive plants can also eliminate nesting habitat on beaches (Clavero et al., 2009; North American Bird Conservation Initiative U.S. Committee, 2009).

Lighting on boats and on offshore oil and gas platforms has also contributed to bird fatalities in open-ocean environments when birds are attracted to these lights, usually in inclement weather conditions (Merkel & Johansen, 2011). Recent studies have looked at different lighting systems and how they may impact migrating songbirds (Poot et al., 2008). Land-based lighting has been linked to episodes of "fallout" (grounding) involving seabirds, especially petrels, and ship-based lighting could have similar effects (Rodríguez et al., 2017).

Large-scale wind energy development offshore Southern California and Hawaii is currently under consideration (Bureau of Ocean Energy Management, 2018) and has the potential to affect bird populations through (1) displacement from favored foraging habitats, especially to species that forage in deeper, offshore waters; and (2) mortality to species that tend to fly within the rotor-swept zones of large wind turbines (approximately 20 m and 200 m from the surface) (Biodiversity Research Institute, 2015).

Natural causes of seabird and shorebird population declines include disease, storms, and harmful algal blooms, although human activities are also associated with harmful algal blooms (Jessup et al., 2009; North American Bird Conservation Initiative U.S. Committee, 2009; Onley & Scofield, 2007). In addition, seabird distribution, abundance, breeding, and other behaviors are affected by cyclical environmental events, such as the El Niño Southern Oscillation and Pacific Decadal Oscillation in the Pacific Ocean (Congdon et al., 2007; Vandenbosch, 2000).

3.9.2.1.5.1 Water Quality

Spills of oil and other petroleum products pose a risk to seabirds and shorebirds through direct contamination and destruction of nesting, roosting, and foraging habitats. Estimates of bird mortality from the BP *Deepwater Horizon* oil spill in the Gulf of Mexico during 2010 are that approximately 200,000 birds were killed in the offshore area and approximately 700,000 killed along the coastline during the 103-day duration of the spill (Haney et al., 2014a, 2014b). Additional mortality occurred subsequently but has not been estimated.

Within the Study Area, the main risk of oil or other petroleum product spills is from ships, whether carrying petroleum to and from ports, or in fuel tanks, and from pipelines and onshore facilities that transport and store oil and gas. One of the largest spills in the Study Area occurred in 1989 when the tanker *Exxon Houston* broke away from its moorings and ran aground at Barber's Point on Oahu, spilling approximately 117,000 gallons of fuel and crude oil (U.S. Coast Guard, 2015).

3.9.2.1.5.2 Commercial Industries

Commercial fisheries are considered the most serious threat to the world's seabirds, while invasive species are the most pervasive – affecting the largest number of species; other threats include pollution, hunting, trapping, energy production, and mining (BirdLife International, 2012). A recent review of reported bycatch estimates suggests that at least 400,000 birds die in gillnets each year (Zydelis et al., 2013). Seabird bycatch in longline fisheries worldwide has been estimated as 160,000 to more than 320,000 annually (Anderson et al., 2011).

Large-scale offshore wind development may occur in highly productive areas offshore Southern California and Oahu, and impact bird populations by (1) displacing some species from their preferred foraging habitats and migration routes, and (2) increasing the mortality of species that fly within the rotor-swept zones of large turbines (Biodiversity Research Institute, 2015).

3.9.2.1.5.3 Disease and Parasites

Avian diseases can cause chronic population declines, dramatic die-offs or reductions in the reproductive success and survival of individual birds. They can even cause extinctions. Certain avian diseases appear to be spreading to populations previously unaffected, including to species already threatened by other factors. Examples include avian botulism, cholera, *Erysipelothrix rhusiopathiae*, West Nile virus and Mycoplasmal conjunctivitis. A brief description of each follows from (BirdLife International, 2008).

Avian botulism is a bacterial disease that is arguably the most important disease of migratory birds worldwide, affecting millions of birds. Avian cholera and *Erysipelothrix rhusiopathiae* are two bacterial diseases that caused considerable declines of Indian yellow-nosed albatross (*Thalassarche carteri*) on Amsterdam Island (French Southern Territories). These two diseases may have spread to nearby colonies of sooty albatross (*Phoebetria fusca*) and Amsterdam albatross (*Diomedea amsterdamensis*) with a world population of approximately 130 birds. Avian cholera has also devastated the population of

Cape cormorant (*Phalacrocorax capensis*) in Western Cape Province, South Africa, killing approximately 13,000 individuals between May and October 2002. The West Nile Virus, a largely mosquito-borne viral disease (causing both bird and human mortalities), has established itself over much of eastern U.S. since 1999, spreading to Latin America and the Caribbean. American crow (*Corvus brachyrhynchos*) and other corvid species have shown very high levels of mortality from this disease but remains relatively stable across its range. Mycoplasmal conjunctivitis, as the disease is commonly called, is caused by a unique strain of *Mycoplasmal gallisepticum*, a parasitic bacterium previously known to infect only poultry. This infectious disease has recently caused a significant decline in the introduced population of house finch (*Carpodacus mexicanus*) in eastern North America, and has started to spread to the native population of this species in western North America (BirdLife International, 2008).

Before humans arrived on the Hawaiian Islands, there were no mosquitoes or any other biting or blood sucking insects. By the mid-1800's however, mosquitoes were firmly established throughout the archipelago introduced inadvertently through human activities. Of these, the southern house mosquito, (*Culex quinquefasciatus*) is the greatest challenge to Hawaiian bird conservation. Introduced in 1926, it is the primary vector of avian malaria and avian pox, and is implicated in the devastation and extinction of many of the native forest bird populations. The first was avian pox virus, first documented in forest birds in 1902. The second, first detected in the 1940s, was avian malaria. These two diseases remain as major sources of mortality for Maui's native forest birds and are important limiting factors in their abundance and distribution. It is unclear when or how these diseases first appeared on the islands, it is thought they were first introduced with the importation of non-native bird species but it may also be that they have always been present on the islands at a low level with migratory seabirds, shorebirds and waterfowl. That all changed with the relatively recent introduction of mosquitoes (Maui Forest Bird Recovery Project, 2017).

Recent research suggests that avian malaria has not only contributed to population declines and extinctions, but is affecting the elevational distributions of many native birds on the Island of Hawai'i. Native bird species experience lower rates of transmission/infection in high-altitude forests where conditions are relatively inhospitable for the mosquito vector. Bird species endemic to low- and mid-altitude forests are at greater risk from this disease (Samuel et al., 2015).

3.9.2.1.5.4 Invasive Species

Significant threats to seabirds occur on islands, which is where seabirds breed, including predation and habitat disturbance from invasive alien species such as rats, cats and pigs. Ground nesting seabirds are particularly vulnerable to these threats, and invasive predators on islands have been the primary cause of global seabird declines, extirpations, and local extinctions (Spatz et al., 2014). However, in many cases, effective island conservation can mitigate these threats.

3.9.2.1.5.5 Climate Change

In the long term, global climate change could be the greatest threat to seabirds (North American Bird Conservation Initiative U.S. Committee, 2009). Species of seabirds that breed on low-lying Pacific islands are particularly vulnerable. For example, great frigatebird (*Fregata minor*) breeding colonies in the Pacific are largely restricted to islands with a maximum elevation of 8 m, making them vulnerable to sea level rise. Additionally, a sea level rise of 2 m would flood 39 to 91 percent of black-footed albatross nests on Midway Atoll, Hawaii (BirdLife International & National Audubon Society, 2015). Climate change impacts include changes in air and sea temperatures, precipitation, the frequency and intensity of storms, pH level of sea water, and sea level. These changes could impact the timing of migration and

overall marine productivity, which could in turn have an impact on the food resources, distribution, and reproductive success of seabirds at critical times in their life cycles (Aebischer et al., 1990; Congdon et al., 2007; Davoren et al., 2012; Melillo et al., 2014).

Open-ocean seabird species are particularly vulnerable to climate change due to their low reproductive rates, their use of islands for nesting, and their reliance on a highly variable marine system (North American Bird Conservation Initiative & U.S. Committee, 2010). Coastal birds are vulnerable to climate change due to rising sea levels, which are expected to impact foraging and nesting habitat quality and quantity by flooding or fragmenting habitats such as barrier islands, beaches, and mudflats (North American Bird Conservation Initiative U.S. Committee, 2009).

3.9.2.1.5.6 Marine Debris

Marine debris is any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes (National Oceanic and Atmospheric Administration, 2016). Marine debris is a growing environmental concern. With the rapid increase in global plastics production and the resulting large volume of litter that enters the marine environment, determining the consequences of this debris on marine fauna, including seabirds and ocean health has now become a critical environmental priority, particularly for threatened and endangered species (Wilcox et al., 2016).

Plastic debris is abundant and pervasive in the world oceans and, because of its durability, is continuing to increase. The ingestion of plastics by seabirds such as albatrosses and shearwaters occurs with high frequency and is of particular concern because of impacts on body condition and the transmission of toxic chemicals, both of which affect mortality and reproduction. The rates of plastic ingestion by seabirds are closely related to the concentrations of plastics in different areas of the ocean due to waste discharges and ocean currents, and are increasing (Kain et al., 2016; Wilcox et al., 2015).

The impacts from entanglement of marine species in marine debris are clearly profound, and in many cases entanglements appear to be increasing despite efforts over four decades to reduce the threat. Many coastal states have undertaken certain efforts to reduce entanglement rates through marine debris clean-up measures and installed fishing line recycle centers at boat landings in part due to entanglement of seabirds and other marine species. One such program is the California Lost Fishing Gear Recycling Project administered by the University of California–Davis Wildlife Health Center that began in 2005 (National Oceanic and Atmospheric Administration Marine Debris Program, 2014).

Fishing related gear, balloons and plastic bags were estimated to pose the greatest entanglement risk to marine fauna. In contrast, experts identified a broader suite of items of concern for ingestion, with plastic bags and plastic utensils ranked as the greatest threats. Entanglement and ingestion affected a similar range of taxa, although entanglement was rated as slightly worse because it is more likely to be lethal. Contamination was scored the lowest in terms of impact, affecting a smaller portion of the taxa and being rated as having solely non-lethal impacts (Wilcox et al., 2016).

There are likely other species from other regions of the U.S. that suffer injury or death from being entangled in marine debris, but are not widely recognized or reported. Most of the literature describes entanglement of marine species from Alaska, California, Puget Sound, and Florida. However, the Mid-Atlantic and Gulf of Mexico regions of the U.S. are lacking in reports of marine debris entanglement. Similarly, reports of marine debris entanglement on seabirds are limited to a few papers (National Oceanic and Atmospheric Administration Marine Debris Program, 2014). This review reported entanglement in marine debris in the U.S. of 44 species of seabirds. The majority of cases revolve

around entanglement in fishing gear and abandoned, lost or otherwise discarded fishing gear and to a lesser degree other plastic debris.

Variable impacts of common debris items on the health of marine wildlife were identified, with entanglement by fishing related gear, balloons and plastic bags emerging as the greatest threat to seabirds. However, a wide variety of other items posed at least some threat to these organisms through either ingestion, contamination or both, suggesting that a comprehensive approach to preventing plastics from entering the ocean is vitally needed (Wilcox et al., 2016).

The amount, composition, and trends of marine debris on the U.S. Pacific Coast and Hawaii were assessed using data from 1998 to 2007 collected by the National Debris Monitoring Program (Ribic et al., 2012). Data from five sites on the Southern California coast indicated the majority of marine debris was land-based (60 percent), followed by general source debris (31 percent) and ocean-based (8 percent) recreational and commercial sources. In contrast, data from five sites on Hawaii (Oahu) indicated most debris was from ocean-based sources (38 percent), followed by general source debris (33 percent) and land-based sources (29 percent). No items of military origin were differentiated. Land-based debris was associated with the concentration of people; general source debris consisted primarily of plastic bottles, which may have been discarded either on land or at sea, and ocean-based debris from fishing and other maritime activities. The deposition of marine debris on beaches of the Study Area was found to be correlated with weather and to have declined in more recent years (Ribic et al., 2012).

3.9.2.2 Endangered Species Act-Listed Species

As shown in Table 3.9-1, there are six species of birds listed as Endangered or Threatened under the ESA in the Study Area. The status, presence, and nesting occurrence of ESA-listed and candidate birds in the Study Area are listed in Table 3.9-1. Critical habitat has not been designated for any of these species.

Table 3.9-1: Endangered Species Act-Listed Bird Species Found in the Study Area

Species Name and Regulatory Status[1]			*Presence in Study Area[2]*		
Common Name	***Scientific Name***	***ESA Status***	***Open Ocean Area***	***Large Marine Ecosystem***	***Bays and Harbors***
California least tern	*Sternula antillarum browni*	Endangered	None	California Current (nesting)	San Diego Bay
Hawaiian petrel	*Pterodroma sandwichensis*	Endangered	North Pacific Subtropical Gyre	Insular Pacific-Hawaiian (nesting)	None
Short-tailed albatross	*Phoebastria albatrus*	Endangered	North Pacific Subtropical Gyre	California Current, Insular Pacific-Hawaiian	None
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	None	California Current	None
Newell's shearwater	*Puffinus auricularis newelli*	Threatened	North Pacific Subtropical Gyre	Insular Pacific-Hawaiian (nesting)	None

Table 3.9-1: Endangered Species Act-Listed Bird Species Found in the Study Area (continued)

Species Name and Regulatory Status[1]			*Presence in Study Area*[2]		
Common Name	***Scientific Name***	***ESA Status***	***Open Ocean Area***	***Large Marine Ecosystem***	***Bays and Harbors***
Band-rumped storm-petrel, Hawaii distinct population segment	*Oceanodroma hydrobates castro*	Endangered	North Pacific Subtropical Gyre	Insular Pacific-Hawaiian (nesting)	None

[1]ESA listing status

[2]Presence in the Study Area indicates open ocean areas (North Pacific Subtropical Gyre) and coastal waters of large marine ecosystems (California Current, Insular Pacific-Hawaiian) in which the species are found. Nesting in the Study Area is indicated in parentheses. Refer to Section 3.0.2.1 (Biogeographic Classifications) for additional description and figures.

3.9.2.2.1 California Least Tern (*Sternula antillarum browni*)

The California least tern is a federal and state endangered species that has been listed since 1970. California least terns are coastal and nearshore foragers and surface-feeding fish eaters. They are opportunistic in their search for prey, eating fish that are small enough to catch including anchovies (*Engraulidae* sp.) and smelt (*Atherinops* sp.). California least terns have black-capped heads and long, black-tipped narrow pale gray wings that contrast with their white bodies, and a broad, forked tail. When full grown, this species is less than 25 centimeters (cm) long and has a 75 cm wingspan (U.S. Fish and Wildlife Service, 2010a).

3.9.2.2.1.1 Status and Management

The California least tern is listed as endangered under the ESA. No critical habitat has been designated for the California least tern. Conservation for the California least tern is addressed in multiple memoranda of understanding and Integrated Natural Resource Management Plans for military lands and adjacent waters in the Study Area, including Naval Amphibious Base Coronado (U.S. Department of the Navy, 2013b), San Diego Bay (U.S. Department of the Navy, 2013a), and Marine Corps Base Camp Pendleton (Marine Corps Base Camp Pendleton, 2012).

3.9.2.2.1.2 Habitat and Geographic Range

Preferred nesting habitat for the California least tern consists of beaches, dunes, and sand bars on the ocean shore (U.S. Fish and Wildlife Service, 1985). The California least tern nests in areas generally free of vegetation above the high tide mark. Colony sites are often near estuaries, lagoons, rivers, or the seacoast (U.S. Fish and Wildlife Service, 1985). Atwood and Minsky (1983) noted that before the decline of the species, at least 82 percent of known nesting sites in California were within 1 mile (mi.) of a river mouth or estuarine habitat.

California least terns spend the breeding season (April through August) in coastal waters along the central and Southern California coast, as well as along the west and southwestern coast of Mexico. Their distribution is from San Francisco to Baja California on the Pacific Coast of North America (U.S. Fish and Wildlife Service, 2010a). The California least tern historically nested on coastal beaches of Monterey,

California, to Cabo San Lucas, Baja California (Atwood & Minsky, 1983). The two largest nesting colonies in the state are on Marine Corps Base Camp Pendleton and Naval Base Coronado (Frost, 2016).

Foraging habitats include nearshore ocean waters, bays, river mouths, salt marshes, marinas, river channels, lakes, and ponds (Thompson et al., 1997). California least terns feed within 2 mi. of the shoreline in ocean waters less than 60 ft. deep, with most foraging within 1 mi. of shore (Atwood & Minsky, 1983). Atwood and Minsky (1983) also observed a tendency for foraging birds to be concentrated in coastal waters near major river mouths. Foraging habitat use varies within and between years, depending on the stage of breeding and prey availability (Atwood & Minsky, 1983; BirdLife International, 2009). Atwood and Minsky (1983) noted in their coastal colony study that, before terns disperse after breeding, they typically forage within 2 mi. of nesting sites, although large groups were occasionally observed foraging at greater distances from colonies, including inland water sources. The presence of eelgrass is important because it is habitat for several prey species of the least tern such as topsmelt (U.S. Department of the Navy, 2013a).

California least terns occur in coastal waters throughout the Southern California portion of the Study Area during the breeding, nonbreeding, and migration seasons. The current nesting range is from San Francisco Bay and south along the California coast to San Diego County which includes the Southern California portion of the Study Area in the California Current Large Marine Ecosystem and parts north of the Study Area (Massey & Fancher, 1989). During migration, California least terns remain near the coast, although they have been observed foraging in multispecies feeding flocks 1 to 20 mi. off the western coast of Baja California in late April and early May (U.S. Fish and Wildlife Service, 2005a). The California least tern can be found in more offshore waters during the breeding season (courtship and incubation stages) when they forage farther from the nest site over open and deep water. Adults tend to travel farther when food availability is low, foraging in open ocean waters (BirdLife International, 2009).

3.9.2.2.1.3 Population Trends

The California least tern population in California averaged about 4,300 pairs between 2000 and 2002, making up about 10 percent of the North American population (U.S. Fish and Wildlife Service, 2005a). The California population increased almost 12-fold from a low of 600 pairs in the early 1970s to roughly 7,100 pairs in 2005 (U.S. Fish and Wildlife Service, 2001, 2005a), but declined in recent years to an estimated 4,202-5,295 pairs as of 2015 (Frost, 2016).

3.9.2.2.1.4 Predator and Prey Interactions

California least terns forage by plunge-diving to catch prey in upper surface waters, usually within the first 1-2 m of water depth (U.S. Department of the Navy, 2013a). No information exists on specific dive depths for California least terns. Prey species include anchovies, topsmelt, opaleye, and gobies (BirdLife International, 2009). Prey species composition varies throughout the year, depending on availability. Length of foraging and peak foraging behavior typically occur from the end of May through mid-July after chicks hatch.

California least terns are preyed upon by various species; these include gulls, gull-billed terns, ravens, crows, rodents, raccoons, and coyotes, which prey upon tern eggs, chicks, and adults (U.S. Fish and Wildlife Service, 2006).

3.9.2.2.1.5 Species-Specific Threats

Threats to breeding least terns include the alteration of river habitat, flooding and development of coastal areas, disruptive recreation, an increase in aggressive gulls that compete for nesting sites, and

predation by native and feral species, such as rats, great horned owls, black-crowned night herons, dogs, and cats (Sidle et al., 1992; U.S. Fish and Wildlife Service, 1990).

3.9.2.2.2 Hawaiian Petrel (*Pterodroma Sandwichensis*)

The Hawaiian petrel was recently split from the Galapagos petrel (*Pterodroma phaeopygia*) based on genetic and morphological evidence; before the split they were collectively known as the dark-rumped petrel (U.S. Fish and Wildlife Service, 2005a). The Hawaiian Petrel has a dark gray head, wings, and tail, and a white forehead and belly. It has a stout grayish-black bill that is hooked at the tip, and pink and black feet. This bird measures 16 inches (in.) in length and has a wing span of three ft. It has a distinctive call during breeding season that sounds like "oo ah oo." They also have calls that sound like the yapping of a small dog (U.S. Fish and Wildlife Service, 2012c).

3.9.2.2.2.1 Status and Management

The Hawaiian petrel is found only in Hawaii and is listed as endangered throughout its range under the ESA (U.S. Fish and Wildlife Service, 2005a); there is no designated critical habitat. It is known from five locations in the main Hawaiian Islands, at least two of which (Mauna Loa on Hawaii Island and West Maui) are threatened by development. Its limited distribution and declines primarily result from predation by introduced mammals and urbanization (International Union for Conservation of Nature, 2017). In some cases, predation has caused more than 70 percent nesting failure (U.S. Fish and Wildlife Service, 2005a). Numerous knowledge gaps remain for the Hawaiian Petrel such as foraging and other at-sea behavior; annual and age-specific survival, especially for non-breeders; and the scope and severity of threats at sea (U.S. Fish and Wildlife Service, 2011a). On Maui, there is a long-term monitoring program in the Haleakala National Park and efforts are made to control introduced mammals. In 1976, a perimeter fence was put up around the main colony to exclude feral goats and pigs from the habitat. The predator enclosures placed around the national park may have facilitated an increase in the number of birds in eastern Maui (International Union for Conservation of Nature, 2017). On Kauai, auditory surveys to detect colonies are ongoing, and have included documenting the first known nesting sites on Kauai in the Upper Limahuli Preserve. Also on Kauai, street lighting is shielded in critical areas and lighting on some buildings has been modified to reduce collisions. A ruling by the USFWS under the ESA has resulted in a campaign running since 2005, in which nonessential lights on Kauai are turned off or shielded between 15 September and 15 December when young birds leave their nests. The island's electricity company is helping by darkening all of its 3,000 street lights, and shielding or turning some of them off. The company has also fitted large balls to power lines in an effort to reduce the number of birds that collide with the cables. Significant improvements have been made in reducing light attraction and collision, although there is still a considerable amount of new and existing infrastructure that requires modification (International Union for Conservation of Nature, 2017).

3.9.2.2.2.2 Habitat and Geographic Range

Hawaiian Petrel ranges in the central Pacific and breeds only in the main Hawaiian Islands, though there are specimen records from Japan, Philippines, and Moluccas at the western edge of the distribution. On Maui, Mauna Kea and Mauna Loa, nesting takes place mainly between 2,000 and 3,000 m, in lava cavities with little vegetation nearby. Elsewhere, for example West Maui and Kauai, it nests at lower elevations, amongst dense shrubs and ferns, or in native grasslands with bracken. On Haleakala, Maui, birds nest in rock crevices and tunnels that are over 0.5 m deep, often exceeding 2 m. Generally, the nest chamber can be from 1 to 9 m deep. Pairs nest in cavities in the volcanic terrain, in burrows beneath rocks or at the base of clay cliffs. At lower altitudes, they excavate burrows or nest in cavities

often at the base of trees, although many burrows on Lanai are not at the base of trees. On Lanai, birds breed in dense uluhe fern habitat (*Dicranopteris linearis* and *Diplopterygium pinnatum*) and start breeding in March whereas on Haleakala, Maui, birds begin breeding in early February (International Union for Conservation of Nature, 2017).

The Hawaiian petrel typically feeds well offshore but tends to feed closer to shore (0 to 45 mi.) during spring than in the fall (most abundant at 170 to 230 mi.) (Spear et al., 1995). The Hawaiian petrel favors open ocean water conditions, with an average sea surface temperature of 80 degrees Fahrenheit, sea surface salinity of 34 parts per thousand, wind speed of 19 mi. per hour (mph), and a wave height of 5 ft. It also prefers an average depth from the warmer surface water to the point where cold water begins (the thermocline) of 35 ft. (Spear et al., 1995).

The Hawaiian petrel is an open ocean species of the central tropical Pacific (U.S. Fish and Wildlife Service, 2005a). They occur in open ocean waters throughout most of the Hawaii portion of the Study Area and the western portion of the Transit Corridor in the Insular Pacific-Hawaiian Large Marine Ecosystem. The Hawaiian petrel occurs largely in equatorial waters of the eastern tropical Pacific, generally from 10 degrees South to 20 degrees North. Because of the difficulty in identification, the precise southeastern extent of the Hawaiian petrel and the northwestern extent of the similar Galapagos petrel remains uncertain (Spear et al., 1995).

Hawaiian petrels have important resting sites in coastal waters throughout the Hawaii portion of the Study Area in portions of the Insular Pacific-Hawaiian Large Marine Ecosystem. An area of the north shore of Kauai is widely known as a resting location for Hawaiian petrels (Birding Hawaii, 2004). Based on known or suspected colony sites, gathering areas likely occur near shore on Lehua Rock, Kauai, Molokai, Lanai, Maui, and Hawaii (Day & Cooper, 1995; Day et al., 2003; U.S. Fish and Wildlife Service, 2005a) and perhaps around Kahoolawe (U.S. Fish and Wildlife Service, 2005a). These areas provide resting habitat before the birds fly to inland nesting colonies. Hawaiian petrels move to and from nesting colonies during dusk and dawn (International Union for Conservation of Nature, 2017).

3.9.2.2.2.3 Population Trends

A population estimate supported by pelagic surveys put the total population at 19,000 (range 10,600–34,400), including a best estimate of 4,500–5,000 breeding pairs. However, the discovery of previously unknown colonies in 2006-2007 may bring the total population closer to the upper estimate of 6,500–8,300 pairs (International Union for Conservation of Nature, 2017). The current status of the Hawaiian petrel is uncertain due to the difficulty surveying this species. Recent at-sea surveys are currently being analyzed for Hawaiian petrel and Newell's shearwater (U.S. Fish and Wildlife Service, 2011a). The total population of Hawaiian petrels was estimated at 20,000, with a breeding population of 4,500–5,000 pairs (Spear et al., 1995; U.S. Fish and Wildlife Service, 2005a) overall population trends on the Hawaiian Islands are not known (U.S. Fish and Wildlife Service, 2005a). Numbers of breeding Hawaiian petrels on Maui appear stable and have increased in areas of the Haleakala National Park, where predators are being managed (U.S. Fish and Wildlife Service, 2005a). On Hawaii, numbers may be declining because of predation by introduced species (U.S. Fish and Wildlife Service, 2005a).

3.9.2.2.2.4 Predator and Prey Interactions

It has been found that at least some Hawaiian petrels nesting on Lanai feed in waters around the Aleutian Islands, as shown through the use of tracking devices on several breeding individuals. The species usually forages in mixed species flocks, typically over schools of predatory fish species. Hawaiian petrels eat mostly squid (50 to 75 percent of their diet), fish, and crustaceans. They forage both night

and day; they capture prey by resting on the water surface and dipping their bill and by aerial pursuit of flying fish (International Union for Conservation of Nature, 2017). The foraging member of a pair may fly up to 930 mi. from the nesting island (U.S. Fish and Wildlife Service, 2005a).

The most serious current threat is predation by introduced vertebrates including feral cats, barn owls (*Tyto alba*), rats, dogs, pigs and the small Asian mongoose (*Herpestes javanicus*) (although the latter is not yet established on Lanai). Nestlings are very susceptible to predation, as they cannot fly for more than 15 weeks after hatching. Adult and young Hawaiian petrels are preyed on by introduced animals (International Union for Conservation of Nature, 2017).

3.9.2.2.2.5 Species-Specific Threats

Threats to the Hawaiian petrel include predation by introduced mammals, development, light attraction and collision, ocean pollution, and disturbance of its breeding grounds. The petrel does not have any natural defenses against predators such as rats, feral cats, and mongooses, and its burrows are very vulnerable (U.S. Fish and Wildlife Service, 2012c). Although predator control now occurs at several Hawaiian petrel breeding sites, the threat posed by introduced predators remains significant throughout the species' range (U.S. Fish and Wildlife Service, 2011a). Collisions with artificial lights, utility poles, and fences kill Hawaiian petrels on some islands (International Union for Conservation of Nature, 2017). Little progress has been made toward addressing the chief threats to or meeting the recovery criteria for Hawaiian petrels. Remnant breeding colonies thought to occur on west Maui, Hawaii Island, Kauai, Lanai, and possibly Molokai are not mapped or managed. These colonies are certainly subject to predation by alien mammals, possibly are subject to the threat of light attraction and collision, and most are thought to be dwindling as well (U.S. Fish and Wildlife Service, 2011a).

The species may be adversely affected by declines in the populations of large predatory fish that drive prey species to the surface. In addition, a significantly lower percentage of birds come ashore to nest during El Niño years (ca.40 percent compared to ca.65 percent normally), suggesting that the species is sensitive to such disturbances in environmental conditions (International Union for Conservation of Nature, 2017). In addition, the species is currently threatened with habitat disturbance by goats, pigs and cattle. On Lanai, habitat degradation caused by the invasive tree, strawberry guava *Psidium cattleianum*, may be the biggest threat to the long term survival of the colony. On occasion, fledglings become grounded after colliding with lights, and mortality sometimes results from collisions with fences and powerlines. Once on the ground, fledglings are unable to fly and are killed by cars or cats and dogs, or die from starvation or dehydration (International Union for Conservation of Nature, 2017).

3.9.2.2.3 Short-tailed Albatross (*Phoebastria albatrus*)

The short-tailed albatross was formerly in the genus *Diomedea* and known as Steller's albatross. The largest of the north Pacific albatrosses, the adult short-tailed albatross has a prominent pink bill, white body, and a yellow wash on the head. Immature birds are dark, but can be distinguished from black-footed albatross by their pink bill and flesh colored feet. Adults can reach wingspans of 7 ft. (U.S. Fish and Wildlife Service, 2012a).

3.9.2.2.3.1 Status and Management

The status of the short-tailed albatross appears to be improving and the overall threats may be diminishing, although potential new threats are appearing as the climate changes and global resource use and development patterns shift (U.S. Fish and Wildlife Service, 2014). The short-tailed albatross is widely regarded as one of the rarest species of albatrosses and one of the world's rarest birds (Harrison,

1983). The short-tailed albatross is listed as endangered under the ESA throughout its range. Additionally, it is listed as endangered by the state of Hawaii (NatureServe, 2004; U.S. Fish and wildlife Service, 2000, 2005a). No critical habitat has been designated for this species because little is known about its life in the open ocean (Piatt et al., 2007; U.S. Fish and Wildlife Service, 2012a).

3.9.2.2.3.2 Habitat and Geographic Range

Short-tailed albatrosses are typically found in the open ocean and tend to concentrate along the edge of the continental shelf (NatureServe, 2004). Upwelling zones are not only nutrient rich, but they also bring prey (for example, squid and fish) typically found only in deeper water to the surface, where they become available to albatrosses. Upwelling occurs when the wind moves warm, nutrient poor water away from the area, which allows colder, nutrient rich water to rise to the surface of the ocean. Short-tailed albatross nest on isolated, windswept, offshore islands with restricted human access (U.S. Fish and wildlife Service, 2000). Current and historical nesting habitat can be described as flat to steep slopes that are sparsely or fully vegetated. Short-tailed albatrosses disperse throughout the temperate and subarctic North Pacific approximately from May to October when they are not breeding, from Japan through California (U.S. Fish and Wildlife Service, 2005a, 2008b). Non-breeders and failed breeders disperse from the colony months sooner. While many non-breeders return to the colonies each year, the presence of immature birds far from the colony (such as the U.S. Pacific coast) during the breeding season suggests that some immature birds may spend years at sea before they return to the colony (U.S. Fish and Wildlife Service, 2005b).

Open Ocean

The short-tailed albatross is an open ocean species that occurs throughout the Hawaii Range Complex, Transit Corridor, and Southern California Range Complex portions of the Study Area. The range of the short-tailed albatross extends from Siberia south to the China coast, into the Bering Sea and Gulf of Alaska south to Baja California, Mexico, and throughout the North Pacific, including the Northwestern Hawaiian Islands (Committee on the Status of Endangered Wildlife in Canada, 2003; Harrison, 1983; Roberson, 2000). Their at-sea distribution includes the entire North Pacific Ocean north of about 20 degrees North latitude. Short-tailed albatrosses move seasonally around the North Pacific Ocean, with high densities observed during the breeding season (December through May) in Japan and throughout Alaska and along the west coast of North America during the post-breeding season (April through September) (International Union for Conservation of Nature, 2017). Nonbreeding subadults can be found in all areas throughout the year. They are seen regularly in the North Pacific Subtropical Gyre (U.S. Fish and Wildlife Service, 2005b).

California Current Large Marine Ecosystem

Short-tailed albatrosses occasionally occur in Southern California Range Complex portion of the California Current Large Marine Ecosystem, which is part of the Study Area. As the population began a gradual recovery after 1950, sporadic sightings have been recorded off California (International Union for Conservation of Nature and Natural Resources, 2010b). Based on the number of sightings in the Southern California Range Complex, the short-tailed albatross is considered rare in that portion of the Study Area, as well as off the entire California coast. Breeding does not occur in the Southern California Bight, but because of the unique circulation and upwelling characteristics of this area, potential foraging habitat exists. Two documented sightings of the short-tailed albatross have occurred in Southern California. Roberson (2000) reported a sighting in 1977 of an all-dark immature bird approximately

90 mi. west of the San Diego area. McCaskie and Garrett (2002) reported a sighting in the vicinity of Santa Barbara Island in late February of 2002.

Insular Pacific-Hawaiian Large Marine Ecosystem

Short-tailed albatrosses occur in coastal waters throughout the Hawaii portion of the Study Area in the Insular Pacific-Hawaiian Large Marine Ecosystem. The short-tailed albatross regularly occurs on Midway Atoll and has been observed at other Northwestern Hawaiian Islands. Since the 1930s, short-tailed albatrosses have been occasionally reported during the breeding season at Midway Atoll. Some of these short-tailed albatrosses were recorded for several successive years. The first confirmed nest site that produced an egg did not occur until 1993 (International Union for Conservation of Nature and Natural Resources, 2010b). A chick was fledged by a breeding pair on Midway Atoll in 2011, 2012, and 2014 (U.S. Fish and Wildlife Service, 2014). Nesting elsewhere on the Northwestern Hawaiian Islands has been attempted, but successful nesting has not been confirmed (U.S. Fish and Wildlife Service, 2005b). In the Hawaiian Islands, there was an unconfirmed sighting at Barking Sands on Kauai during March 2000 (Birding Hawaii, 2004). Other known occurrences in Hawaii are of single birds (in 1976 and 1981) at French Frigate Shoals in the Northwestern Hawaiian Islands (U.S. Fish and Wildlife Service, 2008a).

3.9.2.2.3.3 Population Trends

The total population estimate for breeding age short-tailed albatrosses as of the 2013–2014 nesting season is 1,928 individuals, including approximately 1,624 at Torishima (Japan), 293 on the Senkaku (or Diaoyutai) Islands (in disputed ownership among China, Taiwan, and Japan), 4 in the Northwestern Hawaiian Islands, and a few birds on other Japanese islands (U.S. Fish and Wildlife Service, 2014). The Torishima population is growing rapidly, averaging 7.5 percent annually (International Union for Conservation of Nature and Natural Resources, 2010b; U.S. Fish and Wildlife Service, 2005b). Average population survival rate is 96 percent, and the current annual population growth is greater than 6 percent (U.S. Fish and Wildlife Service, 2005b). Overall, the high population growth rates continue, and some substantial threats are being addressed in much of the species' range. However, to ensure the continuing recovery of the species, it is important to consider sources of uncertainty and work toward reducing those threats that adversely affect short-tailed albatrosses. The population does not yet meet the recovery goals for downlisting or delisting, and therefore, the short-tailed albatross remains endangered throughout its range (U.S. Fish and Wildlife Service, 2014).

3.9.2.2.3.4 Predator and Prey Interactions

Short-tailed albatrosses are surface feeders and scavengers, feeding more inshore than other North Pacific albatrosses. In Japan, their diet consists of shrimp, squid, and fish (including bonita, flying fish, and sardines); diet information is not available for birds in the Study Area (U.S. Fish and Wildlife Service, 2005b). Unlike other North Pacific albatrosses, short-tailed albatrosses frequently feed in sight of land.

Short-tailed albatross chicks are predated by other birds and introduced mammals such as cats and rats on nesting colonies (U.S. Fish and Wildlife Service, 2005b).

3.9.2.2.3.5 Species-Specific Threats

Short-tailed albatrosses have survived multiple threats to their existence. During the late 1800s and early 1900s, feather hunters clubbed to death an estimated five million of them, stopping only when the species was nearly extinct. In the 1930s, nesting habitat on the only active nesting island in Japan was damaged by volcanic eruptions, leaving fewer than 50 birds by the 1940s. Loss of nesting habitat to

volcanic eruptions, severe storms, and competition with black-footed albatrosses for nesting habitat continue to be natural threats to short-tailed albatrosses today.

Current threats to this species include ingestion of plastics mistaken for food items, volcanic eruption (at Torishima, Japan), typhoons, sunken longline fishing in Alaska and Russia, jig/troll fishery in Japan, invasive species at colonies (cats, rats, and plants), and researcher disturbance (U.S. Fish and Wildlife Service, 2005b). The prevalence and extent of plastic impacts needs further investigation to determine its acute and long-term effects on the short-tailed albatross (U.S. Fish and Wildlife Service, 2014). Additional human-induced threats include contamination from oil spills, and potential predation by introduced mammals on breeding islands. Furthermore, incidental interactions from commercial longline gear, though McCracken (2014) asserts in an internal report, there has not been an observed incidental interaction with a short-tailed albatross during the history of the National Marine Fisheries Service observer program with respect to the Hawaii deep-set longline fishery. Shipping conflicts and potential oil spills appear to be growing threats but the likelihood and magnitude is uncertain. Global climate change may be causing changes in the distribution of the short-tailed albatross in the North Pacific, but the overall impact of that change is also unknown. The lack of information about the magnitude or impact of these threats on the short-tailed albatross results in uncertainty about the future recovery of the population (U.S. Fish and Wildlife Service, 2014).

3.9.2.2.4 Marbled Murrelet (*Brachyramphus marmoratus*)

The marbled murrelet is a small, chubby seabird that has a very short neck. During the breeding season it has dark brown to blackish upperparts and a white belly and throat that are greatly mottled. During the winter the upperparts become grey, dark marks form on the sides of the breast and a white ring develops around the eye. Males and females are similar in appearance and size (International Union for Conservation of Nature, 2017; U.S. Fish and Wildlife Service, 2017b).

3.9.2.2.4.1 Status and Management

The marbled murrelet is listed as a threatened species in California, Oregon, and Washington under the ESA (U.S. Fish and Wildlife Service, 1992) and is considered endangered by the state of California (California Department of Fish and Wildlife, 2016). Marbled murrelet populations have suffered significant declines in the Pacific Northwest, caused primarily by the removal of essential nesting habitat by logging and coastal development (International Union for Conservation of Nature, 2017). To stem these declines, critical habitat was designated in 1996 and revised in 2011 to protect mature and old-growth forest nesting habitat determined to have been occupied by the species at the time of listing (U.S. Fish and Wildlife Service, 1996, 2011c). The entire area of designated critical habitat is outside of the Study Area. The USFWS is seeking public comment on its recent determination that all areas currently designated meet the statutory definition of critical habitat (U.S. Fish and Wildlife Service, 2015b).

3.9.2.2.4.2 Habitat and Geographic Range

Murrelets spend most of their lives in the marine environment where they forage in nearshore areas and consume a diversity of prey species, including small fish and invertebrates. In their terrestrial environment, the presence of platforms (large branches or deformities) used for nesting is the most important characteristic of their nesting habitat. Murrelet habitat use during the breeding season is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge habitat, reduced habitat fragmentation, proximity to the marine environment, and forests that are increasing in stand age and height (U.S. Fish and Wildlife

Service, 2009). Marbled murrelets do not build a nest but use natural features, such as moss, clumps of mistletoe, or piles of needles as a nest site on tree limbs (International Union for Conservation of Nature, 2017). Nests are in large conifers, such as coast redwood and western hemlock, in old-growth stands typically within 35 mi. of marine waters. Important features in nesting habitat are stands of 500 acres or larger, multistoried canopy layers, and less than average canopy closures (Grenier & Nelson, 1995; Hamer & Nelson, 1995; Miller & Ralph, 1995). In addition, habitat along major drainages (e.g., rivers and streams) is a key component (International Union for Conservation of Nature, 2017), as murrelets tend to use these drainages as flight corridors to and from inland nest sites.

Marbled murrelets generally remain near breeding sites year-round in most areas (U.S. Fish and Wildlife Service, 2005a). Foraging habitat is generally found within 3 mi. from shore and in water less than 195 ft. deep (Day & Nigro, 2000; International Union for Conservation of Nature, 2017). Birds occur closer to shore in exposed coastal areas and farther offshore in protected coastal areas (International Union for Conservation of Nature, 2017). The highest concentrations are found in protected inshore waters (U.S. Fish and Wildlife Service, 2005a). Physical and biological oceanographic processes that concentrate prey (such as upwelling and rip currents) have an important influence on the foraging distribution of marbled murrelets (Ainley et al., 1995; Burger, 1995, 2002; Day & Nigro, 2000; International Union for Conservation of Nature, 2017; Strong et al., 1995). They are more commonly found inland during the summer breeding season but make daily trips to the ocean to gather food and have been detected in forests throughout the year. When not nesting, the birds live at sea, spending their days feeding close to shore and then moving several miles offshore at night.

Marbled murrelets only occur in coastal waters of the California Current Large Marine Ecosystem within the northeast corner of the Southern California Range Complex portion of the Study Area. Eight reported sightings of marbled murrelets have been documented within the Study Area off the California coast. Sightings have been reported at Marina del Rey, off Santa Barbara Island, at Mugu Lagoon in Ventura County, along the coast in San Diego County, and at the northern end of the Study Area near San Simeon Point (McCaskie & Garrett, 2001). All of these documented sightings were recorded between November and March.

Foraging habitat in the Southern California Bight occurs usually within 3 mi. of the coast in waters less than 195 ft. deep (Day & Nigro, 2000; International Union for Conservation of Nature, 2017); however, because upwelling areas represent important foraging habitat for the marbled murrelet, the potential exists for individuals to be observed farther offshore in the Southern California Bight.

Winter distributions of marbled murrelets are poorly documented. In California, most birds appear to be year-round residents near breeding areas (Naslund, 1993), although dispersal in the winter as far south as Southern California and northern Mexico has been documented (Erickson et al., 1995). A single sighting has occurred at Ensenada Harbor (Erickson et al., 1995). The species is a rare fall/winter vagrant (occurring outside of its normal range) to Southern California, and is “accidental” from the U.S.-Mexico border south along the Mexico coastline (International Union for Conservation of Nature, 2017).

3.9.2.2.4.3 Population Trends

The total estimated marbled murrelet population is 358,200–417,500 individuals, rounded here to 350,000-420,000 individuals, based on 271,000 individuals in Alaska, 72,600–125,600 in British Columbia, and 14,631–20,952 individuals in Washington, Oregon and California (International Union for Conservation of Nature, 2017). The population was estimated to have declined by approximately 15 percent in 2000 to 2007 in Washington, Oregon, and California, with a 50 percent decrease in Alaska

in 1972 to 1992 and a 29 percent decrease in 2001 to 2010, and a 40 percent decrease in some parts of British Columbia in 1982–1992. At-sea surveys over the past 25 years in British Columbia suggest declines of approximately 1 percent per year although radar surveys suggest the population may have been relatively stable since 1999. Availability of nesting habitat in British Columbia, which is strongly correlated with local breeding populations, has declined by 22 percent between 1978 and 2008 and is continuing. Declines are suspected to be very rapid and ongoing due to very low measured productivity rates (International Union for Conservation of Nature, 2017).

3.9.2.2.4.4 Predator and Prey Interactions

Marbled murrelets feed opportunistically on small fish, including sand lance, anchovy, herring, capelin, and smelt, and also on invertebrates (U.S. Fish and Wildlife Service, 1996, 2005b). Feeding takes place in the nearshore marine environment, primarily in protected waters where both Pacific sand lance and surf smelt occur (Burger, 2002; Whitworth et al., 2005). Individuals forage by diving, using their wings for underwater propulsion. The murrelet forages by pursuit diving in relatively shallow waters, usually between 20 and 80 m in depth. The majority of birds are found as pairs or as singles in a band about 300–2,000 m from shore. Foraging dive times averaged about 16 seconds. Murrelets generally forage during the day, and are most active in the morning and late afternoon hours. Some foraging occurs at night (Ralph & Miller, 1995).

While at sea, marbled murrelets are preyed on by birds and mammals including peregrine falcons, bald eagles, western gulls, and northern fur seals. Birds such as common ravens, Steller's jays, and sharp-shinned hawks are predators of marbled murrelet eggs, chicks, and adults during the nesting season (Nelson, 1997).

3.9.2.2.4.5 Species-Specific Threats

The decline of marbled murrelets has been largely caused by extensive removal of late-successional and old growth coastal forest which serve as nesting habitat for murrelets. Additional factors in its decline include high nest-site predation rates and human-induced mortality in the marine environment from disturbance, gillnets, and oil spills. In addition, murrelet reproductive success is strongly correlated with the abundance of mid-trophic level prey. Effects to the marine environment that impact the availability of prey can occur through overfishing or oceanographic variation from weather or climate events. Affects to adults in the marine environment from disturbance events like underwater detonations or pile driving can also impact their ability to forage and successfully provide for their young (U.S. Fish and Wildlife Service, 2009). An estimated 3,500 murrelets are killed annually in Alaska by gill-net fisheries (Carter et al., 2005; Piatt & Naslund, 1995). In addition, more than 1,000 oiled marbled murrelet carcasses were collected after the Exxon Valdez oil spill in Alaska (Carter & Kuletz, 1995). Nest failure is caused by predation by raptors, ravens, and jays (Nelson, 1997).

3.9.2.2.5 Newell's Shearwater (*Puffinus auricularis newelli*)

The Newell's shearwater or 'a'o as native peoples refer to it, is a medium-sized shearwater measuring 12 to 14 in. with a wing span of 30-35 in. It has a glossy black top, a white bottom, and a black bill that is sharply hooked at the tip. Its claws are well adapted for burrow excavation and climbing (U.S. Fish and Wildlife Service, 2012b).

As of May 2016, Newell's shearwater is considered a subspecies of Townsend's shearwater (*P. auricularis*) by the U.S. Fish and Wildlife (*Federal Register* 81 (91), 29165-29166, May 11, 2016). It is regarded by some authorities as a distinct species, *P. newelli* (American Ornithological Society, 2018;

International Union for Conservation of Nature, 2017), and at least one author (Harrison, 1983) considered Newell's shearwater a subspecies of Manx shearwater (*P. puffinus newelli*), but since 1982, most authorities have considered it a subspecies of Townsend's shearwater (American Ornithologists' Union, 1998). Newell's shearwater is also known as Newell's dark-rumped shearwater. The Newell's shearwater is a bird of the open tropical seas and offshore waters near breeding grounds. During their nine-month breeding season from April through November, they nest in burrows under ferns on forested mountain slopes. These burrows are used year after year and usually by the same pair of birds. Although Newell's shearwater is capable of climbing shrubs and trees before taking flight, it needs an open downhill flight path through which it can become airborne (U.S. Fish and Wildlife Service, 2012b).

3.9.2.2.5.1 Status and Management

Newell's shearwater appears to have declined very rapidly on its main breeding island, possibly associated with the impacts of Hurricane Iniki in 1992, and continues to decline, with two known colonies in the early 1980s, and possibly a third, now abandoned. Combined with longer term declines owing to a number of other threats, it qualifies as Endangered (International Union for Conservation of Nature, 2017). The Newell's shearwater was listed as a threatened species by the Fish and Wildlife Service in 1975 (U.S. Fish and Wildlife Service, 2012b), and under evaluation to be upgraded to endangered (U.S. Fish and Wildlife Service, 2011b). This species is also listed as threatened by the state of Hawaii (U.S. Fish and Wildlife Service, 2005a). A federal recovery plan was finalized in 1983 (U.S. Fish and Wildlife Service, 1983). The Newell's shearwater was once abundant on all main Hawaiian Islands. Today, the majority of these birds nest primarily in mountainous terrain between 500 and 2,300 ft. on Kauai. This seabird was reported to be in danger of extinction by the 1930s. The introduction of the mongoose, cat, black rat, and Norway rat may have played a primary role in the reduction of ground nesting seabirds (U.S. Fish and Wildlife Service, 2012b).

Newell's shearwater faces a high level of threat, the population is declining sharply, the threats are difficult and costly to mitigate, the threats are largely unmitigated, and the listed entity is currently recognized as a subspecies. This species' sharp decline and the level of threat warrant reclassification of Newell's shearwater from threatened to endangered as it is no longer "likely to become an endangered species" but is now "in danger of extinction throughout all of its range." (U.S. Fish and Wildlife Service, 2011b). Within the Hawaiian Islands Bird Conservation Region, Newell's shearwater is evaluated as highly imperiled, the most serious category, because of restricted breeding distribution and threats to breeding populations (U.S. Fish and Wildlife Service, 2003). There is no critical habitat designation for the Newell's shearwater.

Newell's shearwater was thought to be extinct by 1908 as a consequence of subsistence hunting by Polynesians and predation by introduced rats, pigs, and dogs. However, they were rediscovered offshore in 1947. One was collected on Oahu in 1954 (Day et al., 2003) and Newell's shearwaters were confirmed as still breeding on Kauai in 1967 (U.S. Fish and Wildlife Service, 2005a). The two most important factors limiting population growth are low breeding probability (birds do not mature until 6 years of age and a high proportion are nonbreeding adults), and high rates of predation on adults and subadults (U.S. Fish and Wildlife Service, 2011b). Predator control in key habitat areas, the establishment of Bird Salvage-Aid Stations, translocation, and light attraction studies have been initiated to help save the Newell's shearwater. Outreach to Kauai's local community has resulted in people picking up injured birds and bringing them to aid stations for care and release, giving the seabirds a chance to live (U.S. Fish and Wildlife Service, 2012b).

3.9.2.2.5.2 Habitat and Geographic Range

Newell's shearwater occurs in open ocean waters in the southern portion of the Hawaii portion of the Study Area and into the western portion of the Transit Corridor Study Area. They spend most of their time in the open ocean year-round (U.S. Fish and Wildlife Service, 2005a) and come ashore only to nest. They avoid inshore waters except when gathering before they fly inland to breeding colonies at night (International Union for Conservation of Nature, 2017).

Newell's shearwaters forage only over open ocean waters of depths reportedly much greater than 6,560 ft. (Spear et al., 1995). Even when nesting, they feed over deep waters and are typically not within 15 mi. of island shores (International Union for Conservation of Nature, 2017). In particular, they find abundant food along oceanic fronts, such as the Equatorial Countercurrent (Spear et al., 1995). Preferred average ocean conditions are 80 degrees Fahrenheit sea surface temperature, 34.5 parts per thousand sea surface salinity, and 250 ft. depth to cold water (Spear et al., 1995). The meteorological conditions favored by Newell's shearwaters are frequent clouds and rain squalls typical of intertropical convergence zones (Spear et al., 1995).

Insular Pacific-Hawaiian Large Marine Ecosystem

Newell's shearwater occurs in coastal waters throughout the Hawaii portion of the Study Area during the breeding season. Newell's shearwater nesting is entirely confined to the main Hawaiian Islands, from Lehua Rock east to Hawaii. Nesting is known on Lehua Rock, Kauai, Molokai, and Hawaii. No population estimates exist for the small nesting colonies that exist on Lehua Rock and Molokai (Day & Cooper, 1995; International Union for Conservation of Nature, 2017; U.S. Fish and Wildlife Service, 2005a). About 20 breeding colonies of Newell's shearwaters are known in the main Hawaiian Islands, but others probably exist (International Union for Conservation of Nature, 2017). In 1992, 11 colonies were known on Kauai. There is evidence but no confirmation of nesting on Oahu, Maui, and Lanai (U.S. Fish and Wildlife Service, 2005a).

Newell's shearwaters nest on Kauai at high elevations (525–3,935 ft.) on steep, densely vegetated mountain slopes and in burrows or deep rock crevices, although a substantial number also nest on dry sparsely vegetated cliffs on the Na Pali coast of Kauai and on Lehua Island (Reynolds & Ritchotte, 1997; U.S. Fish and Wildlife Service, 2005a). The use of steep slopes (mostly greater than 65 degrees) for nesting is probably a consequence of predation pressure from introduced pigs, mongooses, and cats; they select sites where there is either an open canopy of trees and ground cover of uluhe ferns or a dense ground cover of tussock grasses (International Union for Conservation of Nature, 2017).

On the Island of Hawaii, Newell's shearwaters fly over the entire island except the southwestern coast. Shearwaters are most numerous flying to and from the Kohala Mountains on the north coast (Day et al., 2003). During adult presence in the breeding season (April to September), Newell's shearwaters gather on the water close to shore before they fly inland around sunset (International Union for Conservation of Nature, 2017). Based on known or suspected colony locations, Newell's shearwaters are expected to be found gathering in early evening at Niihau (north end around Lehua Rock), Kauai, Oahu, Maui, Molokai, Lanai, and Hawaii from April to September.

Open Ocean

During the breeding season, some Newell's shearwaters forage west and north of the Hawaiian Islands so that the central part of their marine range moves northward in the Transit Corridor portion of the Study Area (International Union for Conservation of Nature, 2017; U.S. Fish and Wildlife Service, 2005a).

3.9.2.2.5.3 Population Trends

The pelagic population of Newell's shearwater is estimated at 84,000 individuals (with a 95 percent confidence interval of 57,000 to 115,000) and from this the breeding population is estimated at 16,700 to 19,300 pairs. Radar data from 1993 and 1999–2001 across 13 sites indicates a 60 to 62 percent decline in numbers visiting Kauai, while recoveries of stranded young birds showed a 72 percent decline over the same time period (Day & Cooper, 1995; Day et al., 2003). Population models incorporating best estimates of breeding effort and success yielded a population decline of 3.2 percent annually. When variables estimating the anthropogenic mortality suffered by the species (predation, light attraction, and collision) were included, these models predicted a population decline of 30 to 60 percent over 10 years. Combining this with longer term declines owing to habitat loss, introduced predators, disorientation owing to urban lighting and collision with powerlines, the species is estimated to be declining at rates exceeding 50 percent over 47 years, three generations (International Union for Conservation of Nature, 2017). Population in the 1980s and early 1990s was estimated at about 84,000, but numbers in 2000 may have been only 21 percent of what they were in 1987 (U.S. Fish and Wildlife Service, 2005a). The largest known population, found on Kauai, was devastated by two hurricanes in 1982 and 1992. Since that last storm, the species has been in steady decline on Kauai. The remaining adults and fledglings are suffering significant deaths from utility pole and line strikes (International Union for Conservation of Nature, 2017). Between 1978 and 2007, more than 30,000 Newell's shearwaters were picked up by island residents from Kauai's highways, athletic fields, and hotel grounds (U.S. Fish and Wildlife Service, 2012b). Continuing forest habitat destruction and predation from introduced mammals are also taking a toll on this species (International Union for Conservation of Nature, 2017).

3.9.2.2.5.4 Predator and Prey Interactions

Although the diet of the Newell's shearwater is not well known, evidence suggests that squid are a major dietary item. It often forages hundreds of kilometers (km) offshore, often in large, mixed species flocks associated with schools of large, predatory fish that drive prey species to the ocean surface. Newell's shearwaters capture food by pursuit-plunging (diving into water and swimming after prey, typically 10 to 30 m deep), usually in company with multispecies feeding flocks associated with tuna (International Union for Conservation of Nature, 2017). This species is not attracted to discarded fish byproducts and does not follow ships (Onley & Scofield, 2007).

Newell's shearwaters are preyed on by introduced animals at their breeding sites, such as cats and birds such as barn owls (Ainley et al., 1997). Another potential predator, the small Asian mongoose *Herpestes javanicus*, has recently been discovered on Kauai (International Union for Conservation of Nature, 2017). Nocturnal activity and cavity-nesting behaviors are their only defense against mammalian predators.

3.9.2.2.5.5 Species-Specific Threats

Historical threats to Newell's shearwater included subsistence hunting by Polynesians and predation by introduced species (a continuing threat) including rats, dogs, pigs, barn owls, feral cats, and the small Indian mongoose (*Herpestes auropunctatus*) (Hawaii Department of Land and Natural Resources, 2005). Current threats include hooking and drowning on commercial longline gear (McCracken, 2014), artificial lights (e.g., street and resort lights) along the coast that blind and disorient fledglings. Once on the ground, these fledglings are unable to fly and thousands are killed each year by cars, cats, and dogs. In addition, adults can collide with power facilities and associated utility wires and associated lines are in the direct path of known Newell's flight corridors. Additional threats are the loss and degradation of forested habitat caused by introduced plants and herbivores.

On Kauai, hurricanes Iwa and Iniki devastated the forests in 1982 and 1992 (Ainley et al., 1997) and, since the latter, the species' population has been declining. Given that a large proportion of the population breeds on Kauai, catastrophic events, like hurricanes, are a serious threat (International Union for Conservation of Nature, 2017).

3.9.2.2.6 Band-rumped Storm-petrel (*Oceanodroma [Hydrobates] castro*), Hawaii Distinct Population Segment

The Hawaii distinct population segment of band-rumped storm-petrel is also known as the Hawaiian storm-petrel (American Ornithologists' Union, 1998; Harrison, 1983). It is intermediate in many respects between the Wilson's and Leach's storm-petrels. Plumage is blackish-brown overall with pale wing bars and a clear, curved white band across rump; white on rump is more extensive than on Leach's but less than on Wilson's (where white extends fully onto undertail coverts). The band-rumped storm-petrel is difficult to identify reliably at sea (U.S. Fish and Wildlife Service, 2017a).

3.9.2.2.6.1 Status and Management

Storm-petrels are the smallest of all the oceanic seabirds (Onley & Scofield, 2007). The Hawaiian population had been a candidate for listing under the ESA since 1989 (U.S. Fish and Wildlife Service, 2004), and was listed as an endangered distinct population segment in 2016 (81 Federal Register 67786). The global population is not a conservation concern due to large populations in Japan and the Galapagos Islands (International Union for the Conservation of Nature and Natural Resources, 2010; U.S. Fish and Wildlife Service, 2005a). In the Hawaiian Islands, band-rumped storm-petrels are the rarest breeding seabirds (International Union for the Conservation of Nature and Natural Resources, 2010; U.S. Fish and Wildlife Service, 2005a). The State of Hawaii categorizes the local population as endangered (U.S. Fish and Wildlife Service, 2005a) and regards it as highly imperiled within the Hawaiian Islands Bird Conservation Region, based on population size, breeding distribution, and threats to breeding distribution (U.S. Fish and Wildlife Service, 2003).

3.9.2.2.6.2 Habitat and Geographic Range

Band-rumped storm-petrels prefer warm deep water of 1,000 m to more than 2,000 m deep. This species occurs close to land where deep water is near an island; otherwise, they occur offshore or in upwelling regions (International Union for the Conservation of Nature and Natural Resources, 2010). Preferred waters range from 80 to 84 degrees Fahrenheit (International Union for the Conservation of Nature and Natural Resources, 2010). Nesting habitat in the main Hawaiian Islands consists of steep cliffs and barren lava flows at high elevations. Nests are in burrows or crevices in rock or lava (International Union for the Conservation of Nature and Natural Resources, 2010; U.S. Fish and Wildlife Service, 2004, 2005a). Also, they have been documented using artificial nest boxes. These sites may well be the last resort of predator avoidance for a species that formerly most likely nested closer to the coast (International Union for the Conservation of Nature and Natural Resources, 2010).

Insular Pacific-Hawaiian Large Marine Ecosystem

Band-rumped storm-petrels occur in coastal waters of the Hawaii portion of the Study Area and into the western portion of the Transit Corridor portion of the Study Area. Colonies in the main Hawaiian Islands are known or suspected on Lehua Island, Kauai, Maui, Kahoolawe, and Hawaii. Other colonies are likely in Waimea Canyon and Hanapepe Valley on the western side of Kauai. On Hawaii, one small population is known to nest on the upper west slope of Mauna Loa. Nesting on remote cliffs on Lehua Island is also confirmed (81 Federal Register 67786). Vocalizations have been heard, indicating occurrence on Kahoolawe, Lanai, Lehua Rock, and Maui (Haleakala Crater) (International Union for the Conservation of

Nature and Natural Resources, 2010; U.S. Fish and Wildlife Service, 2004). There is no known nesting in the Northwestern Hawaiian Islands (U.S. Fish and Wildlife Service, 2004).

During the nesting season, deep water (more than 1,000 m) close to shore can be used for foraging. Fishermen report them mostly at about 3 mi. off the Na Pali coast of Kauai (International Union for the Conservation of Nature and Natural Resources, 2010). Band-rumped storm-petrels are known to gather in nearshore waters before they fly inland to nesting colonies in the early evening.

Open Ocean

Band-rumped storm-petrels occur in the Hawaii portion of the Study Area and the western portion of the Transit Corridor Study Area. They are distributed in the Pacific from Japan east to Central America and northern South America (Harrison, 1983). Pacific populations are divided into distinct Japanese, Hawaiian, and Galapagos breeding populations (U.S. Fish and Wildlife Service, 2004). The Hawaiian population at sea is thought to remain in the central Pacific, ranging south to the Equatorial Countercurrent. Some individuals spend most of their time in open ocean, occurring far offshore from nesting islands; others seem to remain close to nesting colonies year-round (U.S. Fish and Wildlife Service, 2005a).

3.9.2.2.6.3 Population Trends

The global population of band-rumped storm-petrels is estimated to be 20,000 to 200,000 individuals. Due to the difficulty in studying this species, the number of birds breeding in Hawaii is currently unknown but is thought to be in the low hundreds (Kauai Endangered Seabird Recovery Project, 2017). The Hawaiian population appears to be significantly reduced in numbers following human occupation of the Hawaiian Islands (81 Federal Register 67786) and is likely a tiny remnant of historical numbers (National Marine Fisheries Service & U.S. Fish and Wildlife Service, 2005). In 2004, the population of band-rumped storm-petrels at sea was estimated at about 5,500 (U.S. Fish and Wildlife Service, 2004). In 2002, the population on Kauai was estimated at 171 to 221 breeding pairs, mostly occurring along the Na Pali coast (Pohakuao Valley, Kalalau Valley, Awaawapuhi Valley, Nuololo Aina, and Nuololo Kay) on the west side of the island.

3.9.2.2.6.4 Predator and Prey Interactions

Band-rumped storm-petrels most likely feed on small fish, squid, and crustaceans, based on records from the Galapagos Islands; diet information is not available for Hawaiian birds (U.S. Fish and Wildlife Service, 2005a). Foraging is confirmed diurnally and suspected nocturnally. Food is captured while sitting on the water or off the surface by bill snatching as the bird gently flaps just above the surface of the water (International Union for the Conservation of Nature and Natural Resources, 2010). Foraging occurs mostly in deep water in all seasons. They are attracted to discarded fish by-product from fishing boats (Onley & Scofield, 2007). Band-rumped storm-petrels are vulnerable to predation by introduced rats, mice, cats, mongooses, pigs, and barn owls (U.S. Fish and Wildlife Service, 2005a).

3.9.2.2.6.5 Species-Specific Threats

The small population size and limited distribution of the band-rumped storm-petrel in Hawaii threaten this endangered population by increasing the potential population consequences of other threats, including natural catastrophes such as hurricanes and landslides (81 Federal Register 67786). The band-rumped storm-petrel is highly vulnerable to predation by introduced rats, mice, cats, mongooses, pigs, and barn owls, as well as being vulnerable to striking power lines and street lights at night (U.S. Fish and Wildlife Service, 2005a). Street and resort lights disorient fledglings, causing them to collide with

structures or fall to the ground, where they are at risk from predators and cars. Additional threats are commercial fishing and ocean pollution, and the loss and degradation of forested habitat caused by introduced plants and herbivores.

3.9.2.3 Species Not Listed Under the Endangered Species Act

At least 195 species of birds are found within the Study Area that are not listed under the ESA. The major groups of birds are described in Section 3.9.2.3.1 (Major Groups), and Section 3.9.2.4 (Migratory Birds) describes species that are protected and of conservation concern under the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act.

3.9.2.3.1 Major Groups

There are nine major groups of birds represented in the Study Area. These birds may be found in air, at the water's surface, or in the water column of the Study Area. The vertical distribution descriptions in Table 3.9-2 are meant to provide a representative description of the taxonomic group; however, due to variations in species behavior, these descriptions may not apply to all species within each group. Distribution in the water column is indicative of a species that is known to dive under the surface of the water (for example, during foraging). More detailed species descriptions, including diving behavior, are provided in Sections 3.9.2.3.1.1 (Geese, Swans, Dabbling, and Diving Ducks [Order Anseriformes]) through 3.9.2.3.1.8 (Order Charadriiformes).

All nine major groups of birds in the Study Area occur either in open ocean areas (North Pacific Subtropical Gyre and North Pacific Transition Zone) or coastal waters of large marine ecosystems (California Current and Insular Pacific-Hawaiian) or coastal bays or estuaries (San Diego Bay) (see maps of the Study Area in Figures 3.0-1 and 3.0-2).

Table 3.9-2: Major Groups of Birds in the Study Area

Major Bird Groups[1]		***Vertical Distribution in the Study Area***		
Common Name (Taxonomic Group)	***Description***	***Open Ocean Areas[2]***	***Large Marine Ecosystem[2]***	***Bays and Harbors***
Geese, swans, dabbling and diving ducks (Order Anseriformes)	Diverse group of birds that inhabit shallow waters, coastal areas, and deeper waters. Feed at the surface by dabbling or by diving in deeper water. Often occur in large flocks.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Loons (Order Gaviiformes)	Superficially duck-like, fish-eating birds that capture prey by diving and underwater pursuit.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column

Table 3.9-2: Major Groups of Birds in the Study Area (continued)

Major Bird Groups[1]		*Vertical Distribution in the Study Area*		
Common Name (Taxonomic Group)	***Description***	***Open Ocean Areas*[2]**	***Large Marine Ecosystem*[2]**	***Bays and Harbors***
Grebes (Order Podicipediformes)	Small diving birds, superficially duck-like. May occur in small groups.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Albatrosses, fulmars, petrels, shearwaters, and storm-petrels (Order Procellariiformes)	Group of largely pelagic seabirds. Fly nearly continuously when at sea. Soar low over the water surface to find prey. Some species dive below the surface.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Boobies, gannets, cormorants, anhingas, and frigatebirds (Order Suliformes)	Diverse group of large, fish-eating seabirds with four toes joined by webbing. Often occur in large flocks near high concentrations of bait fish.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Pelicans, herons, egrets, Ibis, and spoonbills (Order Pelecaniformes)	Large wading birds with dagger-like, down-curved, or spoon-shaped bills used to capture prey in water or mud.	None	Airborne, surface, water column	Airborne, surface, water column
Osprey, bald eagles, peregrine falcons (Orders Accipitriformes, and Falconiformes)	Large raptors that inhabit habitats with open water, including coastal areas. Feed on fish, waterfowl, or other mammals. Migrate and forage over open water.	None	Airborne, surface	Airborne, surface
Shorebirds, phalaropes, gulls, noddies, terns, skua, jaegers, and alcids (Order Charadriiformes)	Diverse group of small to medium sized shorebirds, seabirds and allies inhabiting coastal, nearshore, and open ocean waters.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column

[1]American Ornithologists' Union (1998), Sibley (2014), for major bird taxonomic groups.
[2]Presence in the Study Area includes open ocean areas (North Pacific Subtropical Gyre and North Pacific Transition Zone) and coastal waters of two Large Marine Ecosystems (California Current and Insular Pacific-Hawaiian).

3.9.2.3.1.1 Geese, Swans, Dabbling and Diving Ducks (Order Anseriformes)

There are 50 species of swans, geese, and dabbling and diving ducks in the family Anatidae in North America. No birds from this group are considered Birds of Conservation Concern (U.S. Fish and Wildlife Service, 2008b). Birds from this group range from dabbling ducks found in coastal bays, estuaries, and lagoons to more open water ducks found in deeper water environments. Several of these species are

diving ducks that inhabit nearshore or offshore waters of the Study Area, and San Diego Bay in particular (Sibley, 2014). Scaups (*Aythya spp.*) and surf scoters (*Melanitta perspicillata*) are abundant during winter throughout San Diego Bay, diving and foraging on the bottom from shallow (intertidal) to relatively deep (> 20 ft.) waters (U.S. Department of the Navy, 2013a).

Representative species that can be found in the Study Area include geese (e.g., Canada goose [*Branta canadensis*], brant [*Branta bernicla*]); dabbling ducks (e.g., mallard [*Anas platyrhynchos*], American wigeon [*Anas americana*], northern shoveler [*Anas clypeata*]); diving ducks (e.g., bufflehead [*Bucephala albeola*], greater scaup [*Aythya marila*], lesser scaup [*Aythya affinis*], and red-breasted merganser [*Mergus serrator*]); and scoters (e.g., surf scoter [*Melanitta perspicillata*], black scoter [*Melanitta americana*]) (American Ornithologists' Union, 1998).

3.9.2.3.1.2 Loons (Order Gaviiformes)

There are five species of loons in the family Gaviidae in North America (American Ornithologists' Union, 1998), three of which occur in the Study Area. The common loon (*Gavia immer*) and the red-throated loon (*G. stellata*) are Birds of Conservation Concern (U.S. Fish and Wildlife Service, 2008b). Loons are medium to large fish-eating birds that capture prey by diving underwater (Sibley, 2014). Loons can dive down to 250 ft. with an average dive time of 40 seconds (Sibley, 2014). Loons move ashore only to breed, and all loon species nest on banks of inland ponds or lakes, requiring specific habitat features such as undeveloped shoreline and nest sites that have steep drop offs so they can approach their nest from underwater (Cornell Lab of Ornithology, 2009a). For example, common loons spend their time in both freshwater and saltwater environments but prefer to nest on islands where the shoreline is not developed. Most loons need about 100 ft. of room to take off, so size is another habitat feature that is important for nesting areas. During migration, loons fly high above land or water in loose groups or singly. They winter in coastal, nearshore, or open water marine habitats (Sibley, 2014). For example, the Pacific loon (*G. pacifica*) prefers deep water and is found on the open ocean and in bays. The red-throated loon, a representative species within the Study Area, has a circumpolar distribution, breeds in high latitudes on remote ponds, and winters along the Atlantic and Pacific coasts (American Ornithologists' Union, 1998).

3.9.2.3.1.3 Albatrosses, Fulmars, Petrels, Shearwaters, and Storm-Petrels (Order Procellariiformes)

The Procellariiformes is a large order of open ocean seabirds that are divided into four families: Diomedeidae (albatrosses), Procellariidae (petrels and shearwaters), Hydrobatidae (storm-petrels), and Pelecanoididae (diving-petrels) (Enticott & Tipling, 1997; Onley & Scofield, 2007). These seabirds are generally long-lived, breed once a year, and lay only one egg, thus, they have a low reproductive output. They have extremely broad distributions and include all marine birds that spend most of their lives at sea and exclusively feed in the open ocean, primarily on fish, crustaceans, and crabs. They can be found in high numbers resting on the water in flocks where prey is concentrated (Enticott & Tipling, 1997). Some species feed around fishing boats or become injured from longline gear (Enticott & Tipling, 1997) (Onley & Scofield, 2007). They nest in colonies on remote islands uninhabited by people. Some are ground nesters; others nest in cavities or burrows (Ramos et al., 1997). They return to their birth colonies. Most species of this order are monogamous and mate for life. Both parents participate in egg incubation and chick rearing (Elphick et al., 2001). Representative species that occur in the Study Area include Laysan albatross (*Phoebastria immutabilis*), Northern fulmar (*Fulmaris glacialis*), mottled petrel (*Pterodroma inexpectata*), pink-footed shearwater (*Puffinus creatopus*), and Wilson's storm-petrel (*Oceanites oceanicus*).

3.9.2.3.1.4 Boobies, Gannets, Cormorants, and Frigatebirds (Order Suliformes)

The Suliformes order is a diverse group of large seabirds including anhingas, gannets, boobies, cormorants, and frigatebirds. This order is composed of 16 species in 4 families – 12 species representing 2 families that occur within the Study Area. Three of these species are considered Birds of Conservation Concern (U.S. Fish and Wildlife Service, 2008b). Species of concern within the Study Area include the brown booby (*Sula leucogaster*), great cormorant (*Phalacrocorax carbo*), and magnificent frigatebird (*Fregata magnificens*) (American Ornithologists' Union, 1998).

Suliformes are less pelagic than the Procellariiformes, although some of these species such as frigatebirds are pelagic. Most species are colonial, feed on fish, and use a variety of breeding habitats including trees and bushes (but not burrows). Breeding strategies vary among species, with some being long-lived and having low breeding success, while others have higher annual breeding success, but higher annual adult death (Enticott & Tipling, 1997; Onley & Scofield, 2007).

Cormorants are voracious predators on inshore fishes and have been implicated as a major threat to the recovery efforts of Atlantic salmon in the Gulf of Maine where they feed on juvenile salmon (smolts) leaving the estuaries (Fay et al., 2006; National Marine Fisheries Service & U.S. Fish and Wildlife Service, 2005). Their offshore foraging range is limited by their need for undisturbed, dry nocturnal roosting sites (Shields et al., 2002).

Boobies and gannets are large seabirds that plunge from the air to capture their prey. Filling similar niches, boobies inhabit warmer areas and gannets colder regions. Boobies and gannets often nest on islands in colonies, with gannets nesting on cliffs (BirdLife International, 2012) and boobies generally on the ground if predators allow (Pratt et al., 1987). They forage offshore, often in large flocks, feeding on fish but also foraging at night, often feeding on squid (Pratt et al., 1987).

Like tropicbirds and pelicans, members of this group all have webbed feet and eight toes, and all have a throat sac, called a gular sac (Brown & Harshman, 2008). This sac is highly developed and visible in pelicans and frigatebirds but is also readily apparent in boobies and cormorants. Pelicans use the sac to trap fish, frigatebirds use it as a mating display and to feed on fish, squid, and similar marine life (Dearborn et al., 2001), and cormorants and boobies use the sac for heat regulation. These birds nest in colonies, but individual birds are monogamous (Brown & Harshman, 2008).

3.9.2.3.1.5 Tropicbirds (Order Phaethontiformes)

Tropicbirds are medium-sized seabirds, predominately white with black patterning on the back, wings, and face. They have thick, pointed bills that are red or orange in color that are slightly decurved. Their most notable feature is the extremely long and narrow central tail feathers, which can be 11 to 22 in. long. Their wingspans average around 3 ft. Superficially, tropicbirds resemble terns. Tropicbirds are plunge divers that feed on fish and are highly pelagic foragers in tropical and subtropical oceans, coming to land mainly to breed (Sibley, 2014). Red-billed tropicbirds (*Phaethon aethereus*) are rare visitors to the Study Area in both southern California and Hawaiian waters, whereas white-tailed and red-tailed tropicbirds (*P. lepturus* and *P. rubricauda*, respectively) nest in the Hawaiian Islands occur in the surrounding waters (Sibley, 2014).

3.9.2.3.1.6 Pelicans, Herons, Egrets, Ibis, and Spoonbills (Order Pelecaniformes)

Pelecaniformes is a large group composed of long-legged, large billed species that includes pelicans, herons, egrets, ibis, and spoonbills. However, with the exception of two species of pelicans (described below), they are inhabitants of freshwater marshes and are unlikely to occur in the Study Area.

The brown pelican (*Pelecanus occidentalis*) primarily occurs in shallow (less than 150 ft.) warm coastal marine and estuarine environments, as well as offshore where they forage primarily on fish by head first plunge-diving. Most plunge-diving is limited to 1 to 2 m within the water column. Foraging occurs within 20 km of nesting islands during the breeding season, and up to 75 km offshore during the nonbreeding season (Shields et al., 2002). American white pelicans (*Pelecanus erythrorhynchos*) are found in shallow coastal bays, inlets, and estuaries that support forage fish (Knopf & Evans, 2004). Flocks forage cooperatively, swimming and encircling fish as a coordinated group or driving them into shallows, where they are caught with synchronized bill dipping (Enticott & Tipling, 1997; Onley & Scofield, 2007).

3.9.2.3.1.7 Osprey, Bald Eagles, Kites and Falcons (Orders Accipitriformes and Falconiformes)

Accipitriformes is a large group consisting of 60 species in three families (American Ornithologists' Union, 1998). This order generally has broad wings well suited for soaring. Falconiformes include 9 North American species that, with the exception of the caracara (*Caracara cheriway*), are fast-flying predators with pointed wings and a streamline body shape (Sibley, 2014). Members of both orders hunt by day and feed on a variety of prey, including fish, small mammals, reptiles, and carrion. Species that are likely to occur within the Study Area include the osprey (*Pandion haliaetus)* bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), and swallow-tailed kite (*Elanoides forficatus*). The bald eagle, peregrine falcon, and swallow-tailed kite are Birds of Conservation Concern.

Ospreys live near slow-moving waters of coastal, nearshore, and freshwater environments in many parts of the Study Area. They are plunge feeders but also have the ability to capture prey with their feet while keeping their head above water. Fish make up a large portion of their diet, and therefore, their vision is well adapted to detecting underwater objects from 10 to 40 m above water (Poole et al., 2002). Ospreys nest around the shores of San Diego Bay and forage in the waters of the bay (U.S. Department of the Navy, 2013a).

3.9.2.3.1.8 Shorebirds, Phalaropes, Gulls, Noddies, Terns, Skimmers, Skuas, Jaegers, and Alcids (Order Charadriiformes)

Shorebirds are small, generally long-legged coastal birds, many of which forage below the high tide in the surf zone by picking and probing for small aquatic prey (Sibley, 2014). Shorebirds undergo some of the longest distance migrations known for birds, for example, the red knot annually migrates more than 15,000 km. Though most of their life cycle is spent in coastal areas, shorebird migration over open ocean does occur (Elphick, 2007). Although taxonomically grouped among some shorebirds, two species of phalaropes in the family Scolopacidae that occur within the Study Area are functionally seabirds, spending the nonbreeding months out on the open ocean. These include the red-necked phalarope (*Phalaropus lobatus*) and red phalarope (*Phalaropus fulicarius*), both of which breed in high arctic habitats but spend migrate and winter at sea, gathering in small flocks at upwellings and convergence zones, foraging on zooplankton and other small aquatic animals that rise to the surface (Rubega et al., 2000).

Gulls, noddies, and terns in the family Laridae are a diverse group of small to medium sized seabirds that inhabit coastal, nearshore, and open sea waters. Skuas and jaegers in the family Stercorariidae are stocky powerful birds with long pointed wings, long tails, strong hooked bills, and sharp talons known for robbing the food of smaller seabirds, teasing and harassing them until they drop their prey. Murres, murrelets, and auklets in the family Alcidae are good swimmers and divers and have short wings, which require them to flap their wings rapidly to fly.

Species in the order Charadriiformes occupy diverse habitats. Some species in this order spend most of their time at sea (e.g., jaegers, skuas, alcids), whereas others are more coastal or near shore (e.g., gulls). Many charadriiforms inhabit marine and freshwater wetlands; others spend most of their lives in or near the ocean. Many species breed in colonies, and some species lay more than one egg (Ericson et al., 2003; Fain & Houde, 2007; Harrison, 1983; Onley & Scofield, 2007). Representative species within the Study Area include semipalmated plover (*Charadrius semipalmatus*), Bonaparte's gull (*Larus philadelphia*), black-legged kittiwake (*Rissa tridactyla*), Forster's tern (*Sterna forsteri*), parasitic jaeger (*Stercorarius parasiticus*), common murre (*Uria aalge*), sooty shearwater (*Puffinus tenuirostris*), and rhinoceros auklet (*Cerorhinca monocerata*).

3.9.2.4 Migratory Birds

Most of the bird species that would be encountered in the Study Area are listed under the Migratory Bird Treaty Act (U.S. Fish and Wildlife Service, 2015a). The Migratory Bird Treaty Act established federal responsibilities for protecting nearly all migratory species of birds as defined in the Act, their eggs, and nests. Under the Migratory Bird Treaty Act, migratory bird means any bird, whatever its origin and whether or not raised in captivity, which belongs to a species listed in Section 10.13 of the Migratory Bird Treaty Act, or which is a mutation or a hybrid of any such species, including any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof. Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 Code of Federal Regulations [CFR] part 21), the USFWS has promulgated a rule that authorizes the incidental take of migratory birds provided they do not result in a significant impact on the population of a migratory bird species. Of the 1,027 species protected under the Migratory Bird Treaty Act (U.S. Fish and Wildlife Service, 2013), over 100 species occur in the Study Area. These species are not analyzed individually, but rather are grouped based on taxonomic or behavioral similarities based on the stressor that is being analyzed. Conclusions of potential impacts on species protected under the Migratory Bird Treaty Act are presented at the conclusion of each stressor subsection as well as in Section 3.9.4 (Summary of Potential Impacts on Birds).

Birds of Conservation Concern are species, subspecies, and populations of migratory and non-migratory birds that the USFWS has determined to be the highest priority for conservation actions (U.S. Fish and Wildlife Service, 2008b). The purpose of the Birds of Conservation Concern list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions needed to conserve these species. Of the species that occur within the Study Area, 15 are considered Birds of Conservation Concern (Table 3.9-3). These species are not analyzed individually, but rather are grouped by taxonomic or behavioral similarities based on the stressor that is being analyzed.

Table 3.9-3: Birds of Conservation Concern that Occur within the Study Area

Order/Family	*Common Name*	*Scientific Name*
Order Procellariiformes		
Family Diomedeidae		
	Laysan albatross	*Phoebastria immutabilis*
	Black-footed albatross	*Phoebastria nigripes*
Family Procellariidae		
	Pink-footed shearwater	*Puffinus creatopus*
	Christmas shearwater	*Puffinus nativitatis*
	Black-vented shearwater	*Puffinus opisthomelas*

Table 3.9-3: Birds of Conservation Concern that Occur within the Study Area (continued)

Order/Family	*Common Name*	*Scientific Name*
Family Hydrobatidae		
	Ashy storm-petrel	*Oceanodroma homochroa*
	Band-rumped storm-petrel	*Oceanodroma [Hydrobates] castro*
	Tristram's storm-petrel	*Oceanodroma tristrami*
Order Falconiformes		
Family Falconidae		
	Peregrine falcon	*Falco peregrinus*
Order/Family	***Common Name***	***Scientific Name***
Order Charadriiformes		
Family Lardiae		
Subfamily Sterninae	Blue noddy	*Procelsterna cerulean*
	Gull-billed tern	*Sterna nilotica*
Subfamily Rynchopinae	Black skimmer	*Rynchops niger*
Family Ardeidae		
	Guadalupe murrelet	*Synthliboramphus hypoleucus*
	Scripps's murrelet	*Synthliboramphus scrippsi*
	Cassin's auklet	*Ptychoramphus aleuticus*

3.9.2.4.1 Grebes (Order Podicipediformes)

There are seven species of grebes in the family Podicipedidae in North America, all of which occur in the Study Area (American Ornithologists' Union, 1998). Two of these species, the pied-billed grebe (*Podilymbus podiceps*) and horned grebe (*Podiceps auritus*) are Birds of Conservation Concern (U.S. Fish and Wildlife Service, 2008b). Grebes can be found in a variety of aquatic habitats ranging from seasonally flooded scrubland and roadside ditches to deep lakes and coastal bays. Most grebe species winter in open waters while preferring marshy, vegetated habitats during the summer months (Sibley, 2014). Grebes forage by diving for small aquatic animals such as insects, fish, and crustaceans in the water column. For example, horned grebes can dive for up to 3 minutes and travel 500 ft. underwater, where they are sometimes preyed upon by sharks and orcas (Ehrlich et al., 1988). Grebes tend to escape predators by diving or sinking, leaving only the head exposed, rather than taking flight. All grebe species build floating nests in marshes and winter on the ocean and nearshore coastal areas (Sibley, 2014).

3.9.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact birds known to occur within the Study Area. Tables 2.6-1 through 2.6-5 present the baseline and proposed typical training and testing activity locations for each alternative (including number of events). General characteristics of all Navy stressors were introduced in Section 3.0.3.3 (Identifying Stressors for Analysis), and living resources' general susceptibilities to stressors were introduced in Section 3.0.3.6 (Biological Resource Methods). The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors analyzed for birds are:

- **Acoustics** (sonar and other transducers, air guns, pile driving, aircraft noise, vessel noise, and weapons noise);
- **Explosives** (explosions in-air, explosions in-water);

- **Energy** (in-water electromagnetic devices, in-air electromagnetic devices, and high energy lasers);
- **Physical disturbance and strikes** (vessels & in-water devices, aircraft & aerial targets, military expended materials, seafloor devices);
- **Entanglement** (wires and cables, decelerators/parachutes, biodegradable polymers);
- **Ingestion** (military expended materials – munitions, military expended materials - other than munitions); and
- **Secondary stressors** (impacts on habitat, impacts on prey availability).

Each of these components is analyzed for potential impacts on birds within the stressor categories contained in this section. The specific analysis of the training and testing activities considers these components within the context of geographic location and overlap of marine bird resources. In addition to the analysis here, the details of all training and testing activities, stressors, components that cause the stressor, and geographic overlap within the Study Area are summarized in Section 3.0.3.3 (Identifying Stressors for Analysis) and detailed in Appendix B (Activity Stressor Matrices).

3.9.3.1 Acoustic Stressors

This section evaluates the potential for acoustic stressors to impact birds during training and testing activities in the Study Area. Assessing whether sounds may disturb or injure an animal involves understanding the characteristics of the acoustic sources, the animals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those animals. Impacts could depend on other factors besides the received level of sound, such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound.

The below analysis of effects to birds follows the concepts outlined in Section 3.0.3.6.1 (Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). This section begins with a summary of relevant data regarding acoustic impacts on birds in Section 3.9.3.1.1 (Background). This is followed by an analysis of impacts on birds due to specific Navy acoustic stressors (sonar and other transducers; air guns; pile driving; vessel noise; aircraft noise; and weapons noise). Additional explanation of the acoustic terms and sound energy concepts used in this section is found in Appendix D (Acoustic and Explosive Concepts).

3.9.3.1.1 Background

The sections below include a survey and synthesis of best-available-science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on birds potentially resulting from sound-producing Navy training and testing activities. Impacts on birds depends on the sound source and context of exposure. Possible impacts include auditory or non-auditory trauma, hearing loss resulting in temporary or permanent hearing threshold shift, auditory masking, physiological stress, or changes in behavior, including changing habitat use and activity patterns, increasing stress response, decreasing immune response, reducing reproductive success, increasing predation risk, and degrading communication (Larkin et al., 1996). Numerous studies have documented that birds and other wild animals respond to human-made noise (Bowles et al., 1994; Larkin et al., 1996; National Park Service, 1994). The manner in which birds respond to noise could depend on species physiology life stage, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence/absence of associated visual stimuli, and previous exposure. Noise may cause

physiological or behavioral responses that reduce the animals' fitness or ability to grow, survive, and reproduce successfully.

The types of birds exposed to sound-producing activities depend on where training and testing activities occur. Birds in the study area can be divided into three groups based on breeding and foraging habitat: (1) those species such as albatrosses, petrels, frigatebirds, tropicbirds, boobies, alcids, and some terns that forage over the ocean and nest on oceanic islands; (2) species such as pelicans, cormorants, gulls, and some terns that nest along the coast and forage in nearshore areas; and (3) those few species such as skuas, jaegers, Franklin's gull, Bonaparte's gulls, ring-billed gulls, black terns, and ducks and loons that nest and forage in inland habitats and come to the coastal areas during nonbreeding seasons. In addition, birds that are typically found inland, such as songbirds, may be present flying in large numbers over open ocean areas during annual spring and fall migration periods.

Birds could be exposed to sounds from a variety of sources. While above the water surface, birds may be exposed to airborne sources such as pile driving, weapons noise, vessel noise, and aircraft noise. While foraging and diving, birds may be exposed to underwater sources such as sonar, pile driving, air guns, and vessel noise. While foraging birds will be present near the water surface, migrating birds may fly at various altitudes. Some species such as sea ducks and loons may be commonly seen flying just above the water's surface, but the same species can also be spotted flying high enough (5,800 ft.) that they are barely visible through binoculars (Lincoln et al., 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152 m) and 1,000 ft. (305 m). Radar studies have demonstrated that 95 percent of the migratory movements occur at less than 10,000 ft. (3,050 m), with the bulk of the movements occurring under 3,000 ft. (914 m) (Lincoln et al., 1998).

Seabirds use a variety of foraging behaviors that could expose them to underwater sound. Most seabirds plunge-dive from the air into the water or perform aerial dipping (the act of taking food from the water surface in flight); others surface-dip (swimming and then dipping to pick up items below the surface) or jump-plunge (swimming, then jumping upward and diving underwater). Birds that feed at the surface by surface or aerial dipping with limited to no underwater exposure include petrels, jaegers, and phalaropes. Birds that plunge-dive are typically submerged for short durations, and any exposure to underwater sound would be very brief. Birds that plunge-dive include albatrosses, some tern species, masked boobies, gannets, shearwaters, and tropicbirds. Some birds, such as cormorants, seaducks, alcids, and loons pursue prey under the surface, swimming deeper and staying underwater longer than other plunge-divers. Some of these birds may stay underwater for up to several minutes and reach depths between 50 ft. (15 m) and 550 ft. (168 m) (Alderfer, 2003; Durant et al., 2003; Jones, 2001; Lin, 2002; Ronconi, 2001). Birds that forage near the surface would be exposed to underwater sound for shorter periods of time than those that forage below the surface. Exposures of birds that forage below the surface may be reduced by destructive interference of reflected sound waves near the water surface (see Appendix D, Acoustic and Explosive Concepts). Sounds generated underwater during training and testing would be more likely to impact birds that pursue prey under the surface, although as previously stated, little is known about seabird hearing ability underwater.

3.9.3.1.1.1 Injury

Auditory structures can be susceptible to direct mechanical injury due to high levels of impulsive sound. This could include tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures such as hair cells within the organ of Corti. Auditory trauma differs from auditory fatigue in that the latter involves the overstimulation of the auditory system, rather than direct

mechanical damage, which may result in hearing loss (see Section 3.9.3.1.1.2, Hearing Loss). There are no data on damage to the middle ear structures of birds due to acoustic exposures. Because birds are known to regenerate auditory hair cells, studies have been conducted to purposely expose birds to very high sound exposure levels (SELs) in order to induce hair cell damage in the inner ear. Because damage can co-occur with fatiguing exposures at high SELs, effects to hair cells are discussed below in Section 3.9.3.1.1.2 (Hearing Loss).

Because there is no data on non-auditory injury to birds from intense non-explosive sound sources, it may be useful to consider information for other similar-sized vertebrates. The rapid large pressure changes near non-explosive impulsive underwater sound sources, such as some large air guns and pile driving, are thought to be potentially injurious to other small animals (fishes and sea turtles). While long-duration exposures (i.e., minutes to hours) to high sound levels of sonars are thought to be injurious to fishes, this has not been experimentally observed [see Popper et al. (2014)]. Potential for injury is generally attributed to compression and expansion of body gas cavities, either due to rapid onset of pressure changes or resonance (enhanced oscillation of a cavity at its natural frequency). Because water is considered incompressible and animal tissue is generally of similar density as water, animals would be more susceptible to injury from a high-amplitude sound source in water than in air since waves would pass directly through the body rather than being reflected. Proximal exposures to high-amplitude non-impulsive sounds underwater could be limited by a bird's surfacing response.

In air, the risk of barotrauma would be associated with high-amplitude impulses, such as from explosives (discussed in Section 3.9.3.2, Explosive Stressors). Unlike in water, most acoustic energy will reflect off the surface of an animal's body in air. Plus, air is compressible whereas water is not, allowing energy to dissipate more rapidly. For these reasons, in-air non-explosive sound sources in this analysis are considered to pose little risk of non-auditory injury.

3.9.3.1.1.2 Hearing Loss

Exposure to intense sound may result in hearing loss which persists after cessation of the noise exposure. Hearing loss may be temporary or permanent, depending on factors such as the exposure frequency, received sound pressure level (SPL), temporal pattern, and duration. Hearing loss could impair a bird's ability to hear biologically important sounds within the affected frequency range. Biologically important sounds come from social groups, potential mates, offspring, or parents; environmental sounds; prey; or predators.

Because in-air measures of hearing loss and recovery in birds due to an acoustic exposure are limited [e.g., quail, budgerigars, canaries, and zebra finches (Ryals et al., 1999); budgerigar (Hashino et al., 1988); parakeet (Saunders & Dooling, 1974); quail (Niemiec et al., 1994)] and no studies exist of bird hearing loss due to underwater sound exposures, auditory threshold shift in birds is considered to be consistent with general knowledge about noise-induced hearing loss described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.6.1). The frequencies affected by hearing loss would vary depending on the exposure frequency. The limited data on hearing loss in birds shows that the frequency of exposure is the hearing frequency most likely to be affected (Saunders & Dooling, 1974).

Hearing loss can be due to biochemical (fatiguing) processes or tissue damage. Tissue damage can include damage to the auditory hair cells and their underlying support cells. Hair cell damage has been observed in birds exposed to long duration sounds that resulted in initial threshold shifts greater than 40 dB (Niemiec et al., 1994; Ryals et al., 1999). Unlike many other animals, birds have the ability to

regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks (Rubel et al., 2013; Ryals et al., 1999). Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al., 1999). Birds may be able to protect themselves against damage from sustained sound exposures by reducing middle ear pressure, an ability that may protect ears while in flight (Ryals et al., 1999) and from injury due to pressure changes during diving (Dooling & Therrien, 2012).

Hearing loss is typically quantified in terms of threshold shift—the amount (in dB) that hearing thresholds at one or more specified frequencies are elevated, compared to their pre-exposure values, at some specific time after the noise exposure. The amount of threshold shift measured usually decreases with increasing recovery time — the amount of time that has elapsed since a noise exposure. If the threshold shift eventually returns to zero (i.e., the hearing threshold returns to the pre-exposure value), the threshold shift is called a temporary threshold shift (TTS). If the threshold shift does not completely recover (the threshold remains elevated compared to the pre-exposure value), the remaining threshold shift is called a permanent threshold shift (PTS). By definition, TTS is a function of the recovery time, therefore comparing the severity of noise exposures based on the amount of induced TTS can only be done if the recovery times are also considered. For example, a 20 dB TTS measured 24 hours post-exposure indicates a more hazardous exposure than one producing 20 dB of TTS measured only two minutes after exposure; if the TTS is 20 dB after 24 hours, the TTS measured after two minutes would have likely been much higher. Conversely, if 20 dB of TTS was measured after two minutes, the TTS measured after 24 hours would likely have been much smaller.

Studies in mammals have revealed that noise exposures resulting in high levels of TTS (greater than 40 dB) may also result in neural injury without any permanent hearing loss (Kujawa & Liberman, 2009; Lin et al., 2011). It is unknown if a similar effect would be observed in birds.

Hearing Loss due to Non-Impulsive Sounds

Behavioral studies of threshold shift in birds within their frequencies of best hearing (between 2 and 4 kHz) due to long-duration (30 minutes to 72 hours) continuous, non-impulsive, high-level sound exposures in air have shown that susceptibility to hearing loss varies substantially by species, even in species with similar auditory sensitivities, hearing ranges, and body size (Niemiec et al., 1994; Ryals et al., 1999; Saunders & Dooling, 1974). For example, Ryals et al. (1999) conducted the same exposure experiment on quail and budgerigars, which have very similar audiograms. A 12-hour exposure to a 2.86 kHz tone at 112 dB re 20 µPa SPL [cumulative SEL of 158 dB re 20 $\mu Pa^2 s$] resulted in a 70 dB threshold shift measured after 24 hours of recovery in quail, but a substantially lower 40 dB threshold shift measured after just 12 hours of recovery in budgerigars which recovered to within 10 dB of baseline after three days and fully recovered by one month (Ryals et al., 1999). Although not directly comparable, this SPL would be perceived as extremely loud but just under the threshold of pain for humans per the American Speech-Language-Hearing Association. Whereas the 158 dB re 20 μPa^2-s SEL tonal exposure to quail discussed above caused 20 dB of PTS (Ryals et al., 1999), a shorter (4-hour) tonal exposure to quail with similar SEL (157 dB re 20 μPa^2-s) caused 65 dB of threshold shift that fully recovered within two weeks (Niemiec et al., 1994).

Data on threshold shift in birds due to relatively short-duration sound exposures that could be used to estimate the onset of threshold shift is limited. Saunders and Dooling (1974) provide the only threshold shift growth data measured for birds. Saunders and Dooling (1974) exposed young budgerigars to four levels of continuous 1/3-octave band noise (76, 86, 96, and 106 dB re 20 µPa) centered at 2.0 kHz and

measured the threshold shift at various time intervals during the 72-hour exposure. The earliest measurement found 7 dB of threshold shift after approximately 20 minutes of exposure to the 96 dB re 20 µPa SPL noise (127 dB re 20 μPa^2-s SEL). Generally, onset of TTS in other species has been considered 6 dB above measured threshold (Finneran, 2015), which accounts for natural variability in auditory thresholds. The Saunders and Dooling (1974) budgerigar data is the only bird data showing low levels of threshold shift. Because of the observed variability of threshold shift susceptibility among bird species and the relatively long duration of sound exposure in Saunders and Dooling (1974), the observed onset level cannot be assumed to represent the SEL that would cause onset of TTS for other bird species or for shorter duration exposures (i.e., a higher SEL may be required to induce threshold shift for shorter duration exposures).

Since the goal of most bird hearing studies has been to induce hair cell damage to study regeneration and recovery, exposure durations were purposely long. Studies with other non-avian species have shown that long-duration exposures tend to produce more threshold shift than short-duration exposures with the same SEL [e.g., see Finneran (2015)]. The SELs that induced TTS and PTS in these studies likely over-estimate the potential for hearing loss due to any short-duration sound of comparable SEL that a bird could encounter outside of a controlled laboratory setting. In addition, these studies were not designed to determine the exposure levels associated with the onset of any threshold shift or to determine the lowest SEL that may result in PTS.

With insufficient data to determine PTS onset for birds due to a non-impulsive exposure, data from other taxa are considered. Studies of terrestrial mammals suggest that 40 dB of threshold shift is a reasonable estimate of where PTS onset may begin [see (Southall et al., 2007)]. Similar amounts of threshold shift have been observed in some bird studies with no subsequent PTS. Of the birds studied, the budgerigars showed intermediate susceptibility to threshold shift; the budgerigars exhibited threshold shifts in the range of 40 dB to 50 dB after 12-hour exposures to 112 dB and 118 dB re 20 µPa SPL tones at 2.86 kHz (158 – 164 dB re 20 μPa^2-s SEL), which recovered to within 10 dB of baseline after three days and fully recovered by one month (Ryals et al., 1999). These experimental SELs are a conservative estimate of the SEL above which PTS may be considered possible for birds.

All of the above studies were conducted in air. There are no studies of hearing loss to diving birds due to underwater exposures.

Hearing Loss due to Impulsive Sounds

The only measure of hearing loss in a bird due to an impulsive noise exposure was conducted by Hashino et al. (1988), in which budgerigars were exposed to the firing of a pistol with a received level of 169 dB re 20 µPa peak SPL (two gunshots per each ear); SELs were not provided. While the gunshot frequency power spectrum had its peak at 2.8 kHz, threshold shift was most extensive below 1 kHz. Threshold shift recovered at frequencies above 1 kHz, while a 24 dB PTS was sustained at frequencies below 1 kHz. Studies of hearing loss in diving birds exposed to impulsive sounds underwater do not exist.

Because there is only one study of hearing loss in birds due to an impulsive exposure, the few studies of hearing loss in birds due to exposures to non-impulsive sound are the only other avian data upon which to assess bird susceptibility to hearing loss from an impulsive sound source. Data from other taxa (U.S. Department of the Navy, 2017) indicate that, for the same SEL, impulsive exposures are more likely to result in hearing loss than non-impulsive exposures. This is due to the high peak pressures and rapid pressure rise times associated with impulsive exposures.

3.9.3.1.1.3 Masking

Masking occurs when one sound, distinguished as the 'noise,' interferes with the detection or recognition of another sound. The quantitative definition of masking is the amount in decibels an auditory detection or discrimination threshold is raised in the presence of a masker (Erbe et al., 2016). As discussed in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (Section 3.0.3.6.1), masking can effectively limit the distance over which an animal can communicate and detect biologically relevant sounds. Masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise.

Critical ratios are the lowest ratio of signal-to-noise at which a signal can be detected. When expressed in decibels, critical ratios can easily be calculated by subtracting the noise level (in dB re 1 μPa^2 /Hz) from the signal level (in dB re 1 µPa) at detection threshold. A signal must be received above the critical ratio at a given frequency to be detectable by an animal. Critical ratios have been determined for a variety of bird species [e.g., Dooling (1980), Noirot et al. (2011), Dooling and Popper (2000), and Crowell (2016)] and inter-species variability is evident. Some birds exhibit low critical ratios at certain vocal frequencies, perhaps indicating that hearing evolved to detect signals in noisy environments or over long distances (Dooling & Popper, 2000).

The effect of masking is to limit the distance over which a signal can be perceived. An animal may attempt to compensate in several ways, such as by increasing the source level of vocalizations (the Lombard effect), changing the frequency of vocalizations, or changing behavior (e.g., moving to another location, increase visual display). Birds have been shown to shift song frequencies in the presence of a tone at a similar frequency (Goodwin & Podos, 2013), and in continuously noisy urban habitats, populations have been shown to have altered song duration and shift to higher frequencies (Slabbekoorn & den Boer-Visser, 2006). Changes in vocalization may incur energetic costs and hinder communication with conspecifics, which, for example, could result in reduced mating opportunities. These effects are of long-term concern in constant noisy urban environments (Patricelli & Blickley, 2006) where masking conditions are prevalent.

3.9.3.1.1.4 Physiological Stress

Animals in the marine environment naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Anthropogenic sound-producing activities have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.6.1).

Chronic stress due to disturbance may compromise the general health and reproductive success of birds (Kight et al., 2012), but a physiological stress response is not necessarily indicative of negative consequences to individual birds or to populations (Larkin et al., 1996; National Park Service, 1994). The reported behavioral and physiological responses of birds to noise exposure can fall within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. These responses can include activation of the neural and endocrine systems, causing changes such as increased blood pressure, available glucose, and blood levels of corticosteroids (Manci et al., 1988). It is possible that individuals would return to normal almost immediately after short-term or transient exposure, and the individual's metabolism and energy budget would not be affected in the long term.

Studies have also shown that birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). However, the likelihood of habituation is dependent upon a number of factors, including species of bird (Bowles et al., 1991), and frequency of and proximity to exposure. Although Andersen et al. (1990) did not evaluate noise specifically, they found evidence that anthropogenic disturbance is related to changes in home ranges; for example, raptors have been shown to shift their terrestrial home range when concentrated military training activity was introduced to the area. On the other hand, cardinals nesting in areas with high levels of military training activity (including gunfire, artillery, and explosives) were observed to have similar reproductive success and stress hormone levels as cardinals in areas of low activity (Barron et al., 2012).

While physiological responses such as increased heart rate or startle response can be difficult to measure in the field, they often accompany more easily measured reactions like behavioral responses. A startle is a reflex characterized by rapid increase in heart rate, shutdown of nonessential functions, and mobilization of glucose reserves. Habituation keeps animals from expending energy and attention on harmless stimuli, but the physiological component might not habituate completely (Bowles, 1995).

A strong and consistent behavioral or physiological response is not necessarily indicative of negative consequences to individuals or to populations (Bowles, 1995; Larkin et al., 1996; National Park Service, 1994). For example, many of the reported behavioral and physiological responses to noise are within the range of normal adaptive responses to external stimuli, such as predation, that wild animals face on a regular basis. In many cases, individuals would return to homeostasis or a stable equilibrium almost immediately after exposure. The individual's overall metabolism and energy budgets would not be affected if it had time to recover before being exposed again. If the individual does not recover before being exposed again, physiological responses could be cumulative and lead to reduced fitness. However, it is also possible that an individual would have an avoidance reaction (i.e., move away from the noise source) to repeated exposure or habituate to the noise when repeatedly exposed.

Due to the limited information about acoustically induced stress responses, the Navy conservatively assumes in its effects analysis that any physiological response (e.g., hearing loss or injury) or significant behavioral response is also associated with a stress response.

3.9.3.1.1.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). The manner in which an animal responds to noise could depend on several factors, including life history characteristics of the species; characteristics of the noise source, sound source intensity, onset rate, distance from the noise source, presence or absence of associated visual stimuli, food and habitat availability, and previous exposure (see Section 3.0.3.6.1, Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities). Researchers have documented a range of bird behavioral responses to noise, including no response, head turn, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations (Brown et al., 1999; Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006; Pytte et al., 2003; Stalmaster & Kaiser, 1997). Some behavioral responses may be accompanied by physiological responses, such as increased heart rate or short-term changes in stress hormone levels (Partecke et al., 2006).

Behavioral responses may depend on the characteristics of the noise, and whether the noise is similar to biologically relevant sounds such as alarm calls by other birds and predator sounds. For example,

European starlings (*Sturnus vulgaris*) took significantly longer to habituate to repeated bird distress calls than white noise or pure tones (Johnson et al., 1985). Starlings may have been more likely to continue to respond to the distress because it is a more biologically meaningful sound. Starlings were also more likely to habituate in winter than summer, possibly meaning that food scarcity or seasonal physiological conditions may affect intensity of behavioral response (Johnson et al., 1985).

Behavioral Reactions to Impulsive Sound Sources

Studies regarding behavioral responses by non-nesting birds to impulsive sound sources are limited. Seismic surveys had no noticeable impacts on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas.

Responses to aircraft sonic booms are informative of responses to single impulsive sounds. Responses to sonic booms are discussed below in Behavioral Reactions to Aircraft.

Behavioral Reactions to Sonar and Other Active Acoustic Sources

There are no studies of bird responses underwater to sonars, but the effect of pingers on fishing nets has been examined. Fewer common murres (*Uria aalge*) were entangled in gillnets when the gillnets were outfitted with 1.5 kHz pingers with a source level of 120 dB re 1 µPa; however, there was no significant reduction in rhinoceros auklet (*Cerorhinca monocerata*) bycatch in the same nets (Melvin et al., 1999; Melvin et al., 2011). It was unknown whether the pingers elicited a behavioral response by the birds or decreased prey availability.

Behavioral Reactions to Aircraft

There are multiple possible factors involved in behavioral responses to aircraft overflights, including the noise stimulus as well as the visual stimulus.

Observations of tern colonies responses to balloon overflights suggest that visual stimulus is likely to be an important component of disturbance from overflights (Brown, 1990). Although it was assumed nesting colonial waterbirds would be more likely to flush or exhibit a mob response when disturbed, observations of nesting black skimmers and nesting least, gull-billed, and common terns showed they did not modify nesting behavior in response to military fixed-wing aircraft engaged in low-altitude tactical flights and rotary-wing overflights (Hillman et al., 2015). Maximum behavioral responses by crested tern (*Sterna bergii*) to aircraft noise were observed at sound level exposures greater than 85 A-weighted decibels (dBA) re 20 µPa. However, herring gulls (*Larus argentatus*) significantly increased their aggressive interactions within the colony and their flights over the colony during overflights with received SPLs of 101–116 dBA re 20 µPa (Burger, 1981).

Raptors and wading birds have responded minimally to jet (110 dBA re 20 µPa) and propeller plane (92 dBA re 20 µPa) overflights, respectively (Ellis, 1981). Jet flights greater than 1,640 ft. (500 m) distance from raptors were observed to elicit no response (Ellis, 1981). The impacts of low-altitude military training flights on wading bird colonies in Florida were estimated using colony distributions and turnover rates. There were no demonstrated impacts of military activity on wading bird colony establishment or size (Black et al., 1984). Fixed-winged jet aircraft disturbance did not seem to adversely affect waterfowl observed during a study in coastal North Carolina (Conomy et al., 1998); however, harlequin ducks were observed to show increased agonistic behavior and reduced courtship behavior up to one to two hours after low-altitude military jet overflights (Goudie & Jones, 2004).

It is possible that birds could habituate and no longer exhibit behavioral responses to aircraft noise, as has been documented for some impulsive noise sources (Ellis, 1981; Russel et al., 1996) and aircraft noise (Conomy et al., 1998). Ellis (1981), found that raptors would typically exhibit a minor short-term startle response to simulated sonic booms, and no long-term effect to productivity was noted.

3.9.3.1.1.6 Long Term Consequences

Long term consequences to birds due to acoustic exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.6.1).

Long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. Most research on long-term consequences to birds due to acoustic exposures has focused on breeding colonies or shore habitats, and does not address the brief exposures that may be encountered during migration or foraging at sea. More research is needed to better understand the long-term consequences of human-made noise on birds, although intermittent exposures are assumed to be less likely than prolonged exposures to have lasting consequences.

3.9.3.1.2 Impacts from Sonar and Other Transducers

Sonar and other transducers emit sound waves into the water to detect objects, safely navigate, and communicate. Use of sonar and other transducers would typically be transient and temporary. General categories of sonar systems are described in Section 3.0.3.3.1 (Acoustic Stressors).

Information regarding the impacts of sonar on birds is unavailable, and little is known about the ability of birds to hear underwater. The limited information (Johansen et al., 2016) and data from other species suggest the range of best hearing may shift to lower frequencies in water (Dooling & Therrien, 2012; Therrien, 2014) (see Section 3.9.2.1.4, Hearing and Vocalization). Because few birds can hear above 10 kHz in air, it is likely that the only sonar sources they may be able to detect are low and mid-frequency sources.

Other than pursuit diving species, the exposure to birds by these sounds is likely to be negligible because they spend only a very short time underwater (plunge-diving or surface-dipping) or forage only at the water surface. Pursuit divers may remain underwater for minutes, increasing the chance of underwater sound exposure.

In addition to diving behavior, the likelihood of a bird being exposed to underwater sound depends on factors such as duty cycle (defined as the percentage of the time during which a sound is generated over a total operational period), whether the source is moving or stationary, and other activities that might be occurring in the area. When used, continuously active sonars transmit more frequently (greater than 80% duty cycle) than traditional sonars, but at a substantially lower source level. However, it should be noted that active sonar is rarely used continuously throughout the listed activities, and many sources are mobile. For moving sources such as hull-mounted sonar, the likelihood of an individual bird being repeatedly exposed to an intense sound source over a short period of time is low because the training activities are transient and sonar use and bird diving are intermittent. The potential for birds to be

exposed to intense sound associated with stationary sonar sources would likely be limited for some training and testing activities because other activities occurring in conjunction may cause them to leave the immediate area. For example, birds would likely react to helicopter noise during dipping sonar exercises by flushing from the immediate area, and would therefore not be exposed to underwater sonar.

Injury due to acoustic resonance of air space in the lungs from sonar and other transducers is unlikely in birds. Unlike mammals, birds have compact, rigid lungs with strong pulmonary capillaries that do not change much in diameter when exposed to extreme pressure changes (Baerwald et al., 2008), leading to resonant frequencies lower than the frequencies used for Navy sources.

A physiological impact, such as hearing loss, would likely only occur if a seabird were close to an intense sound source. An underwater sound exposure would have to be intense and of a sufficient duration to cause hearing loss. Avoiding the sound by returning to the surface would limit extended or multiple sound exposures underwater. Additionally, some diving birds may avoid interactions with large moving vessels upon which the most powerful sonars are operated (Schwemmer et al., 2011). In general, birds are less susceptible to both temporary and PTS than mammals (Saunders & Dooling, 1974). Diving birds have adaptations to protect the middle ear and tympanum from pressure changes during diving that may affect hearing (Dooling & Therrien, 2012). While some adaptions may exist to aid in underwater hearing, other adaptations to protect in-air hearing may limit aspects of underwater hearing (Hetherington, 2008). Because of these reasons, the likelihood of a diving bird experiencing an underwater exposure to sonar or other transducer that could result in an impact on hearing is considered low.

Because diving birds may rely more on vision for foraging and there is no evidence that diving birds rely on underwater acoustic communication for foraging (see Section 3.9.2.1.4, Hearing and Vocalization), the masking of important acoustic signals underwater by sonar or other transducers is unlikely.

There have been no studies documenting diving seabirds' reactions to sonar. However, given the information and adaptations discussed above, diving seabirds are not expected to detect high frequency sources underwater and are only expected to detect mid- and low-frequency sources when in close proximity. A diving bird may not respond to an underwater source, or it may respond by altering its dive behavior, perhaps by reducing or ceasing a foraging bout. It is expected that any behavioral interruption would be temporary as the source or the bird changes location.

Some birds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses, as there is increased potential of foraging success as the prop wake brings prey to the surface (Hamilton, 1958; Hyrenbach, 2001, 2006; Melvin et al., 2001). Birds that approach vessels while foraging are the most likely to be exposed to underwater active acoustic sources, but only if the ship is engaged in anti-submarine warfare or mine warfare with active acoustic sources. However, hull-mounted sonar does not project sound aft of ships (behind the ship, opposite the direction of travel), so most birds diving in ship wakes would not be exposed to sonar. In addition, based on what is known about bird hearing capabilities in air, it is expected that diving birds may have limited or no ability to perceive high-frequency sounds, so they would likely not be impacted by high-frequency sources such as those used in mine warfare.

3.9.3.1.2.1 Impacts from Sonar and Other Transducers Under Alternative 1

Impacts from Sonar and Other Transducers Under Alternative 1 for Training Activities

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training under Alternative 1 are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions).

Under Alternative 1, the number of Major Training Exercises, Integrated/Coordinated Training activities, Civilian Port Defense activities, and Sinking Exercises would fluctuate annually. In addition, a portion of Anti-Submarine Warfare Tracking Exercise-Ship unit-level training activities would be conducted using synthetic means (e.g., simulators) or in conjunction with other training exercises.

Sonar and other transducers would not be regularly used in nearshore areas that could be used by foraging shorebirds, except during maintenance and for navigation in areas around ports. The Pacific Current runs through the Southern California portion of the HSTT Study Area, and is an area of increased productivity that attracts foraging birds. Therefore, birds that forage in open ocean areas would have a greater chance of underwater sound exposure than birds that forage in coastal areas.

The possibility of an ESA-listed bird species being exposed to sonar and other active acoustic sources depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Hawaiian petrels, band-rumped storm petrels, and short-tailed albatrosses do not submerge while foraging; therefore, it is unlikely they would be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a chance that these species could be exposed to underwater sound from sonar and other transducers. However, their plunge dives are brief, so any chance of exposure would be inconsequential. Most other sonar use occurs farther offshore, however, so the chance for an exposure would be low. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and sonar and other transducers will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of sonar and other transducers during training activities as described under Alternative 1 will have no effect on Hawaiian petrels, band-rumped storm petrels, or short-tailed albatrosses. The use of sonar and other transducers during training activities described under Alternative 1 may affect least terns, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Sonar and Other Transducers Under Alternative 1 for Testing Activities

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during testing under Alternative 1 are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). Under Alternative 1, the number of testing activities would fluctuate annually.

The Pacific Current runs through the Southern California Range Complex portion of the Study Area, and is an area of increased productivity that attracts foraging birds. Therefore, birds that forage in these

open ocean areas would have a greater chance of underwater sound exposure than birds that forage in coastal areas.

The possibility of an ESA-listed bird species being exposed to sonar and other active acoustic sources depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Hawaiian petrels, band-rumped storm petrels, and short-tailed albatrosses do not submerge while foraging; therefore, it is unlikely they would be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a chance that these species could be exposed to underwater sound from sonar and other transducers. However, their plunge dives are brief, so any chance of exposure would be inconsequential. Most other sonar use occurs farther offshore so the chance for an exposure would be low. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and sonar and other transducers will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of sonar and other transducers during testing activities as described under Alternative 1 will have no effect on Hawaiian petrels, band-rumped storm petrels, or short-tailed albatrosses. The use of sonar and other transducers during testing activities described under Alternative 1 may affect least terns, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.1.2.2 Impacts from Sonar and Other Transducers Under Alternative 2

Impacts from Sonar and Other Transducers Under Alternative 2 for Training Activities

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training under Alternative 2 are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions).

Under Alternative 2, the maximum number of training activities could occur every year, except the number of some Major Training Exercises and Integrated/Coordinated Training activities would fluctuate annually. In addition, all unit level Anti-Submarine Warfare Tracking Exercise-Ship activities would be completed through individual events conducted at sea, rather than through leveraging other anti-submarine warfare training exercises or the use of synthetic means (e.g., simulators). This would result in an increase of sonar use compared to Alternative 1.

Sonar and other transducers would not be regularly used in nearshore areas that could be used by foraging shorebirds, except during maintenance and for navigation in areas around ports. The Pacific Current runs through the Southern California Range Complex portion of the Study Area, and is an area of increased productivity that attracts foraging birds. Therefore, birds that forage in these open ocean areas would have a greater chance of underwater sound exposure than birds that forage in coastal areas.

The possibility of an ESA-listed bird species being exposed to sonar and other active acoustic sources depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Hawaiian petrels, band-rumped storm petrels, and short-tailed albatrosses do not submerge while foraging; therefore, it is not likely they would be exposed to underwater sound from

sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a chance that these species could be exposed to underwater sound from sonar and other transducers. However, their plunge dives are brief, so any chance of exposure would be inconsequential. Most other sonar use occurs farther offshore so the chance for an exposure would be low. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and sonar and other transducers will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of sonar and other transducers during training activities as described under Alternative 2 will have no effect on Hawaiian petrels, band-rumped storm petrels, or short-tailed albatrosses. The use of sonar and other transducers during training activities described under Alternative 2 may affect least terns, marbled murrelet, and Newell's shearwater.

Impacts from Sonar and Other Transducers Under Alternative 2 for Testing Activities

General categories and characteristics of sonar systems and the number of hours these sonars would be operated during training under Alternative 2 are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities using sonars and other transducers would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions).

Under Alternative 2, the maximum number of nearly all testing activities would occur every year. This would result in an increase of sonar use compared to Alternative 1.

The Pacific Current runs through the Southern California Range Complex portion of the Study Area, and is an area of increased productivity that attracts foraging birds. Therefore, birds that forage in these open ocean areas would have a greater chance of underwater sound exposure than birds that forage in coastal areas.

The possibility of an ESA-listed bird species being exposed to sonar and other active acoustic sources depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Hawaiian petrels, band-rumped storm petrels, and short-tailed albatrosses do not submerge while foraging; therefore, it is unlikely they would be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a chance that these species could be exposed to underwater sound from sonar and other transducers. However, their plunge dives are brief, so any chance of exposure would be inconsequential. Most other sonar use occurs farther offshore so the chance for an exposure would be low. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and sonar and other transducers will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of sonar and other transducers during testing activities as described under Alternative 2 will have no effect on Hawaiian petrels, band-rumped storm petrels, or short-tailed albatrosses. The use of sonar and other transducers during testing activities described under Alternative 2 may affect least terns, marbled murrelet, and Newell's shearwater.

3.9.3.1.2.3 Impacts from Sonar and Other Transducers Under No Action Alternative

Impacts from Sonar and Other Transducers Under No Action Alternative for Training and Testing

Under the No Action Alternative, the Navy would not conduct the training and testing activities in the HSTT Study Area. Various acoustic stressors (e.g., sonar and other transducers) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.1.3 Impacts from Air Guns

Air guns can introduce brief impulsive, broadband sounds into the marine environment. Section 3.0.3.3.1.2 (Air Guns) provides additional details on the use and acoustic characteristics of the small underwater air guns used during Navy activities.

Impulses from air guns lack the strong shock wave and rapid pressure increases of explosions that can cause primary blast injury or barotraumas. Underwater impulses would be generated using small (approximately 60 cubic in.) air guns, which are essentially stainless steel tubes charged with high-pressure air via a compressor. An impulsive sound is generated when the air is almost instantaneously released into the surrounding water, an effect similar to popping a balloon in air. Generated impulses would have short durations, typically a few hundred milliseconds.

The exposure to these sounds by birds, other than pursuit diving species, would be negligible because they spend only a very short time underwater (plunge-diving or surface-dipping) or forage only at the water surface. Pursuit divers may remain underwater for minutes, increasing the chance of underwater sound exposure. However, the short duration of an air gun pulse and its relatively low source level means that a bird would have to be very close to a small air gun used in Navy activities at the moment of discharge to be exposed. In addition, air guns may be fired at greater depths than birds conduct their foraging dives. Because of these reasons, the likelihood of a diving bird experiencing an underwater exposure to an air gun that could result in an impact on hearing is negligible.

Because diving birds may rely more on vision for foraging, there is no evidence that diving birds rely on underwater acoustic communication for foraging (see Section 3.9.2.1.4, Hearing and Vocalization), and the signal from an air gun is very brief, the masking of important acoustic signals underwater by an air gun is unlikely.

The limited data on behavioral reactions to underwater impulsive noise suggest that birds are unlikely to exhibit any notable behavioral reaction toward a small air gun (see Section 3.9.3.1.1.5, Behavioral Reactions).

3.9.3.1.3.1 Impacts from Air Guns Under Alternative 1

Impacts from Air Guns Under Alternative 1 for Training Activities

Training activities under Alternative 1 do not use air guns.

Impacts from Air Guns Under Alternative 1 for Testing Activities

Characteristics of air guns and the number of times they would be operated during testing under Alternative 1 are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities using air guns would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions).

Under Alternative 1, small air guns (12 - 60 cubic inches) would typically be fired at offshore locations in the Hawaii and Southern California Range Complexes.

The possibility of an ESA-listed seabird species being exposed to sounds from an air gun depends on whether it submerges during foraging and whether it forages in areas where this sound source may be used. Hawaiian petrels and short-tailed albatrosses do not submerge while foraging; therefore, it is unlikely they would be exposed to underwater sound from air guns. Least terns, marbled murrelets, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater). The remote possibility of exposure to a brief air gun signal exists, but only for pursuit divers that may be underwater long enough to be exposed. As discussed above, impacts on individual birds, if any, are expected to be minor and limited. No long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and air guns will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of air guns during testing activities as described under Alternative 1 will have no effect on Hawaiian petrels, short-tailed albatrosses, or least terns. The use of air guns during testing activities described under Alternative 1 may affect marbled murrelet and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.1.3.2 Impacts from Air Guns Under Alternative 2

Impacts from Air Guns Under Alternative 2 for Training Activities

Training activities under Alternative 2 do not use air guns.

Impacts from Air Guns Under Alternative 2 for Testing Activities

Air gun testing activities planned under Alternative 2 are identical to those planned under Alternative 1; therefore, the estimated impacts would be identical. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and air guns will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of air guns during testing activities as described under Alternative 2 will have no effect on Hawaiian petrels, short-tailed albatrosses or least terns. The use of air guns during testing activities described under Alternative 2 may affect marbled murrelet and Newell's shearwater.

3.9.3.1.3.3 Impacts from Air Guns Under No Action Alternative

Impacts from Air Guns Under No Action Alternative for Training and Testing

Under the No Action Alternative, the Navy would not conduct the training and testing activities in the HSTT Study Area. Various acoustic stressors (e.g., air guns) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.1.4 Impacts from Pile Driving

Impact pile driving and vibratory pile extraction would occur during construction of an Elevated Causeway System, a temporary pier that allows the offloading of ships in areas without a permanent port. Installation of piles would involve the use of an impact hammer mechanism and pile extraction would involve using the vibratory mechanism. These activities would occur over multiple days, although noise generated by the actual pile driving and extraction would only occur over a portion of any given day (generally an hour or less in total). Section 3.0.3.3.1.3 (Pile Driving) provides additional details on

pile driving activities and the noise levels measured from a prior elevated causeway installation and removal.

Noise from the installation and removal of piles has a potential to affect animals in the vicinity of the training event. Impact pile driving creates repetitive impulsive sound. An impact pile driver generally operates in the range of 36–50 blows per minute. Vibratory pile extraction creates a nearly continuous sound made up of a series of short duration rapid impulses at a much lower source level than impact pile driving. The sounds are emitted both in the air and in the water in nearshore areas where some birds forage. It is expected that most birds would exhibit avoidance behavior and leave the pile driving location. However, if prey species such as fish are killed or injured as a result of pile driving, some birds may continue to forage close to the construction area, or may be attracted to the area, and be exposed to associated noise. Behavioral responses and displacement from the area are expected to be temporary for the duration of the pile driving and extraction activities.

Impulses from the impact hammer are broadband and carry most of their energy in the lower frequencies. The underwater SPLs produced by impact pile driving during Navy activities are below the conservatively estimated injury thresholds recommended for other small animals with similar sized air cavities (sea turtles and fish; see Popper et al. (2014)). Therefore, the risk of barotrauma to any diving birds is negligible. Impulses from the impact hammer attenuate more quickly in air than in water and birds are likely to avoid the area during impact driving. Therefore, the risk of barotrauma to birds in air or at the water surface is negligible.

Pursuit divers may remain underwater for minutes, increasing the chance of underwater sound exposure. However, the short duration of driving or extracting a single pile would limit the likelihood of exposure, especially since a bird that is disturbed by pile driving while underwater may respond by swimming to the surface. Although it is not known what duration or intensity of underwater sound exposure would put a bird at risk of hearing loss, birds are less susceptible to both temporary and PTS than mammals (Saunders & Dooling, 1974). Diving birds have adaptations to protect the middle ear and tympanum from pressure changes during diving that may affect hearing (Dooling & Therrien, 2012). While some adaptions may exist to aid in underwater hearing, other adaptations to protect in-air hearing may limit aspects of underwater hearing (Hetherington, 2008). Because of these reasons, the likelihood of a diving bird experiencing an underwater exposure to impact pile driving that could affect hearing is considered low. Vibratory pile extraction sound levels are low and are not considered to pose a risk to bird hearing in air or in water.

Because diving birds may rely more on vision for foraging, there is no evidence that diving birds rely on underwater acoustic communication for foraging (see Section 3.9.2.1.4, Hearing and Vocalization), and individual pile driving and extraction occurs only over a few minutes, the masking of important acoustic signals underwater by pile driving is unlikely. The potential for masking of calls in air would also likely be limited because of the short duration of individual pile driving and extraction and the likelihood that birds would avoid the area around pile driving activities.

Responses by birds to noise from pile driving would be short-term behavioral or physiological responses (e.g., alert response, startle response, and temporary increase in heart rate). Startle or alert reactions are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any birds. Some birds may be attracted to the area to forage for prey species killed or injured as a result of pile driving and be exposed to noise from pile driving temporarily.

Birds may be temporarily displaced and there may be temporary increases in stress levels; however, behavior and use of habitat would return shortly after the training is complete.

3.9.3.1.4.1 Impacts from Pile Driving Under Alternative 1

Impacts from Pile Driving Under Alternative 1 for Training Activities

Characteristics of pile driving and the number of times pile driving for the elevated causeway system would occur during training under Alternative 1 are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities with pile driving would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). This activity would take place nearshore and within the surf zone up to two times per year at either Silver Strand Training Complex in San Diego, California, or Marine Corps Base Camp Pendleton, California.

The impact of noise produced by pile driving and extraction would be short-term and localized. Birds in the close vicinity are expected to most likely respond by increasing distance from pile driving and extraction activities, or not respond at all to extraction activities. As discussed above, impacts on individual birds, if any, are expected to be minor and limited. No long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations and pile driving will not have a significant adverse effect on populations of migratory bird species.

One ESA-listed seabird is known to be present in areas where pile driving and extraction could occur. California least terns could be exposed to intermittent pile driving noise during the approximate two-week period of each elevated causeway event. However, during the elevated causeway activity, any impact based on displacement from the activity area would be minimized due to the availability of suitable foraging habitat in adjacent boat training lanes at the Silver Strand Training Complex. Further, an exposure resulting in a short-term behavioral response would only be expected if the seabirds did not leave the area prior to the start of the elevated causeway activity. Repeated exposure of individual seabirds is unlikely based on the seabird's capability to avoid or rapidly vacate an area of disturbance and availability of non-impacted foraging habitats.

Pursuant to the ESA, the use of pile driving during training activities described under Alternative 1 will have no effect on Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, or Newell's shearwater. The use of pile driving during training activities described under Alternative 1 may affect least terns. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Pile Driving Under Alternative 1 for Testing Activities

Testing activities under Alternative 1 do not include pile driving.

3.9.3.1.4.2 Impacts from Pile Driving Under Alternative 2

Impacts from Pile Driving Under Alternative 2 for Training Activities

Pile driving training activities planned under Alternative 2 are identical to those planned under Alternative 1; therefore, the estimated impacts would be identical. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and pile driving will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of pile driving during training activities described under Alternative 2 will have no effect on Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled

murrelet, or Newell's shearwater. The use of pile driving during training activities described under Alternative 2 may affect least terns.

Impacts from Pile Driving Under Alternative 2 for Testing Activities

Testing activities under Alternative 2 do not include pile driving.

3.9.3.1.4.3 Impacts from Pile Driving Under No Action Alternative

Impacts from Pile Driving Under No Action Alternative for Training and Testing

Under the No Action Alternative, the Navy would not conduct the training and testing activities in the HSTT Study Area. Various acoustic stressors (e.g., pile driving) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.1.5 Impacts from Vessel Noise

The training and testing proposed in the Study Area involve maneuvers by various types of surface ships, boats, submarines, and unmanned vehicles (collectively referred to as vessels) (see Section 3.0.3.3.1.4, Vessel Noise). Birds could be exposed to both in-air and underwater noise from vessels throughout the Study Area, but few exposures would occur based on the infrequency of operations and the low density of vessels within the Study Area at any given time. Potential for exposure to vessel noise due to Navy activities would be greatest near Navy ports.

Birds respond to vessels in various ways. Some birds are commonly attracted to and follow vessels including certain species of gulls, storm-petrels, and albatrosses (Hamilton, 1958; Hyrenbach, 2001, 2006), while other species such as frigatebirds, sooty terns, and a variety of diving birds seem to avoid vessels (Borberg et al., 2005; Hyrenbach, 2006; Schwemmer et al., 2011). Vessel noise could elicit short-term behavioral or physiological responses but are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any birds. Harmful bird/vessel interactions are commonly associated with commercial fishing vessels because birds are attracted to concentrated food sources around these vessels (Dietrich & Melvin, 2004; Melvin & Parrish, 2001). The concentrated food sources (catch and bycatch) that attract birds to commercial fishing vessels are not present around Navy vessels.

Although loud sudden noises can startle and flush birds, Navy vessels are not expected to result in major acoustic disturbance of birds in the Study Area. The continuous noise from Navy vessels has the potential to cause masking for birds, both in air and underwater. Due to the transient nature of Navy vessels, this masking is expected to be temporary. Birds near ports may experience increased masking and become habituated to this noise or attempt to compensate for the masking. Noises from Navy vessels are similar to or less than those of the general maritime environment. Birds may respond to the physical presence of a vessel, regardless of the associated noise (see Section 3.9.3.4.1, Impacts from Vessels and In-Water Devices).

3.9.3.1.5.1 Impacts from Vessel Noise Under Alternative 1

Impacts from Vessel Noise Under Alternative 1 for Training Activities

Characteristics of vessel noise that would occur during training under Alternative 1 are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities with vessel noise would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). Navy vessel traffic could occur anywhere within the Study Area, but would be

concentrated near Navy ports such as San Diego and Pearl Harbor, and the HSTT Transit Lane, which are heavily trafficked by private and commercial vessels, in addition to naval vessels. Navy vessel noise would continue to be a minor contributor to overall radiated vessel noise in the exclusive economic zone. A study of Navy vessel traffic found that traffic was heaviest in the easternmost part of Southern California Range Complex and in the area surrounding Honolulu (Mintz, 2012).

A bird in the open ocean could be exposed to vessel noise as the vessel passes. Birds foraging or migrating through a training area in the open ocean may respond by avoiding areas of temporarily concentrated vessel noise. Exposures to most seabirds would be infrequent, based on the brief duration and dispersed nature of the vessels.

If a bird responds to vessel noise, only short-term behavioral responses such as startle responses, head turning, or avoidance responses would be expected. Repeated exposures would be limited due to the transient nature of vessel use and regular movement of birds. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and vessel noise will not have a significant adverse effect on populations of migratory bird species.

Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, least terns, marbled murrelets and Newell's shearwaters could be exposed to intermittent vessel noise along the coast. If present in the open water areas where training activities involving vessel noise occur, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelets and Newell's shearwaters could be temporarily disturbed while foraging or migrating.

Pursuant to the ESA, vessel noise during training activities as described under Alternative 1 may affect Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, least terns, marbled murrelets, and Newell's shearwaters. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Vessel Noise Under Alternative 1 for Testing Activities

Characteristics of Navy vessel noise are described in Section 3.0.3.3.1 (Acoustic Stressors). Activities with vessel noise would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). Testing activities within the Study Area typically consist of a single vessel involved in unit-level activity for a few hours, one or two small boats conducting testing, or during a larger training event. Navy vessel traffic could occur anywhere within the Study Area, but would be concentrated near Navy ports such as San Diego and Pearl Harbor, which are heavily trafficked by private and commercial vessels, in addition to naval vessels. Navy vessel noise would continue to be a minor contributor to overall radiated vessel noise in the exclusive economic zone. A study of Navy vessel traffic found that traffic was heaviest in the easternmost part of Southern California Range Complex and in the area surrounding Honolulu (Mintz, 2012).

A bird in the open ocean could be exposed to vessel noise as the vessel passes. Birds foraging or migrating through a testing area in the open ocean may respond by avoiding areas of temporarily concentrated vessel noise. Exposures to most birds would be infrequent, based on the brief duration and dispersed nature of the vessels. If a bird responds to vessel noise, only short-term behavioral responses such as startle responses, head turning, or avoidance responses would be expected. Repeated exposures would be limited due to the transient nature of vessel use and regular movement of birds. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird

populations, and vessel noise will not have a significant adverse effect on populations of migratory bird species.

Hawaiian petrels, short-tailed albatrosses, least terns, marbled murrelets and Newell's shearwaters could be exposed to intermittent vessel noise along the coast. If present in the open water areas where training activities involving vessel noise occur, Hawaiian petrels, short-tailed albatrosses, marbled murrelets and Newell's shearwaters could be temporarily disturbed while foraging or migrating.

Pursuant to the ESA, vessel noise during training activities as described under Alternative 1 may affect Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, least terns, marbled murrelets, and Newell's shearwaters. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.1.5.2 Impacts from Vessel Noise Under Alternative 2

Impacts from Vessel Noise Under Alternative 2 for Training Activities

While there would be an increase in the amount of at-sea vessel time during training under Alternative 2, the general locations and types of effects due to vessel noise would be the same as described in Alternative 1. Therefore, the general locations and types of effects due to vessel noise described above for testing under Alternative 1 would be the same under Alternative 2. Navy vessel noise would continue to be a minor contributor to overall radiated vessel noise in the exclusive economic zone.

Pursuant to the ESA, vessel noise during training activities as described under Alternative 2 may affect Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, least terns, marbled murrelets, and Newell's shearwaters.

Impacts from Vessel Noise Under Alternative 2 for Testing Activities

The difference in vessel noise contributed by testing activities under Alternative 2 compared to Alternative 1 is so small as to not be discernable. Therefore, the general locations and types of effects due to vessel noise described above for testing under Alternative 1 would be the same under Alternative 2. Navy vessel noise would continue to be a minor contributor to overall radiated vessel noise in the exclusive economic zone.

Pursuant to the ESA, vessel noise during testing activities as described under Alternative 2 may affect Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, least terns, marbled murrelets, and Newell's shearwaters.

3.9.3.1.5.3 Impacts from Vessel Noise Under No Action Alternative

Impacts from Vessel Noise Under No Action Alternative for Training and Testing

Under the No Action Alternative, the Navy would not conduct the training and testing activities in the HSTT Study Area. Various acoustic stressors (e.g., vessel noise) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.1.6 Impacts from Aircraft Noise

Birds could be exposed to airborne noise associated with subsonic and supersonic fixed-wing aircraft and helicopter overflights while foraging or migrating in open water, nearshore, or coastal environments within the Study Area. Tilt-rotor impacts would be similar to fixed-wing or helicopter impacts, depending

on which mode the aircraft is in. A description of aircraft noise produced during Navy activities is provided in Section 3.0.3.3.1.5 (Aircraft Noise).

Exposure to fixed-wing aircraft noise would be brief as an aircraft quickly passes overhead. Exposures would be infrequent based on the transitory and dispersed nature of the overflights; repeated exposure of individual birds over a short period of time (hours or days) is unlikely. Birds repeatedly exposed to aircraft noise, often become habituated to the noise and do not respond behaviorally (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). However, habituation seems unlikely in the Study Area given the widely dispersed and infrequent nature of the operations.

Common behavioral responses of wildlife to aircraft noise include no response or stationary alert behavior (Johnson & Reynolds, 2002), startle response, flying away, and increased vocalizations (Bowles, 1995; Larkin et al., 1996; National Park Service, 1994). In some instances, behavioral responses could interfere with breeding, raising young, foraging, habitat use, and physiological energy budgets, particularly when an animal continues to respond to repeated exposures. The potential for masking of calls in air is possible if a bird remains in the area; however, due to the transitory nature of aircraft overflights, the duration of masking would be limited.

Some air combat maneuver training would involve high altitude, supersonic flight, which would produce sonic booms, but such airspeeds would be infrequent and are typically conducted at high altitudes and far from shore, limiting the areas where birds could be exposed. Boom duration is generally less than 300 milliseconds. Sonic booms would cause seabirds to startle, but the exposure would be brief, and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or at worst, a flight response. Because most fixed-wing flights are not supersonic and both birds and aircraft are transient in any area, exposure of birds in the open ocean to sonic booms would be infrequent. It is unlikely that individual birds would be repeatedly exposed to sonic booms in the open ocean.

Helicopters typically operate below 1,000 ft. (304.8 m) altitude and often occur as low as 75–100 ft. (22.9–30.5 m) altitude. This low altitude increases the likelihood that birds would respond to noise from helicopter overflights with reactions such as flushing (Stalmaster & Kaiser, 1997), although a large portion of birds may exhibit no reaction to nearby helicopters (Grubb et al., 2010). Helicopters travel at slower speeds (less than 100 knots) which increases the duration of noise exposure compared to fixed-wing aircraft. Helicopter flights are generally limited to locations closer to the coast, unless deployed onboard ships. Helicopter flights, therefore, are more likely to impact the greater numbers of birds that forage in coastal areas than those that forage in open ocean areas. Nearshore areas of the coast are the primary foraging habitat for many bird species. The presence of dense aggregations of sea ducks, other seabirds, and migrating land birds is a potential concern during low-altitude helicopter activities. Although birds may be more likely to react to helicopters than to fixed-wing aircraft, Navy helicopter pilots avoid large flocks of birds to protect aircrews and equipment, thereby reducing disturbance to birds as well. Noise from low-altitude helicopter overflights would only be expected to elicit short-term behavioral or physiological responses in exposed birds.

Birds in areas that may experience repeated exposure often habituate and do not respond behaviorally (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). Throughout the Study Area, repeated exposure of individual birds or groups of birds is unlikely based on the dispersed nature of the overflights and the capability of birds to avoid or rapidly vacate an area of disturbance. Therefore, the general health of individual birds would not be compromised. Occasional startle or alert reactions to

aircraft noise are not likely to disrupt major behavior patterns (such as migrating, breeding, feeding, and sheltering) or to result in serious injury to any birds.

3.9.3.1.6.1 Impacts from Aircraft Noise Under Alternative 1

Impacts from Aircraft Noise Under Alternative 1 for Training Activities

Characteristics of aircraft noise are described in Section 3.0.3.3.1 (Acoustic Stressors) and the number of training activities that include aircraft under Alternative 1 are shown in Section 3.0.3.3.4.4 (Aircraft). Training activities with aircraft would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions Aircraft) overflights would usually occur near Navy airfields, installations, and in special use airspace within Navy range complexes. In the Study Area, aircraft flights associated with training would be concentrated in the Southern California Range Complex compared to the Hawaii Range Complex and transit corridor. Helicopters use the shortest route available and do not fly adjacent to the coastline when flying to the training and testing areas. Takeoffs and landings on vessels at sea would occur at unspecified locations throughout the Study Area.

A bird in the open ocean could be exposed for a few seconds to fixed-wing aircraft noise as the aircraft quickly passes overhead. If present in the open water areas where training and testing activities involving aircraft overflights occur, Hawaiian petrel, band-rumped storm petrel, short-tailed albatross, marbled murrelet, and Newell's shearwater could be temporarily disturbed while foraging or migrating. California least terns could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast.

Most helicopter activities are transient in nature, although helicopters could also hover for extended periods. Activities involving helicopters would occur closer to the coast and in inshore estuarine locations. Activities involving helicopters may occur for extended periods of time, up to a couple of hours in some areas, increasing the potential for exposure. During these activities, helicopters would typically transit throughout an area and may hover over the water. Longer activity durations and periods of time where helicopters hover may increase the potential for behavioral reactions, startle reactions, and physiological stress. However, the likelihood that birds would remain in the immediate vicinity while an aircraft or helicopter transits directly nearby would be low. Helicopters that hover in a fixed location for an extended period of time could increase the potential for exposure. However, impacts from training activities would be highly localized and concentrated in space and duration. If a bird responds to aircraft noise, only short-term behavioral responses such as startle responses, head turning, or avoidance responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of birds. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and aircraft overflight noise will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, aircraft noise during training activities as described under Alternative 1 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Aircraft Noise Under Alternative 1 for Testing Activities

Characteristics of aircraft noise are described in Section 3.0.3.3.1 (Acoustic Stressors) and the number of testing activities with aircraft under Alternative 1 are shown in Section 3.0.3.3.4.4 (Aircraft). Testing

activities using aircraft would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). Aircraft overflights would usually occur near Navy airfields, installations, and in special use airspace within Navy range complexes. The general locations and types of effects due to aircraft noise described above for training would be similar for many testing activities. Helicopters use the shortest route available and do not fly adjacent to the coastline when flying to the training and testing areas. Takeoffs and landings on vessels at sea would occur at unspecified locations throughout the Study Area.

A bird in the open ocean could be exposed for a few seconds to fixed-wing aircraft noise as the aircraft quickly passes overhead. If present in the open water areas where training and testing activities involving aircraft overflights occur, Hawaiian petrel, short-tailed albatross, marbled murrelet, and Newell's shearwater could be temporarily disturbed while foraging or migrating.

Most helicopter activities are transient in nature, although helicopters could also hover for extended periods. Activities involving helicopters would occur closer to the coast and in inshore estuarine locations. Activities involving helicopters may occur for extended periods of time, up to a couple of hours in some areas, increasing the potential for exposure. During these activities, helicopters would typically transit throughout an area and may hover over the water. Longer activity durations and periods of time where helicopters hover may increase the potential for behavioral reactions, startle reactions, and physiological stress. However, the likelihood that birds would remain in the immediate vicinity while an aircraft or helicopter transits directly nearby would be low. Helicopters that hover in a fixed location for an extended period of time could increase the potential for exposure. However, impacts from training activities would be highly localized and concentrated in space and duration.

If a bird responds to aircraft noise, only short-term behavioral responses such as startle responses, head turning, or avoidance responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of birds. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and aircraft overflight noise will not have a significant adverse effect on populations of migratory bird species.

California least terns could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast. Pursuant to the ESA, aircraft noise during testing activities as described under Alternative 1 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.1.6.2 Impacts from Aircraft Noise Under Alternative 2

Impacts from Aircraft Noise Under Alternative 2 for Training Activities

There would be a minor increase in aircraft overflights under Alternative 2 compared to Alternative 1; however, the types of impacts would not be discernible from those described for training under Alternative 1.

Pursuant to the ESA, aircraft noise during training activities as described under Alternative 2 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater.

Impacts from Aircraft Noise Under Alternative 2 for Testing Activities

There would be a minor increase in aircraft overflights under Alternative 2 compared to Alternative 1; however, the types of impacts would not be discernible from those described for testing under Alternative 1.

Pursuant to the ESA, aircraft noise during testing activities as described under Alternative 2 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater.

3.9.3.1.6.3 Impacts from Aircraft Noise Under No Action Alternative

Impacts from Aircraft Noise Under No Action Alternative for Training and Testing

Under the No Action Alternative, the Navy would not conduct the training and testing activities in the HSTT Study Area. Various acoustic stressors (e.g., aircraft noise) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.1.7 Impacts from Weapons Noise

Birds may be exposed to sounds caused by the firing of weapons, objects in flight and the impact of non-explosive projectiles on the water's surface. Other devices intentionally produce noise to serve as a non-lethal deterrent. These sounds are described in Section 3.0.3.3.1.6 (Weapon Noise). Navy training activities in the Study Area include firing or launching a variety of weapons, including missiles; rockets; and small-, medium-, and large-caliber projectiles. Most weapons firing activities occur far from shore, limiting most possible exposures to birds that forage or migrate greater than 3 nautical miles (NM) offshore. In addition to noise from weapons firing and launching, birds could be briefly disturbed by the impact of non-explosive practice munitions at the water surface. Because of the potential for blast injury due to explosives, the impacts due to explosive munitions and other explosives used during Navy activities are discussed in Section 3.9.3.2.2 (Impacts from Explosives).

Sounds produced by weapons firing (muzzle blast), launch boosters, and projectile travel are potential stressors to birds. Sound generated by a muzzle blast is intense, but very brief. A bird very close to a large weapons blast could be injured or experience hearing loss due to acoustic trauma or threshold shift. Sound generated by a projectile travelling at speeds greater than the speed of sound can produce a low amplitude bow shock wave in a narrow area around its flight path. Inert objects hitting the water surface would generate a splash and the noise may disturb nearby birds. Bird responses to weapons-firing and projectile travel noise may include short-term behavioral or physiological responses such as alert responses, startle responses, or temporary increases in heart rate. Studies of impacts of weapons noise on raptors show that these birds show little reaction (e.g., head turn) and do not alter behavior in the presence of noise from weapons testing (Brown et al., 1999; Schueck et al., 2001; Stalmaster & Kaiser, 1997). Once surface weapons firing activities begin, birds would likely disperse away from the area around the ship and the path of projectiles if disturbed.

Other activities in the general area that precede these activities, such a vessel movement or target setting, could potentially disperse birds away from the area in which weapons-firing noise would occur. Species such as frigatebirds and sooty terns seem to avoid vessels (Borberg et al., 2005; Hyrenbach, 2006). Increased ship activity could drive these and other species from their natural habitat at a critical time or in an important foraging area (Borberg et al., 2005). On the other hand, some birds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses (Hamilton, 1958;

Hyrenbach, 2001, 2006). A number of bird species are attracted to ships because of the increased potential for foraging success (Dietrich & Melvin, 2004; Melvin et al., 2001). The propeller wake generated by all ships, but particularly larger ships, disrupts the water column, causing prey to be brought to the surface where it is more easily captured by a greater variety of bird species. Birds that are attracted to ships could be more likely to be exposed to weapons firing noise.

Airborne weapons firing at airborne targets typically occur at high altitudes of 15,000–25,000 ft. during air-to-air gunnery exercises. Noise generated by firing at such high altitudes is unlikely to generate a strong reaction in birds migrating at lower altitudes or foraging at the surface. The altitudes at which migrating birds fly can vary greatly based on the type of bird, where they are flying (over water or over land), and other factors such as weather. Approximately 95 percent of bird flight during migrations occurs below 10,000 ft. (3,048 m) with the majority below 3,000 ft. (914 m) (Lincoln et al., 1998). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152 m) and 1,000 ft. (305 m).

If a bird does not avoid the area of Navy activity and is in the vicinity of a muzzle blast from a large caliber gun or the bow shock wave of a large supersonic projectile, the potential for auditory impacts exists. If in the immediate vicinity of a large gun muzzle blasts, a bird could experience peak SPLs that have been shown to cause a permanent reduction in hearing sensitivity over the low frequency portion of hearing range (see Section 3.9.3.2.2.2, Hearing Loss). Similarly, the bow shock waves of larger projectiles would create a zone around the path of the projectile where a bird could experience auditory effects due to the near-instantaneous passing of a high peak pressure wave (subjectively a “crack” sound). The estimated range to peak sound levels shown to cause permanent reduction in hearing sensitivity over a portion of a bird’s hearing range from the projectile path of a large caliber gun projectile travelling at supersonic speed is about 10 m. Data for onset of PTS is unavailable, but the range to onset of PTS can be assumed to extend beyond 10 m from a large caliber projectile path. The amplitude of the bow shock wave would increase with supersonic projectile size and speed. Because most projectiles spend all or part of their travel path at altitudes above 20 m, impacts on many low-flying seabirds would be minimal.

The impulsive sound caused by weapon firings would have limited potential to mask any important biological sound simply because the duration of the impulse is brief, even when multiple shots are fired in series.

3.9.3.1.7.1 Impacts from Weapons Noise Under Alternative 1

Impacts from Weapons Noise Under Alternative 1 for Training Activities

Activities using weapons and deterrents would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). General characteristics of types of weapons noise are described in Section 3.0.3.3.1.6 (Weapons Noise), and quantities and locations of expended non-explosive practice munitions and explosives (fragment-producing) for training under Alternative 1 are shown in 3.0.3.3.4.2. (Military Expended Materials). (For explosive munitions, only associated firing noise is considered in the analysis of weapons noise. The noise produced by the detonation of explosive weapons is analyzed in Section 3.9.3.2, Explosive Stressors).

Use of weapons during training would typically occur in the range complexes, with fewer activities in the transit corridor. Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other munitions are conducted more than 3 NM from shore.

Most sounds would be brief, lasting from less than a second for a blast or inert impact to few seconds for other launch and object travel sounds. Most incidents of impulsive sounds produced by weapons firing, launch, or inert object impacts would be single events, with the exception of gunfire activities.

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Variants of the Long Range Acoustic Device are used both on vessels and on piers. These devices communicate voice, tones, or prerecorded tracks within the range of human hearing and may reach birds within 3,000 m of the device. Birds have the potential to be briefly startled or temporarily displaced during training with this device.

California least terns would not be exposed to large-caliber weapons noise near the coast. All species could be exposed to small- and medium-caliber weapons noise that may occur closer to shore. If present in the open water areas where training and testing activities involving weapons use occur, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater could be temporarily disturbed while foraging or migrating.

Because weapon firing occurs at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual birds would not be expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and weapons noise will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, weapons noise during training activities described under Alternative 1 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Weapons Noise Under Alternative 1 for Testing Activities

Activities using weapons and deterrents would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). General characteristics of types of weapons noise are described in Section 3.0.3.3.1.6 (Weapon Noise), and quantities and locations of expended non-explosive practice munitions and explosives (fragment-producing) for testing under Alternative 1 are shown in Section 3.0.3.3.4.2 (Military Expended Materials). (For explosive munitions, only associated firing noise is considered in the analysis of weapons noise. The noise produced by the detonation of explosive weapons is analyzed in Section 3.9.3.2 (Explosive Stressors).

Use of weapons during testing would typically occur in the range complexes. Most activities involving large-caliber naval gunfire or the launching of targets, missiles, bombs, or other munitions are conducted more than 3 NM from shore.

All of these sounds would be brief, lasting from less than a second for a blast or inert impact to few seconds for other launch and object travel sounds. Most incidents of impulsive sounds produced by weapons firing, launch, or inert object impacts would be single events, with the exception of gunfire activities.

California least terns would not be exposed to large-caliber weapons noise near the coast. All species could be exposed to small- and medium-caliber weapons noise that may occur closer to shore. If present in the open water areas where training and testing activities involving weapons use occur, Hawaiian petrel, band-rumped storm petrel, short-tailed albatross, marbled murrelet, and Newell's shearwater could be temporarily disturbed while foraging or migrating.

Because weapon firing occurs at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual birds would not be expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and weapons noise will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, weapons noise during testing activities described under Alternative 1 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.1.7.2 Impacts from Weapons Noise Under Alternative 2

Impacts from Weapons Noise Under Alternative 2 for Training Activities

There would be minor increase in weapons use under Alternative 2 compared to Alternative 1; however, the types and locations of impacts would be the same as those described for testing under Alternative 1. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and weapons noise will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, weapons noise during testing activities described under Alternative 2 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Weapons Noise Under Alternative 2 for Testing Activities

There would be minor increase in weapons use under Alternative 2 compared to Alternative 1; however, the types of impacts and locations of impacts would be the same as those described for testing under Alternative 1. Because impacts on individual birds, if any, are expected to be minor and limited, no long-term consequences to individuals are expected. Accordingly, there would be no consequences to any bird populations, and weapons noise will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, weapons noise during testing activities described under Alternative 2 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelet, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.1.7.3 Impacts from Weapons Noise Under No Action Alternative

Impacts from Weapons Noise Under No Action Alternative for Training and Testing

Under the No Action Alternative, the Navy would not conduct the training and testing activities in the HSTT Study Area. Various acoustic stressors (e.g., weapons noise) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.2 Explosive Stressors

Explosions in the water, near the water surface, and in the air can introduce loud, impulsive, broadband sounds into the marine environment. But, unlike other acoustic stressors, explosives release energy at a high rate producing a shock wave that can be injurious and even deadly. Therefore, explosive impacts on birds are discussed separately from other acoustic stressors, even though the analysis of explosive impacts will rely on data for bird impacts due to impulsive sound exposure where appropriate.

Explosives are usually described by their net explosive weight, which accounts for the weight and type of explosive material. Additional explanation of the acoustic and explosive terms and sound energy concepts used in this section is found in Appendix D (Acoustic and Explosive Concepts).

This section begins with a summary of relevant data regarding explosive impacts on birds in Section 3.9.3.1.1 (Background). The ways in which an explosive exposure could result in immediate effects or lead to long-term consequences for an animal are explained in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (Section 3.0.3.6.1), and this section follows that framework. Studies of the effects of sound and energy from explosives on birds are limited, therefore, where necessary, knowledge of impacts on other species from explosives is used to assess impacts on birds.

3.9.3.2.1 Background

The sections below include a survey and synthesis of best-available-science published in peer-reviewed journals, technical reports, and other scientific sources pertinent to impacts on birds potentially resulting from Navy training and testing activities. A range of impacts could occur to a bird depending on the explosive source and context of the exposure. In addition to acoustic impacts including temporary or permanent hearing loss, auditory masking, physiological stress, or changes in behavior; potential impacts from an explosive exposure can include non-lethal injury and mortality.

3.9.3.2.2 Impacts from Explosives

3.9.3.2.2.1 Injury

If a bird is close to an explosive detonation, the exposure to high pressure levels and sound impulse can cause barotrauma. Barotrauma is physical injury due to a difference in pressure between an air space inside the body and the surrounding air or water. Sudden very high pressures can also cause damage at tissue interfaces due to the way pressure waves travel differently through tissues with different material properties. Damage could also occur to the structure of the ear, considered to be the body part most susceptible to pressure damage.

Detonations that occur underwater could injure, kill, or disturb diving birds, particularly pursuit divers that spend more time underwater than other foraging birds (Danil & St Leger, 2011). Studies show that birds are more susceptible to underwater explosions when they are submerged versus partially submerged on the surface. Two species of duck were exposed to explosive blasts while submerged

0.61 m and while sitting on the water surface. Onset of mortality (LD_1) was predicted to occur at an impulse exposure of 248 pascal seconds (Pa-s) (36 pounds per square inch per millisecond [psi-ms]) for birds underwater and 690 Pa-s (100 psi-ms) for birds at the water surface (Yelverton & Richmond, 1981). No injuries would be expected for birds underwater at blast pressures below 41 Pa-s (6 psi-ms) and for birds on the surface at blast pressures below 207 Pa-s (30 psi-ms) (Yelverton & Richmond, 1981). Tests of underwater explosive exposures to other taxa (fish, mammals) have shown that susceptibility to injury is related to animal mass, with smaller animals being more susceptible to injury (Yelverton & Richmond, 1981). It is reasonable to assume that this relationship would apply to birds as well. The range to these thresholds would be based on several factors including charge size, depth of the detonation, and how far the bird is beneath the water surface.

Detonations in air or at the water surface could also injure birds while either in flight or at the water surface. Experiments that exposed small, medium, and large birds to blast waves in air were conducted to determine the exposure levels that would be injurious (Damon et al., 1974). Birds were assessed for internal injuries to air sacs, organs, and vasculature, as well as injury to the auditory tympanum, but internal auditory damage was not assessed. Results indicated that peak pressure exposure of 5 psi would be expected to produce no blast injuries, 10 psi would produce slight to extensive injuries, and 20 psi would produce 50 percent mortality. These results also suggested that birds with higher mass may be less susceptible to injury. In addition to the risk of direct blast injury, exposure to an explosion in air may cause physical displacement of a bird that could be injurious if the animal impacts a surface. The same study examined displacement injuries to birds (Damon et al., 1974). Results indicated that impulse exposures below 5 psi-ms would not be expected to result in injuries.

One experiment was conducted with birds in flight, showing how birds can withstand relatively close exposures to in-air explosions (Damon et al., 1974). Flying pigeons were exposed to a 64-pound (lb.) net explosive weight explosion. Birds at 44 to 126 ft. from the blast exhibited no signs of injury, while serious injuries were sustained at ranges less than 40 ft. The no injury zone in this experiment was also for exposures less than 5 psi-ms impulse, similar to the results of the displacement injury study.

Ranges to the no injury threshold for a range of in-air explosives are shown in Table 3.9-4.

Table 3.9-4: Range to No Blast Injury for Birds Exposed to Aerial Explosives

Net explosive weight	*Range to 5 psi*
5 pounds (lb.)	21 feet (ft.)
10 lb.	26 ft.
100 lb.	57 ft.

Note: Ranges calculated using the methods in U.S. Department of the Navy (1975).

Another risk of explosions in air is exposure to explosive fragmentation, in which pieces of the casing of a cased explosive are ejected at supersonic speeds from the explosion. The risk of direct strike by fragmentation would decrease exponentially with distance from the explosion, as the worst case for strike at any distance is the surface area of the casing fragments, which ultimately would decrease their outward velocity under the influence of drag. It is reasonable to assume that a direct strike in air or at the water surface would be mortal. Once in water, the drag on any fragments would quickly reduce their velocity to non-hazardous levels (Swisdak & Montanaro, 1992).

The initial detonation in a series of detonations may deter birds from subsequent exposures via an avoidance response, however, birds have been observed taking interest in surface objects related to

detonation events and subsequently being killed by a following detonation [Stemp, R. in Greene et al. (1985)].

3.9.3.2.2.2 Hearing Loss

Exposure to intense sound may result in hearing loss which persists after cessation of the noise exposure. There are no data on hearing loss in birds specifically due to explosives; therefore, the limited data on hearing loss due to impulsive sounds, described for acoustic stressors in Section 3.9.3.1.1.2 (Hearing Loss), apply to explosive exposures.

3.9.3.2.2.3 Physiological Stress

Birds naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to diseases and naturally occurring toxins, lack of prey availability, social interactions with members of the same species, nesting, and interactions with predators all contribute to stress. Exposures to explosives have the potential to provide additional stressors beyond those that naturally occur, as described in the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.6.1).

There are no data on physiological stress in birds specifically due to explosives; therefore, the limited data on physiological stress due to impulsive sounds, described for acoustic stressors in Section 3.9.3.1.1.4 (Physiological Stress), apply to explosive exposures.

3.9.3.2.2.4 Masking

Masking occurs when one sound, distinguished as the 'noise,' interferes with the detection or recognition of another sound. Exposure to explosives may result in masking. There are no data on masking in birds specifically due to explosives; therefore, the limited data on masking due to impulsive sounds, described for acoustic stressors in Section 3.9.3.1.1.3 (Masking), apply to explosive exposures. Due to the very brief duration of an explosive sound, any masking would be brief during an explosive activity.

3.9.3.2.2.5 Behavioral Reactions

Numerous studies have documented that birds and other wild animals respond to human-made noise, including aircraft overflights, weapons firing, and explosions (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). The limited data on behavioral reactions due to impulsive sounds, described for acoustic stressors in Section 3.9.3.1.1.5 (Behavioral Reactions), apply to explosive exposures.

Because data on behavioral responses by birds to explosions is limited, information on bird responses to other impulsive sounds may be informative. Seismic surveys had no noticeable impacts on the movements or diving behavior of long-tailed ducks undergoing wing molt, a period in which flight is limited and food requirements are high (Lacroix et al., 2003). The birds may have tolerated the seismic survey noise to stay in preferred feeding areas. The sensitivity of birds to disturbance may also vary during different stages of the nesting cycle. Similar noise levels may be more likely to cause nest abandonment during incubation of eggs than during brooding of chicks because birds have invested less time and energy and have a greater chance of re-nesting (Knight & Temple, 1986).

3.9.3.2.2.6 Long-term Consequences

Long-term consequences to birds due to explosive exposures are considered following the Conceptual Framework for Assessing Effects from Acoustic and Explosive Activities (see Section 3.0.3.6.1).

Long-term consequences to a population are determined by examining changes in the population growth rate. Physical effects that could lead to a reduction in the population growth rate include mortality or injury, which could remove animals from the reproductive pool, and permanent hearing impairment, which could impact foraging and communication. The long-term consequences due to individual behavioral reactions and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies. It is more likely that any long-term consequences to an individual would be a result of costs accumulated over a season, year, or life stage due to multiple behavioral or stress responses resulting from exposures to multiple stressors over significant periods of time. Conversely, some birds may habituate to or become tolerant of repeated acoustic exposures over time, learning to ignore a stimulus that in the past did not accompany any overt threat. More research is needed to better understand the long-term consequences of anthropogenic stressors, although intermittent exposures to explosive noise are assumed to be less likely to have lasting consequences.

3.9.3.2.2.7 Impacts from Explosives Under Alternative 1

Impacts from Explosives Under Alternative 1 for Training Activities

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). General characteristics, quantities, and net explosive weights of underwater explosives used during training under Alternative 1 are provided in Section 3.0.3.3.2 (Explosive Stressors). Quantities and locations of fragment-producing explosives during training under Alternative 1 are shown in 3.0.3.3.4.2 (Military Expended Materials). Under Alternative 1, there could be fluctuation in the amount of explosives use that could occur annually, although potential impacts would be similar from year to year.

Training activities involving explosions would typically be conducted in the range complexes, with little explosive activity in the transit corridor. Activities that involve underwater detonations and explosive munitions typically occur more than 3 NM from shore, with exceptions for Mine Warfare ranges at Silver Strand Training Complex, San Clemente Island, and proximate to Pearl Harbor.

Sound and energy generated by most small underwater explosions are unlikely to disturb birds above the water surface. If a detonation is sufficiently large or is near the water surface, however, pressure will be released at the air-water interface. Birds above this pressure release could be injured or killed. Explosives detonated at or just above the water surface, such as those used in anti-surface warfare, would create blast waves that would propagate through both the water and air. Detonations in air could also injure birds while either in flight or at the water surface. Detonations in air during anti-air warfare training would typically occur at much higher altitudes (greater than 3,000 ft. [914 m] above sea level) where seabirds and migrating birds are less likely to be present, although some events target incoming threats at lower altitudes. Detonations of bombs with larger net explosive weights, any event employing static targets, or multiple detonations could be more likely to cause seabird mortalities or injuries. If prey species, such as fish, are killed or injured as a result of detonations, some birds may continue to forage close to the area, or may be attracted to the area, and be exposed to subsequent detonations in the same area within a single event, such as gunnery exercises, which involves firing multiple high-explosive 5-in. rounds at a target area; bombing exercises, which could involve multiple bomb drops separated by several minutes; or underwater detonations, such as multiple explosive munitions disposal charges. However, a fleeing response to an initial explosion may reduce seabird exposure to any additional explosions that occur within a short timeframe.

Detonations either in air or underwater have the potential to cause a permanent or TTS, which could affect the ability of a bird to communicate with conspecifics or detect biologically relevant sounds.

An explosive detonation would likely cause a startle reaction, as the exposure would be brief and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or a flight response. The range of impacts could depend on the charge size, distance from the charge, and the animal's behavior at the time of the exposure. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent.

Nearshore waters are the primary foraging habitat for many seabird species. Any small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Larger detonations would typically occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas.

Least terns could startle in the vicinity of explosive detonations from training at the Silver Strand Training Complex as they forage areas where nearshore detonations occur. Other ESA-listed species that forage offshore may be exposed to explosives used during testing activities, however, the short duration of an explosion and the dispersed presence of these birds means the potential for overlap would be small.

Because most events would consist of a limited number of detonations, exposures would not occur over long durations; and since events occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost and individual birds would not be repeatedly exposed to explosive detonations. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected, and explosives will not have a significant adverse effect on populations of migratory bird species.

The Navy will implement mitigation for seabirds during applicable explosive mine warfare activities in the Southern California portion of the Study Area. The mitigation will help avoid or reduce potential impacts on concentrations of seabirds and birds that have the ability to forage underwater, as discussed in Section 5.3.3 (Explosive Stressors).

Pursuant to the ESA, the use of explosives during training activities described under Alternative 1 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelets, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Explosives Under Alternative 1 for Testing Activities

Activities using explosives would be conducted as described in Chapter 2 (Description of Proposed Action and Alternatives) and Appendix A (Navy Activity Descriptions). General characteristics, quantities, and net explosive weights of underwater explosives used during testing under Alternative 1 are provided in Section 3.0.3.3.2 (Explosive Stressors). Quantities and locations of fragment-producing explosives during testing under Alternative 1 are shown in 3.0.3.3.4.2 (Military Expended Materials).

Testing activities involving explosions would typically be conducted in the range complexes, with little explosive activity in the transit corridor. Activities that involve underwater detonations and explosive munitions typically occur in the range complexes more than 3 NM from shore, with exceptions for Silver Strand Training Complex, San Clemente Island, and Puuloa Underwater Range. Although testing

activities under Alternative 1 differ in number and location from training activities under Alternative 1, the types and severity of impacts would not be discernible from those described above in Impacts from Explosives under Alternative 1 for Training Activities.

Sound and energy generated by most small underwater explosions are unlikely to disturb birds above the water surface. If a detonation is sufficiently large or is near the water surface, however, pressure will be released at the air-water interface. Birds above this pressure release could be injured or killed. Explosives detonated at or just above the water surface, such as those used in anti-surface warfare, would create blast waves that would propagate through both the water and air. Detonations in air could also injure birds while either in flight or at the water surface. Detonations in air during anti-air warfare testing would typically occur at much higher altitudes (greater than 3,000 ft. [914 m] above sea level) where seabirds and migrating birds are less likely to be present, although some events target incoming threats at lower altitudes. Detonations of bombs with larger net explosive weights, any event employing static targets, or multiple detonations could be more likely to cause seabird mortalities or injuries. If prey species, such as fish, are killed or injured as a result of detonations, some birds may continue to forage close to the area, or may be attracted to the area, and be exposed to subsequent detonations in the same area within a single event, such as bombing tests, which could involve multiple bomb drops separated by several minutes. However, a fleeing response to an initial explosion may reduce seabird exposure to any additional explosions that occur within a short timeframe.

Detonations either in air or underwater have the potential to cause a permanent or TTS, which could affect the ability of a bird to communicate with conspecifics or detect biologically relevant sounds.

An explosive detonation would likely cause a startle reaction, as the exposure would be brief and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or a flight response. The range of impacts could depend on the charge size, distance from the charge, and the animal's behavior at the time of the exposure. Any impacts related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent.

Nearshore waters are the primary foraging habitat for many seabird species. Any small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Larger detonations would typically occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas.

Because most events would consist of a limited number of detonations, exposures would not occur over long durations, and events occur at varying locations, it is expected there would be an opportunity to recover from an incurred energetic cost and individual birds would not be repeatedly exposed to explosive detonations. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected, and explosives will not have a significant adverse effect on populations of migratory bird species.

Least terns could startle in the vicinity of explosive detonations from training at the Silver Strand Training Center portion of the Southern California Range Complex as they forage areas where nearshore detonations occur. Other ESA-listed species that forage offshore may be exposed to explosives used during testing activities, however, the short duration of an explosion and the dispersed presence of these birds means the potential for overlap would be small.

The Navy will implement mitigation for seabirds during applicable explosive mine warfare activities in the Southern California portion of the Study Area. The mitigation will help avoid or reduce potential impacts on concentrations of seabirds and birds that have the ability to forage underwater, as discussed in Section 5.3.3 (Explosive Stressors).

Pursuant to the ESA, the use of explosives during testing activities described under Alternative 1 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelets, and Newell's shearwater. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.2.2.8 Impacts from Explosives Under Alternative 2

Impacts from Explosives Under Alternative 2 for Training Activities

There would be minor increase in explosives use under Alternative 2 compared to Alternative 1; however, the types of impacts and locations of impacts would be the same as those described for training under Alternative 1. Most impacts on individual birds, if any, are expected to be minor and limited. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected, and explosives will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of explosives during training activities described under Alternative 2 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelets, and Newell's shearwater.

Impacts from Explosives Under Alternative 2 for Testing Activities

There would be minor increase in explosives use under Alternative 2 compared to Alternative 1; however, the types of impacts and locations of impacts would be the same as those described for testing under Alternative 1. Most impacts on individual birds, if any, are expected to be minor and limited. Although a few individuals may experience long-term impacts and potential mortality, population-level impacts are not expected, and explosives will not have a significant adverse effect on populations of migratory bird species.

Pursuant to the ESA, the use of explosives during testing activities described under Alternative 2 may affect least terns, Hawaiian petrels, band-rumped storm petrels, short-tailed albatrosses, marbled murrelets, and Newell's shearwater.

3.9.3.2.2.9 Impacts from Explosives Under the No Action Alternative

Impacts from Explosives Under the No Action Alternative Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the training and testing activities in the HSTT Study Area. Various explosive stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.3 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from (1) in-water electromagnetic devices, (2) in-air electromagnetic devices, and (3) high-energy lasers. As discussed in Section 3.0.3.3.3.3 (Lasers, subsection on Low-Energy Lasers), analysis has shown that low-energy lasers would not affect animals and therefore do not require further analysis.

3.9.3.3.1 Impacts from In-Water Electromagnetic Devices

Several different types of in-water electromagnetic devices are used during training and testing activities. In-water electromagnetic training and testing activities include an array of magnetic measuring components used in mine countermeasure operations in the Study Area. For a discussion of the types of activities that use electromagnetic devices, where they are used, and how many activities would occur under each alternative, see Appendix B, Tables B-1 and B-2. Aspects of in-water electromagnetic stressors that are applicable to marine organisms in general are presented in Section 3.0.3.6.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities). Potential impacts of those activities on birds are applicable to everywhere in the Study Area that in-water electromagnetic devices are used.

The kinetic energy weapon referred to as a rail gun is an in-water electromagnetic device that will be tested and eventually used in training events aboard surface vessels, firing non-explosive projectiles at land- or sea-based targets. This system charges for approximately two minutes and discharges in less than a second. The duration of the firing event is extremely short (about 8 milliseconds), which makes it quite unlikely that a bird would fly over at the precise moment of firing. The short duration of each firing event also means that the likelihood of affecting any animal using magnetic fields for orientation is extremely small. Further, the high magnetic field levels experienced within 80 ft. of the launcher quickly dissipate and return to background levels beyond 80 ft. The magnetic field levels outside of the 80 ft. buffer zone would be below the most stringent guidelines for humans (i.e., people with pacemakers or active implantable medical devices). Therefore, the electromagnetic impacts would be temporary in nature and not expected to result in impacts on organisms (U.S. Department of the Navy, 2009), and are not analyzed further in this section.

Birds are known to use the Earth's magnetic field as a navigational cue during seasonal migrations (Akesson & Hedenstrom, 2007; Fisher, 1971; Wiltschko & Wiltschko, 2005). Birds use numerous other orientation cues to navigate in addition to magnetic fields. These include position of the sun, celestial cues, visual cues, wind direction, and scent (Akesson & Hedenstrom, 2007; Fisher, 1971; Haftorn et al., 1988; Wiltschko & Wiltschko, 2005). It is believed that birds are able to successfully navigate long distances by using a combination of these cues. A magnetite-based (magnetic mineral) receptor mechanism in the upper beak of birds provides information on position and compass direction (Wiltschko & Wiltschko, 2005). Towed in-water electromagnetic device impacts on birds would only occur underwater and would only impact diving species or species on the surface in the immediate area where the device is deployed. There is no information available on how birds react to electromagnetic fields underwater.

3.9.3.3.1.1 Impacts from In-Water Electromagnetic Devices Under Alternative 1

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Training Activities

As indicated in Section 3.0.3.3.3.1 (In-Water Electromagnetic Devices), under Alternative 1, training activities involving in-water electromagnetic devices occur primarily near shore and near harbors (or at established mine warfare ranges) in the Southern California Range Complex, e.g., within the Silver Strand Training Complex (Appendix A, Section A.2.8.1, Airborne Mine Countermeasures – Mine Detection).

The distribution of birds in these portions of the Study Area is patchy (Fauchald et al., 2002; Haney, 1986a; Nevitt & Veit, 1999; Savoca, 2016; Schneider & Duffy, 1985). Exposure of birds would be limited to those foraging at or below the surface (e.g., cormorants, loons, petrels, grebes, etc.) because that is

where the devices are used. Birds that forage inshore could be exposed to these in-water electromagnetic stressors because their habitat overlaps with some of the activities that occur in the nearshore portions of the Southern California Range Complex. However, the in-water electromagnetic fields generated would be distributed over time and location near mine warfare ranges and harbors and any influence on the surrounding environment would be temporary and localized. More importantly, the in-water electromagnetic devices used are typically towed by a helicopter, surface ship, or unmanned vehicle. It is likely that any birds in the vicinity an approaching vehicle towing an in-water electromagnetic device would be dispersed by the noise and disturbance generated by the vehicles (Section 3.9.3.1.6 Impacts from Aircraft Noise) and therefore move away from the vehicle and device before any exposure could occur.

Impacts on birds from potential exposure to in-water electromagnetic devices would be temporary and inconsequential based on the: (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 200 m from the source), (2) very localized potential impact area, (3) temporary duration of the activities (hours), (4) occurrence only underwater, and (5) the likelihood that that any birds in the vicinity of the approaching vehicles towing an in-water electromagnetic devices would move away from the vehicle and device before any exposure could occur. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of in-water electromagnetic devices during training activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from In-Water Electromagnetic Devices Under Alternative 1 for Testing Activities

As indicated in Section 3.0.3.3.3.1 (In-Water Electromagnetic Devices), under Alternative 1, testing activities involving in-water electromagnetic devices would occur in both the California Current and the Insular Pacific-Hawaiian Large Marine Ecosystems, within the Southern California and Hawaii Range Complexes, respectively. Typical locations would include Pearl Harbor, San Diego Bay, and the Silver Strand Training Complex, as well as waters farther offshore (Appendix A, e.g., Sections A.2.8.2, Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercise; and A.3.2.1.2, At-Sea Sonar Testing).

California least terns could be exposed to intermittent in-water electromagnetic stressors in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving in-water electromagnetic stressors occur nearby, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Any temporary disorientation experienced by birds from in-water electromagnetic changes caused by testing activities in the Study Area may be considered a short-term impact and would not hinder bird navigation abilities. Repeated exposures would be limited due to the transient nature of the testing activities using in-water electromagnetic devices and regular movement of birds. For reasons stated in training activities discussion, any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of bird populations. No long-term or population-level impacts are expected.

Pursuant to the ESA, the use of in-water electromagnetic devices during testing activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets,

Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.3.1.2 Impacts from In-Water Electromagnetic Devices Under Alternative 2

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Training Activities

The number and distribution of training activities using in-water electromagnetic devices under Alternative 2 would be the same as for Alternative 1 (Table 3.0-13); therefore, impacts would be the same as for Alternative 1.

Pursuant to the ESA, the use of in-water electromagnetic devices during training activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

Impacts from In-Water Electromagnetic Devices Under Alternative 2 for Testing Activities

The number and distribution of testing activities using in-water electromagnetic devices under Alternative 2 would be the same as for Alternative 1 (Table 3.0-13); therefore, impacts would be the same as for Alternative 1.

Pursuant to the ESA, the use of in-water electromagnetic devices during testing activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.3.1.3 Impacts from In-Water Electromagnetic Devices Under the No Action Alternative

Impacts from In-Water Electromagnetic Devices Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various in-water electromagnetic device stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.3.2 Impacts from In-Air Electromagnetic Devices

Several different types of in-air electromagnetic devices are used during training and testing activities, including an array of communications transmitters, radars, and electronic countermeasures transmitters. For a discussion of the types of activities that use in-air electromagnetic devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.3.3.3.2 (In-Air Electromagnetic Devices). Aspects of in-air electromagnetic stressors that are applicable to marine organisms in general are presented in Section 3.0.3.6.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities).

As discussed in Section 3.0.3.3.3.2 (In-Air Electromagnetic Devices), most of the transmissions from in-air electromagnetic devices (e.g., for routine surveillance, communications, and navigation) will be at low power. Based on human standards, high-power in-air electromagnetic devices are those that produce peak pulses of 200 kilovolts per m in a single pulse (U.S. Department of Defense, 2009); there are no federal standards for electromagnetic radiation exposure on wildlife (Manville, 2016; U.S. Department of Defense, 2009). In-air electromagnetic devices can also be characterized as "near-field" or "far-field" (i.e., near to, or far from, the source of electromagnetic radiation).

Studies conducted on in-air electromagnetic sensitivity in birds have typically been associated with land, and little information exists specifically on seabird response to in-air electromagnetic changes at sea. Based on these studies, in-air electromagnetic effects can be categorized as thermal (i.e., capable of causing damage by heating tissue) or non-thermal. Thermal effects are most likely to occur when near high-power systems. Should such effects occur, they would likely cause birds to temporarily avoid the area receiving the electromagnetic radiation until the stressor ceases (Manville, 2016; Nicholls & Racey, 2007, 2009).

Currently, questions exist about far-field, non-thermal effects from low-power, in-air electromagnetic devices. Manville (2016) performed a literature review of this topic. Although findings are not always consistent, Manville (2016) reported that several peer-reviewed studies have shown non-thermal effects can include (1) affecting behavior by preventing birds from using their magnetic compass, which may in turn affect migration; (2) fragmenting the DNA of reproductive cells, decreasing the reproductive capacity of living organisms; (3) increasing the permeability of the blood-brain barrier; (4) other behavioral effects; (5) other molecular, cellular, and metabolic changes; and (6) increasing cancer risk.

Cucurachi et al. (2013) also performed a literature review of 113 studies and reported that (1) few field studies were performed (the majority were conducted in a laboratory setting); (2) 65 percent of the studies reported ecological effects both at high as well as low dosages (i.e., those that are compatible with real field situations, at least on land); (3) no clear dose-effect relationship could be discerned but that studies finding an effect applied higher durations of exposure and focused more on mobile phone frequency ranges; and (4) a lack of standardization and a limited number of observations limited the possibility of generalizing results from an organism to an ecosystem level.

Many bird species return to the same stopover, wintering, and breeding areas every year and often follow the exact same or very similar migration routes (U.S. Department of the Navy, 2002), and ample evidence exists that displaced birds can successfully reorient and find their way when one or more cues are removed (U.S. Department of the Navy, 2009). For example, Haftorn et al. (1988) found that after removal from their nests and release into a different area, snow petrels (*Pagodrama nivea*) were able to successfully navigate back to their nests even when their ability to smell was removed. Furthermore, Wiltschko and Wiltschko (2005) report that in-air electromagnetic pulses administered to birds during an experimental study on orientation do not deactivate the magnetite-based receptor mechanism in the upper beak altogether but instead cause the receptors to provide altered information, which in turn causes birds to orient in different directions. However, these impacts were temporary, and the ability of the birds to correctly orient themselves eventually returned. Similar results were found by a subsequent study by Wiltschko et al. (2011) on European robins (*Erithacus rubecula*) that tested the effects of exposure to specific wavelengths of visible light. Therefore, in the unlikely event that a bird is temporarily disoriented by an electromagnetic device, it is expected that it would still be able to reorient using its internal magnetic compass to aid in navigation once the stressor ceases or the bird and stressor are separated by sufficient distance. Therefore, any temporary disorientation experienced by birds from electromagnetic changes caused by training activities in the Study Area may be considered a short-term impact and would not hinder bird navigation abilities. Furthermore, other orientation cues may include position of the sun and moon, visual cues, wind direction, infrasound, and scent; these cues would not be affected by in-air electromagnetic devices.

The Environmental Assessment (EA) for the Upgraded AEGIS Combat System concluded that the rapid increase of the bird population around a newly constructed radar installation "indicates that any negative effects of the radiation zone overhead have been negligible." Another study on the impacts of

extremely low-frequency in-air electromagnetic fields on breeding and migrating birds around the Navy's extra-low-frequency communication system antenna in Wisconsin found no evidence that bird distribution or abundance was impacted by in-air electromagnetic fields produced by the antenna. In addition, radars, including X-band systems, are frequently used to track bird movements as it has been demonstrated that they do not affect bird behavior. Moreover, previous studies have consistently determined that the chances that a bird will move in the same direction and at the same speed as a constant beam of electromagnetic radiation (e.g., while an in-air electromagnetic device tracks a target), and therefore be exposed to radiation that could cause thermal damage, are extremely small.

California least terns could be exposed to intermittent in-air electromagnetic stressors in nearshore areas where training activities occur. If present in the open water areas where training activities involving in-air electromagnetic stressors occur, Hawaiian petrel, short-tailed albatross, marbled murrelet, Newell's shearwater, or band-rumped storm-petrel could be temporarily disturbed while foraging or migrating.

Given (1) the information provided above; (2) the dispersed nature of Navy testing and training activities at sea; and (3) the relatively low-level and dispersed use of these systems at sea, the following conclusions are reached:

1. The chance that in-air electromagnetic devices would cause thermal damage to an individual bird is extremely low;
2. It is possible, although unlikely, that some bird individuals would be exposed to levels of electromagnetic radiation that would cause discomfort, in which case they would likely avoid the immediate vicinity of testing and training activities;
3. The strength of any avoidance response would decrease with increasing distance from the in-air electromagnetic device; and
4. No long-term or population-level impacts would occur.

3.9.3.3.2.1 Impacts from In-Air Electromagnetic Devices Under Alternative 1

Impacts from In-Air Electromagnetic Devices Under Alternative 1 for Training Activities

As indicated in Section 3.0.3.3.3.1 (In-Air Electromagnetic Devices) and Tables 3.0-16 and 3.0-28, under Alternative 1, training activities involving in-air electromagnetic devices would occur throughout the Study Area but would be concentrated in the Hawaii Range Complex and Southern California Range Complexes. For the reasons described above, however, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of in-air electromagnetic devices during training activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from In-Air Electromagnetic Devices Under Alternative 1 for Testing Activities

As indicated in Section 3.0.3.3.3.1 (In-Air Electromagnetic Devices) and Tables 3.0-16 and 3.0-28, under Alternative 1, testing activities involving in-air electromagnetic devices would occur throughout the Hawaii Range Complex and (especially) Southern California Range Complexes, but much less frequently than for training. For the reasons described above, however, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of in-air electromagnetic devices during testing activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.3.2.2 Impacts from In-Air Electromagnetic Devices Under Alternative 2

Impacts from In-Air Electromagnetic Devices Under Alternative 2 for Training Activities

The number and distribution of training activities using in-air electromagnetic devices under Alternative 2 would differ slightly from Alternative 1 insofar as the average number of total vessel and aircraft activities within the Study Area would increase slightly (by a fraction of a percent for both vessel and aircraft activity) over the 5-year period (Table 3.0-16 and Table 3.0-28, respectively). Given the foregoing analysis, this difference is inconsequential and the impacts would be essentially the same as for Alternative 1.

Pursuant to the ESA, the use of in-air electromagnetic devices during training activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

Impacts from In-Air Electromagnetic Devices Under Alternative 2 for Testing Activities

The number and distribution of testing activities using in-air electromagnetic devices under Alternative 2 would differ slightly from Alternative 1 insofar as the average number of total vessel and aircraft activities within the Study Area would increase slightly (by approximately 4.6 percent and 10.3 percent, respectively) over the 5-year period (Table 3.0-16 and Table 3.0-28, respectively). The majority of the increase in activity would occur in Southern California. Given the foregoing analysis, this difference is inconsequential and the impacts would be essentially the same as for Alternative 1.

Pursuant to the ESA, the use of in-air electromagnetic devices during testing activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.3.2.3 Impacts from In-Air Electromagnetic Devices Under the No Action Alternative

Impacts from In-Air Electromagnetic Devices Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various in-air electromagnetic device stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.3.3 Impacts from High-Energy Lasers

This section analyzes the potential impacts of high energy lasers on birds. As discussed in Section 3.0.3.3.3.3 (Lasers), and described in Appendix A, Sections A.3.1.5.4 (High Energy Laser Weapons Test) and A.3.2.2.1 (Radar and Other System Testing), high-energy laser weapons are designed to disable targets, rendering them immobile. Test activities would involve firing the laser from an aircraft or vessel at an unmanned surface or aerial target. Tests would be conducted at unspecified locations in the Hawaii and Southern California Range Complexes. The primary concern is the potential for a bird to be directly struck with the laser beam, which could result in injury or death.

3.9.3.3.3.1 Impacts from High-Energy Lasers Under Alternative 1

Impacts from High-Energy Lasers Under Alternative 1 for Training Activities

There would be no use of high-energy lasers as part of Alternative 1 training activities in the Study Area and, therefore, no impacts from this potential stressor, under Alternative 1 for training activities (Table 3.0-14).

Impacts from High-Energy Lasers Under Alternative 1 for Testing Activities

Under Alternative 1, high-energy laser weapons tests would take place at testing ranges (Figure 2.1-8) and other locations in the Hawaii Range Complex and Southern California Range Complex (refer to Chapter 2, Description of Proposed Action and Alternatives). Bird species that occur within the Hawaii and Southern California Range Complexes would potentially be exposed to high-energy lasers. Species that occur within these areas could be exposed, including the ESA-listed California least-tern, ESA-listed Hawaiian Petrel, and ESA-listed short-tailed albatross.

Laser safety procedures (Section 2.3.3.1.3, Laser Safety) require the clearance of unauthorized personnel from the range, and, while not required, marine species may incidentally be detected and avoided as a result. This reduces the possibility of a bird being struck by a high-energy laser beam, although birds could fly rapidly through a target area, or be present unseen. The avoidance of large flocks of birds by Navy pilots in order to lessen bird strike risks (Section 2.3.3.3, Aircraft Safety) also reduces the likelihood of large numbers of birds being in flight between the aircraft and the target when a laser is fired. A bird in flight or at long distance might not be detectable, but the likelihood of a bird crossing the laser beam at the instant the laser is fired is extremely remote but possible.

No long-term or population-level impacts are expected. Birds are not likely to be exposed to high energy lasers based on the: (1) relatively low number of activities, (2) very localized potential impact area of the laser beam, and (3) temporary duration of potential impact (seconds). The likelihood that an ESA-listed bird species would be struck by a high-energy laser beam is so small as to be discountable; no impacts on ESA-listed species are anticipated.

Pursuant to the ESA, the use of high-energy lasers during testing activities as described under Alternative 1 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.3.3.2 Impacts from High-Energy Lasers Under Alternative 2

Impacts from High-Energy Lasers Under Alternative 2 for Training Activities

There would be no use of high-energy lasers as part of Alternative 2 training activities in the Study Area and, therefore, no impacts from this potential stressor under Alternative 2 for training activities (Table 3.0-14).

Impacts from High-Energy Lasers Under Alternative 2 for Testing Activities

The use of high-energy lasers associated with Alternative 2 testing activities will be the same as with Alternative 1 (Table 3.0-14); therefore potential impacts on birds resulting from high-energy lasers would be expected to be the same.

Pursuant to the ESA, the use of high-energy lasers during testing activities as described under Alternative 2 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.3.3.3 Impacts from High-Energy Lasers Under the No Action Alternative

Impacts from High-Energy Lasers Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various high-energy laser electromagnetic device stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.4 Physical Disturbance and Strike Stressors

This section describes the potential impacts on birds by aircraft and aerial target strikes, vessels (disturbance and strike), and military expended material strike. For a list of Navy activities that involve this stressor refer to Section 3.0.3.3.4 (Physical Disturbance and Strike Stressors). Aircraft include fixed-wing and rotary-wing aircraft; vessels include various sizes and classes of ships, and other boats; in-water devices include devices that are towed, unmanned surface, and underwater vehicles; military expended material includes non-explosive practice munitions, target fragments, decelerators/parachutes, and other objects.

Physical disturbance and strike risks, primarily from aircraft, have the potential to impact all taxonomic groups found within the Study Area (Table 3.9-1). In addition to the potential for injury and mortality, impacts of physical disturbance include behavioral responses such as temporary disorientation, collision, change in flight direction, and avoidance response behavior. Physical disturbances (discussed in Section 3.9.4.3.3, Impacts from Aircraft and Aerial Targets) may elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, and a temporary increase in heart rate. These disturbances can also result in abnormal behavioral, growth, or reproductive impacts in nesting birds and can cause foraging and nesting birds to flush from or abandon their habitats and or nests (Andersen et al., 1989; Komenda-Zehnder et al., 2003). Aircraft strikes often result in bird mortalities or injuries (Dolbeer, 2006).

Although birds likely hear and see approaching vessels and aircraft, they cannot avoid all collisions. Nighttime lighting on vessels, specifically high-powered searchlights used for navigation in icy waters off of Greenland, has caused birds to become confused and collide with naval vessels, cargo vessels, and trawlers (Gehring et al., 2009; Merkel & Johansen, 2011; Poot et al., 2008). Collisions with vessels can result in bird mortalities or injuries.

3.9.3.4.1 Impacts from Vessels and In-Water Devices

Vessels

The majority of the training and testing activities in the Study Area involve vessels. For a discussion of the types of activities that use vessels, as well as the number and location of activities that include vessels under each alternative, see Section 3.0.3.3.4.1 (Vessels and In-Water Devices). Table 3.0-15 provides representative vessel types and their sizes and typical operating speeds and Table 3.0-16 provides the number and locations of activities that include vessels. Appendix B (Activity Stressor Matrices) provides the types of activities that use vessels.

Potential impacts of those activities on birds are applicable to everywhere in the Study Area that vessels are used. Training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines. The number of Navy ships and smaller vessels in the Study Area

varies based on training and testing schedules. Activities involving vessel movements occur intermittently, ranging from a few hours to a few weeks. Events involving large vessels are widely spread over the open ocean, while smaller vessels are more active and more concentrated in nearshore areas.

Direct collisions with most Navy vessels (or a vessel's rigging, cables, poles, or masts) are unlikely but may occur, especially at night. Many bird species are attracted to artificial lighting, particularly Procellariiformes. Newell's shearwater and Hawaiian petrel fledglings are particularly attracted to light, which can cause exhaustion and increase potential for collision with land-based structures (Reed et al., 1985). Lighting on boats and vessels has also contributed to bird fatalities in open-ocean environments when birds are attracted to these lights, usually in inclement weather conditions (Merkel & Johansen, 2011). Birds can become disoriented at night in the presence of artificial light (Favero et al., 2011; Hamilton, 1958; Hyrenbach, 2001, 2006), and lighting on vessels may attract some birds, increasing the potential for harmful encounters. Other impacts would be the visual and behavioral disturbance from a vessel. Birds respond to moving vessels in various ways. Some birds, including certain species of gulls, storm petrels, and albatrosses, commonly follow vessels (Favero et al., 2011; Hyrenbach, 2001, 2006); while other species such as plovers, curlews, frigatebirds, and sooty terns seem to avoid vessels (Borberg et al., 2005; Hyrenbach, 2006). There could be a slightly increased risk of impacts during the winter, or fall/spring migrations when migratory birds use celestial clues during night time flight and are concentrated in coastal areas. However, despite this concentration, most birds would still be able to avoid collision with a vessel. Vessel movements could elicit short-term behavioral or physiological responses (e.g., alert response, startle response, fleeing the immediate area, temporary increase in heart rate).

Navy aircraft carriers, surface combatant vessels, and amphibious warfare ships are minimally lighted for tactical purposes. For vessels of this type there are two white lights that shine forward and one that shines aft; these lights must be visible for at least 6 NM. A single red and a single green light are located on the port and starboard sides of vessels, respectively. These lights are visible for a minimum of 3 NM. Solid white lighting appears more problematic for birds, especially nocturnal migrants (Gehring et al., 2009; Poot et al., 2008). Navy vessel lights are mostly solid, but sometimes may not appear solid because of the constant movement of the vessel (wave action), making vessel lighting potentially less problematic for birds in some situations.

While some potential exists for birds to be struck by vessels as they are foraging, resting, or flying near the water surface, most birds would be expected to see or hear an oncoming vessel and to fly or swim away to avoid a potentially harmful encounter. Injury or mortality could occur if a bird were struck, but most bird encounters with vessels would be expected to result in a brief behavioral and physiological response as described above. It should be noted that such responses involve at the least a temporary displacement of birds from foraging areas, resulting in energetic costs to the birds (Velando & Munilla, 2011). Birds would be expected to return and resume foraging soon after the vessel passed through the area, or to forage elsewhere, and the fitness of individual birds would probably not be compromised.

Other harmful bird-vessel interactions are commonly associated with commercial fishing vessels because birds are attracted to concentrated food sources around these vessels (Dietrich & Melvin, 2004; Melvin & Parrish, 2001). However, concentrated food sources are not associated with Navy vessels, so birds following Navy vessels would be very unlikely.

Amphibious vessel movements could elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, nest abandonment,

and a temporary increase in heart rate. There could be a slightly increased risk of impacts during the winter, or fall/spring migrations and during nesting season when migratory birds are concentrated in coastal areas where amphibious vessels have the potential to disturb nesting or foraging shorebirds such as the ESA-listed California least tern. The general health of individual birds would not be compromised, unless a direct strike occurred. However, it is highly unlikely that a bird would be struck in this scenario because most foraging shorebirds in the vicinity of the approaching amphibious vessel would likely be dispersed by the noise of its approach before it could come close enough to strike a bird (Acoustics Section 3.9.3.4.1, Impacts from Vessels).

Under a worst-case scenario, vessel movements could cause the localized, temporary movement of birds to areas that are less desirable, resulting in some energetic cost which may or may not be important to an individual's survival and reproduction. However, it is unlikely that impacts would occur to the point that birds would be permanently displaced from important habitats that were not already subject to heavy ongoing use. As such, no long-term or population-level impacts are expected.

In-Water Devices

Section 3.0.3.3.4.1 (Vessels and In-water Devices) provides information on the types, sizes and speeds of in-water devices. Table 3.0-18 provides the locations where they would be used. For a list of activities by name that include the use of in-water devices, see Appendix B (Activity Stressor Matrices). In-water devices include surface and underwater unmanned vehicles, torpedoes and towed devices, and their use occurs virtually throughout the Study Area.

Mine warfare devices that are towed through the water (or the aircraft and cables that connect the aircraft to the device) and remotely operated underwater vehicles used during mine neutralization training and testing could also strike seabirds. No documented instances of seabirds being struck by towed devices have occurred in the Study Area. Additionally, based on the low altitudes and relatively slow air speeds, seabirds would be able to detect and avoid the aircraft and cables that connect the aircraft to the towed device.

3.9.3.4.1.1 Impacts from Vessels and In-Water Devices Under Alternative 1

Impacts from Vessels and In-Water Devices Under Alternative 1 for Training Activities

The majority of training activities use some type of vessel ranging from ships to submarines. Training involving vessel movements occurs intermittently and spans in duration from a few hours up to a few weeks. These activities are widely dispersed throughout the Study Area. Under Alternative 1, approximately 14,678 training activities involving vessels would occur annually, with 80 percent of the total occurring in the Southern California Range Complex, 19 percent in the Hawaii Range Complex, and 1 percent in the Transit Corridor (Table 3.0-16). Ship movements on the ocean surface have the potential to affect seabirds by disturbing or striking individual animals. The probability of ship and seabird interactions occurring in the Study Area depends on several factors, including the presence and density of seabirds; numbers, types, and speeds of vessels; and the duration and spatial extent of activities. The number of Navy ships operating in the Study Area varies based on training schedules and can range up to 10 ships at any given time.

Vessel movements could result in short-term behavioral responses and low potential for injury/mortality from collisions, though based on the lower density of Navy vessels in pelagic waters, the generally intermittent and short duration of activities, and the high mobility of seabirds, the probability of seabird/vessel interaction is low. There would be a greater likelihood of vessel strikes over the high productivity portions of the Study Area, because of the concentration of seabirds is expected to be

greater in those areas. While the density of seabirds may be higher in Southern California, the likelihood and consequence of interacting with an endangered species such as the Hawaiian petrel is higher in Hawaii Range Complex. The relatively lower vessel density in pelagic waters in the Study Area, and the ability of seabirds to detect and avoid vessels reduce the probability that vessel strikes would impact seabird populations.

As indicated in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), there would be up to 2,280 training activities involving the use of in-water devices. These activities could be widely dispersed throughout the Hawaii Range Complex and Southern California Range Complex but would be more concentrated near naval ports, piers, and ranges. In-water devices would not be used within the HSTT Transit Corridor.

In-water devices used are typically towed by a boat, unmanned vehicles or fired from a ship. As discussed for electromagnetic devices (Section 3.9.3.3.1, Impacts from Electromagnetic Devices), it is likely that any birds in the vicinity of the approaching boat, unmanned vehicle or ship firing torpedoes would be dispersed by their sound (Section 3.9.3.1.7, Impacts from Weapons Noise) and move away from the in-water device before any exposure could occur. Therefore, the use of in-water devices is expected to have only short-term impacts on individual birds, with very low potential for injury or mortality, and no population-level impacts.

Pursuant to the ESA, the use of vessels and in-water devices during training activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Vessels and In-Water Devices Under Alternative 1 for Testing Activities

As indicated in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), Navy vessel and in-water activities associated with testing activities would be fewer than those associated with training. Vessels movements would occur throughout the Study Area. Similarly, as indicated in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), the number of activities using in-water devices would be fewer for testing activities than for training activities. However, a small number of activities involving in-water devices would be conducted in the HSTT Transit Corridor.

The potential for interaction is greater in coastal areas rather than pelagic areas where Navy vessel use is less concentrated. However, even in areas of concentrated vessel use, the probability of seabird/vessel interaction is low because of the high mobility of seabirds would allow them to move away from an oncoming vessel. Certain portions of the Study Area, such as areas near ports, naval installations, or testing locations are used more heavily by vessels than other portions of the Study Area. Ship movements on the ocean surface have the potential to affect seabirds by disturbing or striking individual seabirds. The probability of ship and seabird interactions occurring in the Study Area depends on several factors, including the presence and density of seabirds; numbers, types, and speeds of vessels; and the duration and spatial extent of activities. The number of Navy ships operating in the Study Area varies based on the testing activity taking place; up to 10 vessels could be participating in a testing event at any time.

Flushing of seabirds is expected to be greatest with fast-moving, agile vessels. Impacts on seabirds from Navy vessels would be limited to short-term behavioral responses and are not expected to have long-term effects. While flushing or other effects from vessels on individual seabirds may occur, none of these temporary effects are expected to have an impact on the long-term fitness of individual birds or have population level impacts.

The relatively lower vessel density in pelagic waters in the Study Area, and the ability of seabirds to detect and avoid vessels reduce the probability that vessel strikes would impact seabird populations under Alternative 1. The impacts from vessel movements to individual seabirds in the vicinity would be short-term, temporary, and localized. If in the immediate area where vessels or in-water devices are operating, no long-term disturbances to the species or to the population are expected to occur.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.4.1.2 Impacts from Vessels and In-Water Devices Under Alternative 2

Impacts from Vessels and In-Water Devices Under Alternative 2 for Training Activities

Under Alternative 2, potential impacts on birds resulting from vessels and in-water devices associated with training activities would be similar to those discussed for activities under Alternative 1. There would be a very small increase (less than one percent) in vessel and in-water device use in the Study Area (Tables 3.0-16 and 3.0-18). However, the difference would not result in substantive changes to the potential for or types of impacts on birds. Refer to Section 3.9.3.4.1 (Impacts from Vessels and In-Water Devices under Alternative 1) for a discussion of potential impacts.

Pursuant to the ESA, the use of vessels and in-water devices during training activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

Impacts from Vessels and In-Water Devices Under Alternative 2 for Testing Activities

Under Alternative 2, potential impacts on birds resulting from vessels and in-water devices associated with testing activities would be similar to those discussed for activities under Alternative 1. Vessel use would increase by about 0.04 percent (Table 3.0-16), while the number of activities involving in-water devices would remain unchanged (Table 3.0-18). However, the differences in vessel and in-water device use would not result in substantive changes to the potential for or types of impacts on birds. Refer to Section 3.9.3.4.1.1 (Impacts from Vessels and In-Water Devices under Alternative 1) for a discussion of potential impacts.

Pursuant to the ESA, the use of vessels and in-water devices during testing activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.4.1.3 Impacts from Vessels and In-Water Devices Under the No Action Alternative

Impacts from Vessels and In-Water Devices Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., vessels and in-water devices) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.4.2 Impacts from Aircraft and Aerial Targets

Information on aircraft and aerial target use is provided in Section 3.0.3.3.4.4 (Aircraft) and Appendix A (Navy Activity Descriptions). Bird strikes could occur during training and testing activities that use aircraft, particularly in nearshore areas, where birds are more concentrated in the Study Area. Training and testing activities where aircraft are used typically occur further offshore, within the range complexes.

Bird-aircraft strikes are a serious concern for the Navy because they can damage equipment and harm aircrews (Bies et al., 2006). The Naval Aviation Safety Program Instruction, Chief of Naval Operations Instruction 3750.6R, identifies measures to evaluate and reduce or eliminate bird/aircraft strike hazards to aircraft, aircrews, and birds and requires the reporting of all strikes when damage or injuries occur as a result of a bird/aircraft strike. From 2006 to 2015, the Navy Bird/Animal Aircraft Strike Hazard program recorded 10,496 bird strikes with the majority occurring during the fall period from September to November. During the 10-year period, bird strikes were greatest in the year 2015 with 1,283 strikes, and lowest in the year 2008 with 755 (Naval Safety Center, 2017). Bird strike potential is greatest in foraging or resting areas, in migration corridors at night, and at low altitudes during the periods around dawn and dusk. For example, birds can be attracted to airports because they often provide foraging and nesting resources. Approximately 97 percent of the reported civilian aircraft- wildlife damaging strikes from 1990 to 1999 involved common, large-bodied birds or large flocks of small birds. Almost 70 percent of these events involved gulls, waterfowl, and raptors (Federal Aviation Administration, 2003). ESA-listed seabird strikes reported in the aircraft strike database include a roseate tern in the East China Sea in 2007; western snowy plovers at Naval Air Station Point Mugu in 2009 and 2014; a least tern in Kingsville, Texas in 2014; and a California least Tern at Naval Air Station North Island in 2008.

As described in Section 2.3.3.3 (Aircraft Safety), the Navy implements standard operating procedures for aircraft safety. Pilots of Navy aircraft make every attempt to avoid large flocks of birds to reduce the safety risk involved with a potential bird strike. Since 2011, the Navy has required that all Navy flying units report all bird strikes through the Web-Enabled Safety System Aviation Mishap and Hazard Reporting System. The standard operating procedures for aircraft safety will benefit birds through a reduction in the potential for aircraft strike.

While bird strikes can occur anywhere aircraft are operated, Navy data indicate that they occur most often within the airfield environment – i.e., over land or close to shore (Naval Air Station Jacksonville, 2012). Dolbeer (2006) reports that about 95 percent of aircraft-wildlife strikes occur on or near airports, when aircraft are below altitudes of 3,500 ft. For military rotary-wing aircraft, wildlife strikes happened most frequently when the aircraft were traveling en route (flying at an altitude greater than 1,000 ft. above ground level) or were engaged in terrain flight (flying at an altitude less than 1,000 ft. above ground level), as opposed to (1) hovering (off the ground at less than 1,000 ft. above ground level, and stationary), (2) on approach (in the early stages of the landing process at greater than 100 ft. above ground level and moving forward), (3) landing (the final stages of landing at less than 100 ft. above ground level), (4) taxiing (moving along the ground, or at less than 10 feet above ground level, in transition from one part of the airport to another), (5) taking off (leaving the ground and ascending upward at less than 100 ft. above ground level), or (6) climbing out (for rotary-wing aircraft in the later stages of taking off at greater than 100 ft. above ground level) (Washburn et al., 2014). The potential for bird strikes to occur in offshore areas is relatively low because Navy activities are widely dispersed and above 3,000 ft. (for fixed-wing aircraft) where bird densities are low.

For the majority of fixed-wing activities, flight altitudes would be above 3,000 ft., with the exception of sorties associated with air-to-surface bombing exercises and sonobuoy drops. Typical flight altitudes during air-to-surface bombing exercises are from 500 to 5,000 ft. above ground level. Most fixed-wing aircraft flight hours (greater than 90 percent) occur at distances greater than 12 NM offshore.

Helicopter flights would occur closer to the shoreline where sheltering, roosting, and foraging birds and bats occur. Helicopters can hover and fly low, and would be used to tow electromagnetic devices as well as for other military activities at sea. This combination would make helicopter bird or bat strikes more likely than for fixed-wing aircraft. Additional details on typical altitudes and characteristics of aircraft used in the Study Area are provided in Chapter 2 (Description of Proposed Action and Alternatives) and Section 3.0.3.3.4.4 (Aircraft).

Approximately 95 percent of bird flight during migration occurs below 10,000 ft., with the majority below 3,000 ft. (U.S. Geological Survey, 2006). Aircraft encounters with birds are more likely to occur during aircraft takeoffs and landings than when the aircraft is engaged in level low-altitude flight. In a study that examined 38,961 bird and aircraft collisions, Dobson (2010) found that the majority (74 percent) of collisions occurred below 500 ft. However, collisions have been recorded at elevations as great as 12,139 ft. (Dobson, 2010).

In a bird strike study for the U.S. Air Force, vultures were the most hazardous group to aircraft, followed by geese, pelicans, and buteo hawks, based on the number of bird strikes reported (Zakrajsek & Bissonette, 2005). These species groups occur within the Study Area but are generally found in nearshore areas (Mowbray et al., 2002; Shields et al., 2002). The potential for bird strikes to occur in offshore areas is relatively low because activities are widely dispersed and occur at relatively high altitudes (above 3,000 ft. for fixed-wing aircraft) where seabird occurrences are generally low.

In addition to manned aircraft, aerial targets such as unmanned drones could also incur a bird strike, however, evidence from returned drones indicate the probability is low.

Bird populations may consist of hundreds or thousands of individuals, ranging across a large geographical area. In this context, the loss of a small number of birds due to physical strikes does not constitute a population-level effect. Bird exposure to a strike potential would be relatively brief as an aircraft transits the area. Strike potential is further decreased by Navy aircrafts' active avoidance of large flocks of birds.

3.9.3.4.2.1 Impacts from Aircraft and Aerial Targets Under Alternative 1

Impacts from Aircraft and Aerial Targets Under Alternative 1 for Training Activities

Aircraft use in the Study Area is described in Section 3.0.3.3.4.4 (Aircraft). Approximately 32,440 training activities involving aircraft would occur annually in the Study Area under Alternative 1. Eighty-seven percent of the activities would occur within the Southern California Range Complex, 13 percent in the Hawaii Range Complex, and one-twentieth of 1 percent in the transit corridor (Table 3.0-28). Aerial targets used in the Study Area are described in Appendix A (A.1.3, Targets). Under Alternative 1 for training activities, air-launched decoys would be used in approximately 129 events annually, 52 percent of these being in the Hawaii Range Complex and 18 percent occurring in the Southern California Range Complex (Table 3.0-23).

Some individual bird strikes and associated bird mortalities or injuries could occur as a result of aircraft and aerial target use in the Study Area under the Alternative 1; however, population-level impacts on birds would not likely result. ESA-listed species could be impacted by aircraft disturbance or strikes while

in flight in areas where low altitude operations are taking place. However, no ESA-listed bird strikes have been reported during training activities.

California least terns could be exposed to intermittent aircraft overflights and strike potential in nearshore areas where training and testing activities occur. If present in the open water areas where training and testing activities involving aircraft occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be briefly exposed to strike potential. However, the data that Navy has collected on bird strikes reports that no ESA-listed species have been struck in the past, so it is not likely they would be struck by aircraft or aerial targets during training and testing activities.

Bird exposure to strike potential would be relatively brief as an aircraft quickly passes. Bird strikes may occur to a relatively small number of individuals, but no long-term or population-level impacts would occur, especially when considering the Navy's standard operating procedures for aircraft safety (see Section 2.3.3, Standard Operating Procedures).

Pursuant to the ESA, the use of aircraft and aerial targets during training activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Aircraft and Aerial Targets Under Alternative 1 for Testing Activities

Aircraft use in the Study Area is described in Section 3.0.3.3.4.4 (Aircraft). Approximately 3,145 testing activities involving aircraft would occur annually in the Study Area under Alternative 1, with 29 percent of activities occurring in the Hawaii Range Complex and 71 percent in the Southern California Range Complex (Table 3.0-28). Under Alternative 1 for testing activities, 1,067 aerial drones would be used annually in the Study Area (Table 3.0-24). The same types of impacts described above for training activities may result from testing activities. Bird strikes may occur to a relatively small number of individuals, but no population-level impacts would occur, especially when considering the Navy's standard operating procedures for aircraft safety (see Section 2.3.3, Standard Operating Procedures).

Pursuant to the ESA, the use of aircraft and aerial targets during testing activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.4.2.2 Impacts from Aircraft and Aerial Targets Under Alternative 2

Impacts from Aircraft and Aerial Targets Under Alternative 2 for Training Activities

The use of aircraft and aerial targets under Alternative 2 for training would be virtually identical (less than one percent difference for aircraft and no difference for targets) to what would occur under Alternative 1 (Table 3.0-28, Table 3.0-23); therefore, the same impact conclusions apply.

Pursuant to the ESA, the use of aircraft and aerial targets during training activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

Impacts from Aircraft and Aerial Targets Under Alternative 2 for Testing Activities

Compared to Alternative 1, the use of aircraft and aerial targets under Alternative 2 for testing would be slightly greater (less than 10 percent difference) for aircraft but would be the same for targets.

Therefore, impacts would be slightly greater under Alternative 2, but would still be inconsequential in terms of numbers of birds affected and population-level effects.

Pursuant to the ESA, the use of aircraft and aerial targets during testing activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.4.2.3 Impacts from Aircraft and Aerial Targets Under the No Action Alternative

Impacts from Aircraft and Aerial Targets Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., aircraft and aerial targets) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.4.3 Impacts from Military Expended Materials

This section analyzes the physical disturbance and strike potential to birds from the following categories of military expended materials: (1) all sizes of non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than munitions, such as sonobuoys, vessel hulks, and expendable targets. See Appendix F (Military Expended Material and Direct Strike Impact Analyses) for more information on the locations, types, and quantities of military expended materials proposed to be used.

Exposure of birds to military expended materials during Navy training and testing activities could result in physical injury or behavioral disturbances to birds in air, at the surface, or underwater during foraging dives. Although a quantitative analysis is not possible due to the absence of bird density information in the Study Area and the dispersed nature of training and testing activities, an assessment of the likelihood of exposure to military expended materials was conducted based on general bird distributions in the Study Area.

The widely dispersed area in which bombs and missiles would be expended in the Study Area annually (see Chapter 2, Description of Proposed Action and Alternatives), coupled with the often patchy distribution of seabirds (Fauchald et al., 2002; Haney, 1986a; Schneider & Duffy, 1985), suggest that the probability of these types of munitions striking a seabird would be low. The number of small-caliber projectiles that would be expended annually during various activities (e.g., gunnery exercises) is much higher than the number of large-caliber projectiles and other large munitions. However, the total number of rounds expended is not a good indicator of strike probability during gunnery exercises because multiple rounds of large-caliber projectiles and other large munitions are generally fired at individual targets during a single event.

Human activity such as vessel movement, aircraft overflights, and target placement could cause birds to flee a target area before the onset of firing, thus avoiding harm. If birds were in the target area, they would likely flee the area prior to the release of military expended materials or just after the initial rounds strike the target area (assuming seabirds were not struck by the initial rounds). Additionally, the force of military expended material fragments dissipates quickly once the pieces hit the water, so direct strikes on seabirds foraging below the surface would not be likely. Also, munitions would not be used in

shallow/nearshore areas. The potential likelihood of individual seabirds being struck or disturbed by munitions is very low; thus, impacts on seabird populations would not be expected.

3.9.3.4.3.1 Impacts from Military Expended Materials Under Alternative 1

Impacts from Military Expended Materials Under Alternative 1 for Training Activities

Tables 3.0-19, 3.0-21, 3.0-23, and 3.0-25 in Section 3.0.3.3.4.2 (Military Expended Materials) provide a breakdown of the number and general location of different activities that generate these materials under both action alternatives for training. Military expended materials would occur throughout the Study Area, although relatively few items would be expended in the transit corridor. Appendix F (Military Expended Material and Direct Strike Impact Analyses) provides details on the types, numbers and footprints of expended materials by location.

The potential impact of military expended materials on birds in the Study Area is dependent on the ability of birds to detect and avoid foreign objects through their sensory systems and the relatively fast flying speeds and maneuverability of most bird species. The potential for impact is related to the probability of a bird and a projectile meeting in the same space at the same time. The amount of materials expended over the vast area over which training and testing activities occur combined with the ability of birds to flee disturbance, would make direct strikes unlikely. Individual birds may be impacted, but strikes would have no impact on species or populations.

Direct strikes from firing weapons (projectiles) or air-launched devices (e.g., sonobuoys, torpedoes) are a potential stressor to seabirds. Seabirds in flight, resting on the water's surface, or foraging just below the water surface would be vulnerable to a direct strike. Strikes have the potential to injure or kill seabirds in the Study Area. However, there would not be long-term population level impacts. The footprint calculations in Appendix F (Military Expended Material and Direct Strike Impact Analyses, e.g., Table F-4) indicate very small areas of Study Area being impacted, and a consequent low probability of strikes to birds, by the types of materials that pose the greatest risk to birds (e.g., projectiles, torpedoes, surface targets) on an annual or cumulative 5-year basis. The vast area over which training activities occur combined with the ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but strikes would have no impact on species or populations.

If ESA-listed species were in the immediate area where military expended materials are present, they could be impacted by military expended material strikes. It is highly unlikely that a bird would be struck by military expended materials because most birds in the vicinity of the approaching aircraft or vessel, from which the military expended materials are released, would likely be dispersed by the sound of its approach before it could come close enough for an impact from a strike or a disturbance to take place. Therefore, activities that release military expended materials would not likely cause any potential strike or disturbance risk to birds in the Study Area.

Pursuant to the ESA, the use military expended materials during training activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Military Expended Materials Under Alternative 1 for Testing Activities

Tables 3.0-20, 3.0-22, 3.0-24, and 3.0-26 in Section 3.0.3.3.4.2 (Military Expended Materials) provide a breakdown of the number and general location of different activities that generate these materials under both action alternatives for testing. Testing activities would not typically occur in the transit

corridor, but would otherwise occur throughout the Study Area. Appendix F (Military Expended Material and Direct Strike Impact Analyses) provides details on the types, numbers and footprints of expended materials by location.

The potential impact of military expended materials on birds in the Study Area is dependent on the ability of birds to detect and avoid foreign objects through their sensory systems and the relatively fast flying speeds and maneuverability of most bird species. The potential for impact is related to the probability of a bird and a projectile meeting in the same space at the same time. The amount of materials expended over the vast area over which training and testing activities occur, combined with the ability of birds to flee disturbance, would make direct strikes unlikely. Individual birds may be impacted, but strikes would have no impact on species or populations.

Direct strikes from firing weapons (projectiles) or air-launched devices (e.g., sonobuoys, torpedoes) are a potential stressor to seabirds. Seabirds in flight, resting on the water's surface, or foraging just below the water surface would be vulnerable to a direct strike. Strikes have the potential to injure or kill seabirds in the Study Area. However, there would not be long-term population level impacts. The footprint calculations in Appendix F (Military Expended Material and Direct Strike Impact Analyses, e.g., Table F-12) indicate very small areas of Study Area being impacted, and a consequent low probability of strikes to birds, by the types of materials that pose the greatest risk to birds (e.g., projectiles, torpedoes, surface targets) on an annual or cumulative 5-year basis. The vast area over which testing activities occur combined with the ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but strikes would have no impact on species or populations.

If ESA-listed species were in the immediate area where military expended materials are present, they could be impacted by military expended material strikes. It is highly unlikely that a bird would be struck by military expended materials because most birds in the vicinity of the approaching aircraft or vessel, from which the military expended materials are released, would likely be dispersed by the sound of its approach before it could come close enough for an impact from a strike or a disturbance to take place. Therefore, activities that release military expended materials would not likely cause any potential strike or disturbance risk to birds in the Study Area.

Pursuant to the ESA, the use military expended materials during testing activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.4.3.2 Impacts from Military Expended Materials Under Alternative 2

Impacts from Military Expended Materials Under Alternative 2 for Training Activities

The differences in expended materials between Alternatives 1 and 2 for training activities are relatively small and inconsequential with respect to the types of materials that pose the greatest risk to birds (Appendix F, Military Expended Material and Direct Strike Impact Analyses, Table F-5). As a result, impacts of military expended materials from training activities under Alternative 2 would be essentially the same as those of Alternative 1.

Pursuant to the ESA, the use military expended materials during training activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

Impacts from Military Expended Materials Under Alternative 2 for Testing Activities

The differences in expended materials between Alternatives 1 and 2 for testing activities are relatively small and inconsequential with respect to the types of materials that pose the greatest risk to birds (Appendix F, Military Expended Material and Direct Strike Impact Analyses, Table F-12). As a result, impacts of military expended materials from testing activities under Alternative 2 would be essentially the same as those of Alternative 1.

Pursuant to the ESA, the use military expended materials during testing activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.4.3.3 Impacts from Military Expended Materials Under the No Action Alternative

Impacts from Military Expended Materials Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., military expended materials) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.4.4 Impacts from Seafloor Devices

As discussed in Section 3.0.3.3.4.3, seafloor devices are used during training and testing activities that are deployed onto the seafloor in shallow water and later recovered. Because these devices are stationary or very slow moving they do not pose a risk of physical disturbance or strike to birds, including ESA-listed species. Because of this, seafloor devices pose no threat of impact on birds and will not be discussed further.

3.9.3.4.5 Impacts from Pile Driving

Section 3.9.3.1.4 (Impacts from Pile Driving) describes the impacts from noise to birds that would occur from the installation and removal of piles in the vicinity of training events involving the construction of an Elevated Causeway System, a temporary pier that allows the offloading of ships in areas without a permanent port. Human activity such as vessel or boat movement, and equipment setting and movement, is expected to cause birds to flee the activity area before the onset of pile driving. If birds were in the activity area, they would likely flee the area prior to, or just after, the initial strike of the pile at the beginning of the ramp-up procedure. Pile driving is, therefore, not considered physical disturbance or strike stressor for birds.

3.9.3.5 Entanglement Stressors

This section analyzes the potential entanglement impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. This analysis includes the potential impacts of three types of military expended materials, including: (1) wires and cables, (2) decelerators/parachutes, and (3) biodegradable polymers. Aspects of entanglement stressors that are applicable to marine organisms in general are presented in Section 3.0.3.3.5 (Entanglement Stressors). The annual numbers and locations of expended wires, cables, decelerators/parachutes, and activities using biodegradable polymers are provided in Tables 3.0-29 through 3.0-32.

Along the continental U.S. and near Hawaii, at least 44 species of seabirds are known to become entangled in plastic or marine debris. From 2001–2005, entanglement rates ranged from 0.2 percent to 1.2 percent for all seabirds observed by beach monitoring programs in California, Oregon, and Washington. Common murres and western gulls were the most common species found entangled. While the vast majority of entanglements involved fishing gear (e.g., monofilament line and hooks), approximately 8.3 percent of the entanglements were from non-fishery-related items (e.g., plastics and other synthetic materials that they may gather for making nests). Cormorants in Maine have been observed making nests from such plastic marine debris, including net fragments and fishing line. It is thought that the biggest threat of entanglement from using debris as nesting material is to the chicks, but no such entanglements have been observed (National Oceanic and Atmospheric Administration, 2016).

Given the limited amount of time that wires and cables would remain suspended in air and the ability of birds to detect and avoid parachutes in-air, the likelihood that a bird would become entangled in-air is considered remote and discountable. As such, this analysis is focused on the potential for entanglement at the water surface, in the water column, or on the seafloor.

The cables, wires, decelerators/parachutes, and biodegradable polymer, in contrast to fishing lines, are fairly conspicuous, relatively brittle, will break if looped beyond its bend radius (3.4 mm), do not tend to snag animals that swim through them, and do not persist for a long time in the water column. Based on the constituents of the biodegradable polymer the Navy proposes to use, it is anticipated that the material would break down into small pieces within a few days to weeks, and break down further and dissolve into the water column within weeks to a few months. The Navy-expended materials sink gradually (0.24 m/second in the case of guidance wires) to the bottom. These materials would be readily avoided by visually oriented seabirds that could be foraging or resting in the water. Unlike fishing gear, the Navy's equipment does not capture fish and therefore decreases the attractiveness to foraging seabirds. Additional information is provided in the sections below.

3.9.3.5.1 Impacts from Wires and Cables

Section 3.0.3.3.5.1 (Wires and Cables) discusses the types of activities that use wires and cables, where they are used, and how many events will occur under each alternative. These items include fiber optic cables, guidance wires, and sonobuoy components.

Fiber optic cables are flexible cables that can range in size up to 300 m in length. The length of guidance wires would generally be equal to the distance the torpedo travels to impact the target, which may increase entanglement risk to birds with long wires (over 1,000 m) expended into the environment. Sonobuoys consist of a surface antenna and float unit and a subsurface hydrophone assembly unit. The two units are attached through a thin-gauge, dual-conductor, hard draw copper strand cable, which is then wrapped by a hollow rubber tubing or bungee in a spiral configuration. The length of cable that extends out is no more than 1500 ft. and is dependent on the water depth and type of sonobuoy. The hydrophone components maybe covered by thin plastic netting depending on type of sonobuoy. Each sonobuoy has a saltwater activated polyurethane float that inflates when the sonobuoy is submerged and keeps the sonobuoy components floating vertically in the water column below it. Sonobuoys remain suspended in the water column for no more than 30 hours, after which they sink to the seafloor. While longer cables present a higher likelihood of bird interactions, and therefore present an increased risk of entanglement of a bird, these cables should be readily avoidable by birds that could be foraging or resting in the water.

The entanglement risk from these components would only occur when a bird and these components were in close proximity at the water surface, in the water column, or on the seafloor. As stated above, however, these materials would be readily avoided by visually oriented seabirds that could be foraging or resting in the water and do not pose the same entanglement risks as fishing gear. Some sonobuoy components, once they sink to the bottom, may be transported by bottom currents or active tidal influence, and present an enduring entanglement risk. In the benthic environment, however, subsequent colonization by encrusting organisms, burying by sediment, and chemical breakdown of the various materials would further reduce the potential for reintroduction as an entanglement risk.

3.9.3.5.1.1 Impacts from Wires and Cables under Alternative 1

Impacts from Wires and Cables under Alternative 1 for Training Activities

As discussed in Section 3.0.3.3.5.1 (Wires and Cables), under Alternative 1 training activities, fiber optic cables, guidance wires, and sonobuoy components that would pose an entanglement risk to birds would be expended in the Hawaii Range Complex and Southern California portion of the Study Area. However, given that these stressors are widely dispersed over vast areas and do not persist or accumulate at the surface or in the water column where seabirds forage, encounters with seabirds would be infrequent. This is coupled with a remote likelihood that a bird encountering the expended material would become entangled, as described above. As a result, the potential for entanglement from wires and cables to lead to injury or mortality is negligible. Therefore, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of wires and cables during training activities as described under Alternative 1 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Wires and Cables under Alternative 1 for Testing Activities

As discussed in Section 3.0.3.3.5.1 (Wires and Cables), under Alternative 1 testing activities, fiber optic cables, guidance wires, and sonobuoy components that would pose an entanglement risk to birds would be expended in the Hawaii and Southern California Range Complexes. However, given that these stressors are widely dispersed over vast areas and do not persist or accumulate at the surface or in the water column where seabirds forage, encounters with seabirds would be infrequent. This is coupled with a remote likelihood that a bird encountering the expended material would become entangled, as described above. As a result, the potential for entanglement from wires and cables to lead to injury or mortality is negligible. Therefore, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of wires and cables during testing activities as described under Alternative 1 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.5.1.2 Impacts from Wires and Cables under Alternative 2

Impacts from Wires and Cables under Alternative 2 for Training Activities

As discussed in Section 3.0.3.3.5.1 (Wires and Cables), under Alternative 2 training activities, fiber optic cables, guidance wires, and sonobuoy components would be expended in the same areas as Alternative 1, with increases in the number of expended items that would pose an entanglement risk. Under Alternative 2, increases in sonobuoy component releases would occur in the Hawaii and Southern

California Range Complexes, at a similar rate and frequency compared to Alternative 1. Given the foregoing analysis, however, the impacts would be essentially the same as for Alternative 1. Therefore, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of wires and cables during training activities as described under Alternative 2 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

Impacts from Wires and Cables under Alternative 2 for Testing Activities

As discussed in Section 3.0.3.3.5.1 (Wires and Cables), under Alternative 2 testing activities, fiber optic cables, guidance wires, and sonobuoy components would be expended in the same areas as Alternative 1, with increases to the number of expended items that would pose an entanglement risk. Under Alternative 2, increases in sonobuoy component releases would occur in the Hawaii and Southern California Range Complexes, at a similar rate and frequency compared to Alternative 1. Given the foregoing analysis, however, the impacts would be essentially the same as for Alternative 1. Therefore, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of wires and cables during testing activities as described under Alternative 2 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.5.1.3 Impacts from Wires and Cables under the No Action Alternative

Impacts from Wires and Cables under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various entanglement stressors (e.g., wires and cables) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.5.2 Impacts from Decelerators/Parachutes

Section 3.0.3.3.5.2 (Decelerators/Parachutes) describes the use and platforms where decelerators/parachutes would be released into the marine environment and therefore present an entanglement risk to birds. Aircraft-launched sonobuoys and lightweight torpedoes (such as the MK 46 and MK 54) use nylon decelerators/parachutes ranging in size from 18 to 48 in. in diameter (small). The majority of the decelerators/parachutes in the small size category are smaller (18 in.) cruciform shape decelerators/parachutes associated with sonobuoys. Illumination flares use large decelerators/parachutes, up to approximately 19 ft. in diameter. Both small- and medium-sized decelerators/parachutes are made of cloth and nylon, many with weights attached to their short attachment lines to speed their sinking. Once a sonobuoy hits the water surface, its decelerator/parachute is designed to produce drag at the surface for 5 to 15 seconds, allowing for deployment of the sonobuoy, then the decelerator/parachute separates and sinks. The decelerator/parachute assembly contains metallic components and could be at the surface for a short period before sinking to the seafloor. Sonobuoy decelerators/parachutes are designed to sink within 15 minutes, but the rate of sinking depends upon sea conditions and the shape of the decelerator/parachute, and the duration of the descent would depend on the water depth. Aerial targets (drones) use large (between 30 and 50 ft. in diameter) and extra-large (80 ft. in diameter) decelerators/parachutes. Large and extra-large decelerators/parachutes are also made of cloth and

nylon, with suspension lines of varying lengths (large: 40 to 70 ft. in length [with up to 28 lines per decelerator/parachute]; extra-large: 82 ft. in length [with up to 64 lines per decelerator/parachute]). Some aerial targets also use a small drag parachute (6 ft. in diameter) to slow their forward momentum prior to deploying the larger primary decelerator/parachute. Unlike the small- and medium-sized decelerators/parachutes, drone decelerators/parachutes do not have weights attached and may remain at the surface or suspended in the water column for some time prior to eventual settlement on the seafloor. Decelerators/parachutes or decelerator/parachute lines may be a risk for birds to become entangled, particularly while at the surface. As stated above, however, these materials would be readily avoided by visually oriented seabirds that could be foraging or resting in the water and do not pose the same entanglement risks as fishing gear.

If the decelerator/parachute and its lines sink to the seafloor in an area where the bottom is calm, it would remain there undisturbed. Over time, it may become covered by sediment in most areas or colonized by attaching and encrusting organisms, which would further stabilize the material and reduce the potential for reintroduction as an entanglement risk. If bottom currents are present, the canopy may billow and pose an entanglement threat to birds that feed in benthic habitats. Bottom-feeding birds tend to forage in nearshore areas rather than offshore, where these decelerators/parachutes are used; therefore, birds are not likely to encounter decelerators/parachutes once they reach the seafloor. The potential for a bird to encounter an expended decelerator/parachute at the surface or in the water column is extremely low, it is even less probable at the seafloor given the general improbability of a bird being near the deployed decelerator/parachute as well as the general behavior of birds. Depending on how quickly the decelerator/parachute may degrade, the risk may increase with time if the decelerator/parachute remains intact. Factors that may influence degradation times include exposure to ultraviolet radiation and the extent of physical damage of the decelerator/parachute on the water's surface, as well as water temperature and sinking depth.

3.9.3.5.2.1 Impacts from Decelerators/Parachutes under Alternative 1

Impacts from Decelerators/Parachutes under Alternative 1 for Training Activities

As discussed in Section 3.0.3.3.5.2 (Decelerators/Parachutes), under Alternative 1 training activities, decelerators/parachutes that would pose an entanglement risk to seabirds would be expended in the open ocean portions of the Study Area. However, given that these stressors are widely dispersed over vast areas and do not persist or accumulate at the surface or in the water column where seabirds forage, encounters with seabirds would be infrequent. This is coupled with a remote likelihood that a bird encountering the expended material would become entangled, as described above. As a result, the potential for entanglement from decelerators/parachutes to lead to injury or mortality is negligible. Therefore, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of decelerators/parachutes during training activities as described under Alternative 1 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Decelerators/Parachutes under Alternative 1 for Testing Activities

Appendix F (Military Expended Material and Direct Strike Analyses) provides a list of expended materials that would include decelerators/parachutes. Table F-1 provides the number of each type of military expended material used for testing activities under Alternative 1. These decelerators/parachutes would be expended in the open ocean portions of the Study Area. However, given that these stressors are

widely dispersed over vast areas and do not persist or accumulate at the surface or in the water column where seabirds forage, encounters with seabirds would be infrequent. This is coupled with a remote likelihood that a bird encountering the expended material would become entangled, as described above. As a result, the potential for entanglement from decelerators/parachutes to lead to injury or mortality is negligible. Therefore, no long-term or population-level impacts on birds would occur.

Pursuant to the ESA, the use of decelerators/parachutes during testing activities as described under Alternative 1 would not affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.5.2.2 Impacts from Decelerators/Parachutes under Alternative 2

Impacts from Decelerators/Parachutes under Alternative 2 for Training Activities

Under Alternative 2, the number of decelerators/parachutes that would be expended during training activities is the same as for Alternative 1. Therefore, the impact conclusion for decelerators/parachutes under Alternative 2 training activities is the same as for Alternative 1.

Impacts from Decelerators/Parachutes under Alternative 2 for Testing Activities

Under Alternative 2, the number of decelerators/parachutes that would be expended during testing activities is the same as for Alternative 1. Therefore, the impact conclusion for decelerators/parachutes under Alternative 2 testing activities is the same as for Alternative 1.

3.9.3.5.2.3 Impacts from Decelerators/Parachutes under the No Action Alternative

Impacts from Decelerators/Parachutes under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various entanglement stressors (e.g., decelerators/parachutes) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.5.3 Impacts from Biodegradable Polymers

The possibility of entanglement in the biodegradable polymer is considered remote and discountable given the fact that the material is only deployed on a small-scale in test locations (Table 3.0-32), is short-lived (days to weeks) in the water, and that diving birds routinely navigate through floating vegetation without becoming entangled (unlike boat propellers which the polymer is designed to entangle). The biodegradable polymer is, therefore, not considered an entanglement stressor for birds.

3.9.3.6 Ingestion Stressors

As described in Section 3.0.3.3.6 (Ingestion Stressors), the types of expended materials that are potentially a source of ingestion stressors include non-explosive practice munitions (small and medium caliber), fragments from high-explosive munitions, fragments from targets, chaff, the plastic end caps and pistons from flares, small decelerators/parachutes, and biodegradable polymers. Other types of expended materials are too large to be mistaken for food items and consumed by birds.

3.9.3.6.1 Impacts from Military Expended Materials-Munitions

Two types of munitions are potentially a source of ingestion stressors: non-explosive practice munitions (small and medium caliber) and fragments from high-explosive munitions. Both types of munitions sink rapidly through the water column and settle to the bottom. Munitions are not used in nearshore-shallow areas and, because of their density, are likely to bury in the bottom and are unlikely to be transported from offshore to nearshore. It is thus highly unlikely that munitions would accumulate where benthic nearshore or intertidal foraging would occur. Rapidly sinking munitions and fragments are unlikely to be accessible or attractive as potential food items to diving birds that feed on fish and invertebrates in the water column. Accordingly, there are no potential impacts on birds feeding in the water column or on the bottom from this category of ingestion stressors and it will not be discussed further.

3.9.3.6.2 Impacts from Military Expended Materials Other Than Munitions

The analysis in this section includes the potential ingestion of military expended materials other than munitions, all of which are expended away from nearshore habitats and close to the water surface. Tables 3.0-23 through 3.0-26 and 3.0-32 through 3.0-34 describe the annual quantities and locations where these materials would be generated by training and testing activities under Alternatives 1 and 2. Appendix A (Navy Activity Descriptions) provides more specific information on the activities that may result in ingestion stressors, and the typical locations where these activities occur.

While it has been widely documented that a wide range of marine organisms (including zooplankton, baleen whales, and seabirds) will ingest plastic, the mechanism that causes these organisms to do so was discovered only recently (Savoca, 2016; Savoca et al., 2016). Procellariiformes, or tube-nosed seabirds (e.g., albatrosses, shearwaters and petrels [Section 3.9.2.3.5]) utilize a highly developed sense of smell to find food that is patchily distributed in offshore and open ocean environments. Specifically, these birds are attracted to dimethyl sulfide, which is produced when the cell walls of algae are damaged (e.g., when marine herbivores such as krill eat it), thereby alerting the seabirds that food (e.g., krill) are nearby. Through a literature review, Savoca et al. (2016) demonstrated that seabirds that utilize dimethyl sulfide as a foraging cue consumed plastic nearly six times more frequently than species that were not attracted to dimethyl sulfide. Savoca et al. (2016) also performed field studies that confirmed that algae growing on three of the most common types of plastic debris (polypropylene and low- and high-density polyethylene) can produce dimethyl sulfide within three weeks at concentrations at least four orders of magnitude above the behavioral detection threshold for Antarctic prions (*Pachyptila desolata*), thereby creating an "olfactory trap."

Birds could potentially ingest expended materials other than munitions used by the Navy during training and testing activities within the Study Area. The Navy expends the following types of materials that could become ingestion stressors for birds during training and testing in the Study Area: missile components, target fragments, chaff and flare endcaps/pistons, and decelerators/parachutes. Biodegradable polymers generated during countermeasures testing are also considered, although they would only be used in testing (Table 3.0-32), and are short-lived due to biodegradation.

Ingestion of expended materials by birds could occur in all large marine ecosystems and open ocean areas and would occur either at the surface or just below the surface portion of the water column, depending on the size and buoyancy of the expended object and the feeding behavior of the birds. Floating material of ingestible size could be eaten by birds that feed at or near the water surface, while materials that sink pose a potential risk to diving birds that feed just below the water's surface (Titmus

& Hyrenbach, 2011). Some items, such as decelerators/parachutes or sonobuoys are too large to be ingested and will not be discussed further. Also, decelerators/parachutes sink rapidly to the seafloor.

Physiological impacts on birds from ingestion include blocked digestive tracts and subsequent food passage, blockage of digestive enzymes, lowered steroid hormone levels, delayed ovulation (egg maturation), reproductive failure, nutrient dilution (nonnutritive debris displaces nutritious food in the gut), exposure to indirect effects from harmful chemicals found in and on the plastic material, and altered appetite satiation (the sensation of feeling full), which can lead to starvation (Azzarello & Van Vleet, 1987). While ingestion of marine debris has been linked to bird mortalities, sublethal impacts are more common (Moser & Lee, 1992).

Many species of seabirds are known to ingest floating plastic debris and other foreign matter while feeding on the surface of the ocean (Auman et al., 1997; Yamashita et al., 2011). Evidence indicates that physical and toxicological impacts from plastic ingestion by seabirds are widespread among species and pervasive in terms of the number of individuals affected, and that impacts are increasing (Kain et al., 2016; Wilcox et al., 2015). For example, 21 of 38 seabird species (55 percent) collected off the coast of North Carolina from 1975 to 1989 contained plastic particles (Moser & Lee, 1992). The mean particle sizes of ingested plastic were positively correlated with the birds' size though the mean mass of plastic found in the stomachs and gizzards of 21 species was below 3 grams. In Hawaii, the proportion of necropsied Newell's shearwaters and wedge-tailed shearwaters (*Ardenna pacifica*) that were found to have ingested plastic more than doubled from 1986 to 1987 to 2007 to 2014 (Kain et al., 2016). The number of plastic particles found in the stomachs of northern fulmars in the North Sea increased by two-to-three-fold from the mid-1980s to mid-1990s and has remained at about 30 particles per bird since then. Since the 1980s, concentrations of industrial plastics in the ocean waters and their consumption by fulmars has decreased by about 75 percent, while the abundance of user plastics and their consumption has shown no obvious trend (van Franeker & Law, 2015). Some seabirds have used plastic and other marine debris for nest building which may lead to ingestion of that debris (Votier et al., 2011). Indirect ingestion of plastic also occurs from consuming prey (such as fishes) that ingest plastic.

Plastic is often mistaken for prey, and the incidence of plastic ingestion appears to be related to a bird's feeding mode and diet (Henry et al., 2011; Provencher et al., 2014). Seabirds that feed by pursuit-diving, surface-seizing, and dipping tend to ingest plastic, while those that feed by plunging or piracy typically do not ingest plastic (Azzarello & Van Vleet, 1987; Provencher et al., 2014). Birds of the order Procellariiformes, which include petrels, shearwaters, and albatrosses, tend to accumulate more plastic than other species (Azzarello & Van Vleet, 1987; Moser & Lee, 1992; Pierce et al., 2004; Provencher et al., 2014). Some birds, including gulls and terns, commonly regurgitate indigestible parts of their food items such as shell and fish bones. However, the structure of the digestive systems of most Procellariiformes makes it difficult to regurgitate solid material such as plastic (Azzarello & Van Vleet, 1987; Moser & Lee, 1992; Pierce et al., 2004). Two species of albatross (*Diomedeidae*) have also been reported to ingest plastic while feeding at sea. While such studies have not conclusively shown that plastic ingestion is a significant source of direct mortality, it may be a contributing factor to other causes of albatross mortality (Naughton et al., 2007).

As summarized by Pierce et al. (2004), Auman et al. (1997) and Azzarello and Van Vleet (1987) documented consequences of plastic ingestion by seabirds include blockage of the intestines and ulceration of the stomach, reduction in the functional volume of the gizzard leading to a reduction of digestive capability, and distention of the gizzard leading to a reduction in hunger. Dehydration has also been documented in seabirds that have ingested plastic (Sievert & Sileo, 1993). Studies have found

negative correlations between body weight and plastic load, as well as between body fat (a measure of energy reserves) and the number of pieces of plastic in a seabird's stomach (Auman et al., 1997; Ryan, 1987; Sievert & Sileo, 1993). Other possible concerns that have been identified include toxic plastic additives and toxic contaminants that could be adsorbed to the plastic from ambient seawater. Pierce et al. (2004) described two cases where plastic ingestion caused seabird mortality from starvation. The examination of a deceased adult northern gannet revealed that a 1.5 in. diameter plastic bottle cap lodged in its gizzard blocked the passage of food into the small intestine, which resulted in its death from starvation. Northern gannets are substantially larger, and dive deeper than the ESA-listed birds in the Study Area. Also, since gannets typically utilize flotsam in nest building (Votier et al., 2011), they may be more susceptible to ingesting marine debris than other species as it gathers that material. Dissection of an adult greater shearwater's gizzard revealed that a 1.5 by 0.5 in. fragment of plastic blocked the passage of food in the digestive system, which also resulted in death from starvation.

Species such as storm-petrels, albatrosses, shearwaters, fulmars, and noddies that forage by picking prey from the surface may have a greater potential to ingest any floating plastic debris (Donnelly-Greenan et al., 2014). Ingestion of plastic military expended material by any species from the taxonomic groups found within the Study Area (Table 3.9-2) has the potential to impact individual birds. The risk of plastic ingestion and impaction in chicks of many species of seabirds may be different from the risks to adults. Albatross chicks appear to be at greater risk than adults, because of their high rates of ingestion and apparent low frequency of regurgitative casting of indigestible material. Hyrenbach et al. (2015) demonstrated that almost 100 percent of chicks of black-footed and Laysan albatrosses breeding in the Northwestern Hawaiian Islands ingest plastics during the pre-fledging period when they are dependent upon food brought to the breeding colony by parents. Floating plastic items are ingested by adult albatrosses and regurgitated to chicks along with normal food items. Negative effects of plastic ingestion may result from impaction of the upper gastrointestinal tract and interference with passage of food through the digestive system, contributing to reduced resistance to disease and lowered post-fledging survival. Significant correlations between plastic loads and body condition or growth rates, were not found, however (Hyrenbach et al., 2015). Flesh-footed shearwater (*Puffinus carnipes*) fledglings in eastern Australia have been found to contain relatively large amounts of plastics, which is correlated with poor body condition and tissue contaminant loads (Lavers et al., 2014).

The distribution of floating expended items would be irregular in both space and time, as training and testing activities do not occur in the same place each time. The random distribution of items across the large Study Area yields very low probabilities that seabirds will encounter a floating item. However, when a seabird does encounter a floating item of ingestible size, an ingestion risk may exist. Although most military expended material components are expected to sink to the seafloor and spend limited periods within the water column, some items remain buoyant for an extended period. Expended training and testing material, such as missile components or target fragments that float, may be encountered by seabirds in the waters of the Study Area, increasing the potential for ingestion of smaller components. Ocean currents concentrate plastic debris, making seabirds that feed along frontal zones more susceptible (Azzarello & Van Vleet, 1987). While some seabird ingestion of expended materials could occur, these factors indicate that a small number of birds would be affected and that population level effects would not be expected.

Target-Related Materials. As described in Section 3.0.3.3.6.3 (Military Expended Materials Other Than Munitions), at-sea targets are usually remotely operated airborne, surface, or subsurface traveling units, most of which are designed to be recovered for reuse. However, if they are used during activities that

use high explosives then they may result in fragments. Expendable targets that may result in fragments would include air-launched decoys, surface targets (e.g., marine markers, paraflares, cardboard boxes, and 10 ft. diameter red balloons), and mine shapes. Most target fragments would sink quickly to the seafloor. Floating material, such as Styrofoam, may be lost from target boats and remain at the surface for some time. Only targets that may result in smaller fragments that do not immediately sink are included in the analyses of ingestion potential.

There are additional types of targets discussed previously, but only surface targets, subsurface targets, air targets, Sinking Exercise ship hulks, and mine shapes would be expected to result in fragments when high-explosive munitions are used.

Chaff. As described in Section 3.0.3.3.6.3 (Military Expended Materials Other Than Munitions), large areas of air space and open water within the Study Area would be exposed to chaff at very low concentrations. This same section also provides a general discussion of chaff as an ingestion stressor and concludes that chaff poses little risk to organisms, except at concentrations substantially higher than those that could reasonably occur from military training. Additional information is provided below.

It is unlikely that chaff would be selectively ingested (U.S. Department of the Air Force, 1997). Ingestion of chaff fibers is not expected to cause physical damage to a bird's digestive tract based on the fibers' small size (ranging in lengths of 0.25 to 3 in. with a diameter of about 40 micrometers) and flexible nature, as well as the small quantity that could reasonably be ingested. In addition, concentrations of chaff fibers that could reasonably be ingested are not expected to be toxic to seabirds. Scheuhammer (1987) reviewed the metabolism and toxicology of aluminum in birds and mammals and found that intestinal adsorption of orally ingested aluminum salts was very poor, and the small amount adsorbed was almost completely removed from the body by excretion. Dietary aluminum normally has minor impacts on healthy birds and mammals, and often high concentrations (greater than 1,000 milligrams per kilogram) are needed to induce effects such as impaired bone development, reduced growth, and anemia (U.S. Department of the Navy, 1999). A bird weighing 2.2 lb. would need to ingest more than 83,000 chaff fibers per day to receive a daily aluminum dose equal to 1,000 per kilogram; this analysis was based on chaff consisting of 40 percent aluminum by weight and a 5 ounce chaff canister containing 5 million fibers. As an example, an adult herring gull weighs about 1.8 to 2.7 lb. (Cornell Lab of Ornithology, 2009b). It is highly unlikely that a bird would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff (i.e., 1.8 fibers per square foot for an unrealistic, worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point).

Flares. A general discussion of flares as an ingestion stressor is presented in Section 3.0.3.3.4.2 (Military Expended Materials Other Than Munitions). Ingestion of flare compression pads or pistons 1.3 in. in diameter and 0.13 in. thick (U.S. Department of the Air Force, 1997) by birds may result in gastrointestinal obstruction or reproductive complications. Based on the information presented above, if a seabird were to ingest a compression pads or pistons, the response would vary based on the species and individual bird. The responses could range from none, to sublethal (reduced energy reserves), to lethal (digestive tract blockage leading to starvation). Ingestion of compression pads or pistons by species that regularly regurgitate indigestible items would likely have no adverse impacts. However, compression pads or pistons are similar in size to those plastic pieces described above that caused digestive tract blockages and eventual starvation. Therefore, ingestion of compression pads or pistons could be lethal to some individual seabirds. Species with small gizzards and anatomical constrictions that make it difficult to regurgitate solid material would likely be most susceptible to blockage (such as

Procellariiformes). Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual birds.

Biodegradable Polymer. The biodegradable polymer used in some testing activities could theoretically be ingested by birds; however, the likelihood is low because the material would persist only until the polymer degrades. Some of the polymer constituents would dissolve within hours of immersion and it is anticipated that the material will breakdown into small pieces within a few days to weeks of deployment (discussed in Section 3.0.3.3.5.3, Biodegradable Polymer). Therefore, the biodegradable polymer is not considered an ingestion stressor for birds and will not be discussed further.

3.9.3.6.2.1 Impacts from Military Expended Materials Other Than Munitions Under Alternative 1

Impacts from Military Expended Materials Other Than Munitions Under Alternative 1 for Training and Testing Activities

As indicated in Section 3.0.3.3.6.3 (Military Expended Materials Other Than Munitions), the use of chaff, flares, and targets would occur and could generate expended materials constituting ingestion stressors throughout the Study Area. Although chaff fibers and pieces of biodegradable polymer are too small for birds to confuse with prey, there is some potential for chaff and biodegradable polymer to be incidentally ingested along with other prey items. If ingested, neither chaff nor biodegradable polymer are expected to impact birds, due to the low concentration that would be ingested and the small size of the fibers.

The plastic materials associated with flare compression pads or pistons sink in saltwater (U.S. Department of the Navy, 1999), which reduces the likelihood of ingestion by seabirds. Although the overall concentration of military expended materials would be low, and Navy standard practice is to collect and remove as much Styrofoam as possible when retrieving a degraded target, military expended materials would not be evenly distributed. Similarly, seabirds are not evenly distributed in the Study Area (Fauchald et al., 2002; Haney, 1986b; Schneider & Duffy, 1985). As noted previously, there is some potential for expended materials that float (e.g., some types of target fragments or chaff end caps or flare compression pads and pistons) to become concentrated along frontal zones, along with food resources that tend to attract foraging seabirds, resulting in the incidental ingestion of such materials, most likely as very small fragments. Military expended materials would constitute a minute portion of the floating debris that seabirds would be exposed to and may accidentally consume in such situations, but could nevertheless contribute to harmful effects of manmade debris on some seabirds. The overall likelihood that individual birds would be negatively impacted by ingestion of military expended materials in the Study Area under Alternative 1 for training is considered low, but not discountable. Population-level effects would be very unlikely given the relatively small quantities and limited persistence of military expended materials in habitats where birds are most likely to forage. This conclusion applies to ESA-listed bird species as well.

Pursuant to the ESA, the use military expended materials other than munitions during training activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

Impacts from Military Expended Materials Other than Munitions Under Alternative 1 for Testing Activities

Testing activities under Alternative 1 would generate the same types of ingestible materials, and in similar quantities, as generated by training activities. Therefore, testing activities would have similar impacts to those of training activities under Alternative 1.

Pursuant to the ESA, the use military expended materials other than munitions during testing activities as described under Alternative 1 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.6.2.2 Impacts from Military Expended Materials Other Than Munitions Under Alternative 2

Impacts from Military Expended Materials Other Than Munitions Under Alternative 2 for Training Activities

The distribution and abundance of ingestion stressors would be the same under Alternative 2 for training activities as under Alternative 1 (Section 3.0.3.3.6, Ingestion Stressors); therefore, the impacts of the two alternatives would be the same.

Pursuant to the ESA, the use military expended materials other than munitions during training activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

Impacts from Military Expended Materials Other Than Munitions Under Alternative 2 for Testing Activities

The distribution and abundance of ingestion stressors would be the same under Alternative 2 for testing activities as under Alternative 1 (Section 3.0.3.3.6, Ingestion Stressors); therefore, the impacts of the two alternatives would be the same.

Pursuant to the ESA, the use military expended materials other than munitions during testing activities as described under Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels.

3.9.3.6.2.3 Impacts from Military Expended Materials Other Than Munitions Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various ingestion stressors (e.g., military expended materials other than munitions) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.3.7 Secondary Stressors

This section analyzes potential impacts on birds exposed to stressors indirectly through impacts on habitat and prey availability (e.g., sediment, water and air quality). Since these stressors also affect primary elements of bird habitat, firm distinctions between indirect impacts and habitat impacts are difficult to maintain. It is important to note that the terms "indirect" and "secondary" do not imply reduced severity of environmental consequences, but instead describe how the impact may occur in an organism or its ecosystem.

Stressors from Navy training and testing activities could pose secondary or indirect impacts on birds via impacts on habitat, sediment, or water quality. Disturbing sediment or impacting water quality could also impact the food-chain, which in turn could largely impact vital seabird habitat and prey availability. Analyses of their potential impacts are discussed in Section 3.2 (Sediments and Water Quality), Section 3.4 (Invertebrates), Section 3.5 (Habitats), and Section 3.6 (Fishes).

3.9.3.7.1 Impacts on Habitat

The potential of water, air quality, and abiotic habitat stressors associated with training and testing activities to indirectly affect birds, as a secondary stressor, was analyzed. The assessment of potential water, air quality, and abiotic habitat stressors is discussed in previous sections in this DEIS/OEIS (Section 3.1, Air Quality; Section 3.2, Sediments and Water Quality; and Section 3.5, Habitats). These analyses address specific activities in local environments that may affect bird habitats. At-sea activities that may impact water and air include general emissions, and at-sea activities that may affect habitats include explosives and physical disturbance and strike.

As noted in Section 3.1 (Air Quality), Section 3.2 (Sediments and Water Quality), and Section 3.5 (Habitats), implementation of the No Action Alternative, Alternative 1, or Alternative 2 would minimally impact sediments, water, air quality, or habitats, and therefore would not indirectly impact seabirds as secondary stressors. Furthermore, any physical impacts on seabird habitats would be temporary and localized because training and testing activities would occur infrequently. These activities would not be expected to adversely impact seabirds or seabird habitats.

Indirect impacts on sediments, water or air quality under Alternative 1 or Alternative 2 would have no effect on ESA-listed bird species due to: (1) the temporary nature of impacts on sediments, water, or air quality, (2) the distribution of temporary sediments, water, or air quality impacts, (3) the wide distribution of birds in the Study Area, and (4) the dispersed spatial and temporal nature of the training and testing activities that may have temporary sediments, water, or air quality impacts. No long-term or population-level impacts are expected.

Pursuant to the ESA, secondary impacts on habitat during training or testing activities as described under Alternative 1 and Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.3.7.2 Impacts on Prey Availability

As noted in Section 3.4 (Invertebrates) and Section 3.6 (Fishes), implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not adversely impact populations of invertebrate or fish prey resources (e.g., crustaceans, bivalves, worms, sand lance, herring, etc.) of birds and therefore would not indirectly impact birds as secondary stressors. Any impacts on seabird prey resources would be temporary and localized. Furthermore, as discussed above, these activities are expected to have minimal impacts on bird habitats. Additional detail is provided below.

As discussed in Section 3.4.3.7 (Secondary Stressors), impacts on invertebrate prey availability resulting from explosives, explosives byproducts, unexploded munitions, metals, and chemicals would likely be negligible overall and population-level impacts on marine invertebrates are not expected. Because individuals of many invertebrate taxa prey on other invertebrates, mortality resulting from explosions or exposure to metals or chemical materials would reduce the number of invertebrate prey items available. A few species prey upon fish, and explosions and exposure to metals and chemical materials could result

in a minor reduction in the number of fish available. However, the effect is expected to be small and discountable. Any vertebrate or invertebrate animal killed or significantly impaired by Navy activities could potentially represent an increase in food availability for scavenging invertebrates. None of the effects described above would likely be detectable at the population or subpopulation level.

As noted in Section 3.6.3.7.2 (Fishes, Impacts on Prey Availability), prey species might exhibit a strong startle reaction to detonations that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals (Hanlon & Messenger, 1996). The sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity to an explosion (Popper et al., 2014; Wright, 1982), which in turn could make them more visible to predators (Kastelein et al., 2008). The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. Alternatively, any prey species that would be directly injured or killed by the blast could draw in scavengers from the surrounding waters that would feed on those organisms, who in turn could be susceptible to becoming directly injured or killed by subsequent explosions. Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting impact on prey availability or the food web would be expected. Indirect impacts of underwater detonations and high explosive munitions use under the Proposed Action would not result in a decrease in the quantity or quality of fish populations in the Study Area.

Based on Sections 3.4 (Invertebrates) and 3.6 (Fishes), project-related stressors would not impact populations of invertebrates and fishes that support birds in the Study Area. Therefore, no secondary impacts associated with prey availability are expected. Furthermore, the Navy will implement mitigation (e.g., not conducting gunnery activities within a specified distance of shallow-water coral reefs) to avoid potential impacts from explosives and physical disturbance and strike stressors on seafloor resources in mitigation areas throughout the Study Area (see Section 5.4.1, Mitigation Areas for Seafloor Resources). This mitigation will consequently help avoid potential impacts on bird prey that inhabits shallow-water coral reefs, live hard bottom, precious coral beds, artificial reefs, and shipwrecks.

Pursuant to the ESA, secondary impacts on prey availability during training or testing activities as described under Alternative 1 and Alternative 2 may affect least terns, Hawaiian petrels, short-tailed albatrosses, marbled murrelets, Newell's shearwaters, and band-rumped storm petrels. The Navy has consulted with the USFWS as required by section 7(a)(2) of the ESA.

3.9.4 Summary of Potential Impacts on Birds

3.9.4.1 Combined Impacts of All Stressors Under Alternative 1

As described in Section 3.0.3.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all stressors from the proposed action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the sections above and, for ESA-listed species, summarized in Section 3.9.5 (Endangered Species Act Determinations). Stressors associated with Navy training and testing activities do not typically occur in isolation but rather occur in some combination. For example, mine neutralization activities include elements of acoustic, physical disturbance and strike, entanglement, ingestion, and secondary stressors that are all coincident in space and time. An analysis of the combined impacts of all stressors considers the potential consequences of aggregate exposure to all stressors and the repetitive or additive consequences of exposure over multiple years. The individual stressor analyses provided previously

indicate that the vast majority of exposures to stressors are non-lethal. Hence the analysis of combined effects focuses on consequences potentially impacting the organism's fitness (e.g., physiology, behavior, reproductive potential).

Most of the birds in the Study Area are relatively long-lived and wide-ranging seabirds, making it likely that individuals would be exposed to multiple activities and stressors over the course of their lifespans. Multiple stressors can affect individual birds in two ways: 1) from exposure to multiple sources of stress during a single event or activity; and 2) from exposure to a combination of stressors over the course of the bird's life. Both general scenarios are more likely to occur where training and testing activities are concentrated. The key difference between the two scenarios is the amount of time between exposures to stressors. Time is an important factor because subsequent disturbances or injuries often increase the time needed for the organism to recover to baseline behavior or physiology, extending the time that the organism's fitness is impacted.

Birds are susceptible to multiple stressors (see Section 3.9.2.1.5, General Threats), and the susceptibility of many species could be enhanced by additive or synergistic effects of multiple stressors. As discussed in the analyses above, birds are not particularly susceptible to energy, entanglement, or ingestion stressors resulting from Navy activities; therefore, the opportunity for Navy stressors to result in additive or synergistic consequences is most likely limited to acoustic/explosive, and physical strike and disturbance stressors. The potential for impacts associated with combined acoustic/explosive and physical strike and disturbance stressors is lessened by the fact that most activities are conducted offshore in areas where birds occur at relatively low concentrations.

Despite uncertainty in the nature of consequences resulting from combined impacts, the location of potential combined impacts can be predicted with more certainty because combinations are much more likely in locations where training and testing activities are concentrated. However, analyses of the nature of potential consequences of combined impacts of all stressors on birds remain largely qualitative and speculative. For example, an individual bird that becomes injured or disoriented from an acoustic or explosive exposure may be less able to avoid subsequent exposure to physical disturbance and strike. Where multiple stressors coincide with high abundances of birds, the possibilities of negative consequences are increased, but not enough is known about the potential additive or synergistic effects to predict them with any confidence. Stressors vary in intensity, with injuries or mortality occurring rarely, and most exposures not having persistent or accumulating effects to individuals or populations. In general, combined impacts will depend upon the coincidence of multiple stressors affecting the same individuals at the same place and time. Such occurrences are relatively infrequent because the activities and stressors are widely dispersed, affecting very small portions of the Study Area and relatively small numbers of individuals at any given time.

It is also likely that Navy stressors will combine with non-Navy stressors, as qualitatively discussed in Chapter 4 (Cumulative Impacts).

3.9.4.2 Combined Impacts of All Stressors Under Alternative 2

Combined impacts of all stressors under Alternative 2 would be largely the same as, but incrementally greater than, those of Alternative 1. Given the slightly larger number of activities overall and proportionately greater exposure of birds to most types of stressors, the potential for additive or synergistic effects is slightly greater under Alternative 2 than Alternative 1. However, as for Alternative 1, the nature of combined impacts is difficult to predict or quantify. Activities and the

resultant stressors are widely dispersed, affecting very small portions of the Study Area and relatively small numbers of individuals at any given time.

3.9.4.3 Combined Impacts of All Stressors Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.9.5 Endangered Species Act Determinations

Pursuant to the ESA, the Navy has consulted with the Honolulu, Hawaii and Carlsbad, California USFWS offices on Alternative 1 (the Preferred Alternative) as required by section 7(a)(2) of the ESA and determined that training and testing activities may affect Hawaii DPS band-rumped storm-petrel, Hawaiian petrel, Newell's shearwater, short-tailed albatross, California least tern, and marbled murrelet. Both the Honolulu, Hawaii and Carlsbad, California USFWS offices concurred with the Navy's determinations that training and testing activities may affect but not likely to adversely affect all ESA-listed bird species. Effect determinations on ESA-listed birds under Alternative 1 are summarized in Table 3.9-5. Copies of agency correspondence are found in Appendix J (Agency Correspondence).

3.9.6 Migratory Bird Treaty Act Determinations

The Navy has determined that the Proposed Action may result in the "take" of migratory birds as designated under the Migratory Bird Treaty Act. The term "take" as defined by the USFWS for Migratory Bird Treaty Act purposes means to "pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR part 10.12). The Proposed Action, however is a military readiness activity; therefore, "take" is in compliance with the Migratory Bird Treaty Act. Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 CFR part 21), the USFWS has promulgated a rule that authorizes the incidental take of migratory birds provided they do not result in a significant adverse effect on a population of a migratory bird species. These proposed training and testing activities would not result in a significant adverse effect on a population of a migratory bird species.

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Table 3.9-5: Bird Effect Determinations for Training and Testing Activities Under Alternative 1 (Preferred Alternative)

Species	Effect Determinations by Stressor																				
	Acoustic						Explo-sives	Energy			Physical Disturbance and Strike					Entanglement			Ingestion		Secon-dary
	Sonar and Other Transducers	Air Guns	Pile Driving	Aircraft Noise	Vessel Noise	Weapons Noise	Explosives	In-water Electromagnetic Devices	In-air Electromagnetic Devices	High-energy Lasers	Vessels	In-water Devices	Aircraft and Aerial Targets	Military Expended Materials	Seafloor Devices	Wires and Cables	Decelerators/Parachutes	Biodegradable Polymer	Military Expended Materials - Munitions	Military Expended Materials - Other Than Munitions	Impacts on Habitat and Prey Availability
Training Activities																					
Band-rumped storm-petrel[1] (Hawaii DPS)	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Short-tailed albatross[2]	NE	N/A	NE	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Hawaiian petrel[1]	NE	N/A	NE	NLAA	NLAA	NLAA	NLAA	NLAA	NE	N/A	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Newell's shearwater[1]	NLAA	N/A	NE	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
California least tern[3]	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Marbled murrelet[3]	NLAA	N/A	NE	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Testing Activities																					
Band-rumped storm-petrel[1] (Hawaii DPS)	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Short-tailed albatross[2]	NE	NE	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Hawaiian petrel[1]	NE	NE	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Newell's shearwater[1]	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
California least tern[3]	NLAA	NE	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA
Marbled murrelet[3]	NLAA	NLAA	N/A	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NLAA	NLAA	NLAA	NLAA	NE	NE	NE	N/A	NE	NLAA	NLAA

Note: NE = no effect; NLAA = may effect, not likely to adversely affect; N/A = not applicable, activity related to the stressor does not occur during specified training or testing events (e.g., there are no testing activities that involve the use of pile driving).

[1]Species only present in Hawaii portion of the Study Area. Concurrence with the Navy's determination came from the Honolulu, Hawaii USFWS office.

[2]Species present in the both the Hawaii and Southern California portions of the Study Area. Concurrence with the Navy's determination came from the both the Honolulu, Hawaii and the Carlsbad, California USFWS offices.

[3]Species only present in the Southern California portion of the Study area. Concurrence with the Navy's determination came from the Carlsbad, California USFWS office.

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3.10 Cultural Resources

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3.10 CULTURAL RESOURCES

PREFERRED ALTERNATIVE SYNOPSIS

The United States Department of the Navy considered all potential stressors that cultural resources could be exposed to from the Proposed Action. The following conclusions have been reached for the Preferred Alternative (Alternative 1):

- Explosive: Explosive stressors resulting from underwater explosions creating shock waves and cratering of the seafloor would not result in effects to known submerged cultural resources. Therefore, no submerged cultural resources are expected to be impacted.
- Physical Disturbance and Strike: Physical disturbance and strike stressors resulting from in-water devices, military expended materials, seafloor devices, pile driving, and vibration from sonic booms during training and testing activities would not result in effects to known submerged cultural resources. Therefore, no submerged cultural resources are expected to be affected.

3.10.1 INTRODUCTION AND METHODS

3.10.1.1 Introduction

Submerged cultural resources are found throughout the Hawaii-Southern California Training and Testing (HSTT) Study Area. The approach for the assessment of submerged cultural resources includes defining the resource; presenting the regulatory requirements for identifying, evaluating, and treating the resource within established jurisdictional parameters; establishing the specific resource subtypes in the Study Area; identifying the data used to define the current conditions; and describing the method of impact analysis.

Cultural resources are defined as districts, landscapes, sites, structures, objects, and ethnographic resources, as well as other physical evidence of human activity, that are considered to be important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources include archaeological resources, architectural resources, and traditional cultural properties related to pre-contact (prior to European contact) and post-contact periods.

Archaeological resources include prehistoric and historic sites and artifacts. Archaeological resources can have a surface component, a subsurface component, or both. Prehistoric resources are physical properties resulting from human activities that predate written records, and include village sites, temporary camps, lithic scatters, roasting pits, hearths, milling features, petroglyphs, rock features, and burials. Historic resources postdate the advent of written records in a region, and include building foundations, refuse scatters, wells, cisterns, and privies. Submerged cultural resources include historic shipwrecks and other submerged historic materials, such as sunken airplanes and prehistoric cultural remains. Architectural resources are elements of the built environment consisting of standing buildings or structures from the historic period. These resources include existing buildings, dams, bridges, lighthouses, and forts. Traditional cultural properties are resources associated with beliefs or cultural practices of a living culture, subculture, or community. These beliefs and practices must be rooted in the group's history and must be important in maintaining the cultural identity of the group. Prehistoric archaeological sites and artifacts, historic and contemporary locations of traditional events, sacred

places, landscapes, and resource collection areas, including fishing, hunting, and gathering areas, may be traditional cultural resources.

3.10.1.2 Identification, Evaluation, and Treatment of Cultural Resources

Procedures for identifying, evaluating, and treating cultural resources within state territorial waters (within 3 nautical miles [NM] of the coast) and United States (U.S.) territorial waters (within 12 NM of the coast) are contained in a series of federal and state laws and regulations, and agency guidelines. Archaeological, architectural, and cultural (including Native American and Native Hawaiian) resources are protected by a variety of laws and their implementing regulations: the National Historic Preservation Act (NHPA) of 1966 as amended in 2006, the Archeological and Historic Preservation Act (AHPA) of 1974, the Archaeological Resources Protection Act (ARPA) of 1979, the American Indian Religious Freedom Act (AIRFA) of 1978, the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, the Submerged Lands Act (SLA) of 1953, the Abandoned Shipwreck Act (ASA) of 1987, and the Sunken Military Craft Act (SMCA) of 2004. The Advisory Council on Historic Preservation (ACHP) further guides treatment of archaeological and architectural resources through the regulations, Protection of Historic Properties (36 Code of Federal Regulations [CFR] part 800). The category of "historic properties" is a subset of cultural resources that is defined in the NHPA (54 United States Code [U.S.C.] section 300308) as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (National Register), including artifacts, records, and material remains related to such a property or resource.

Section 106 of the NHPA, currently codified in 54 U.S.C. 306108, requires federal agencies to consider the effects of their actions on cultural resources listed in or eligible for inclusion in the National Register of Historic Places. The regulations implementing Section 106 (36 CFR part 800) specify a consultation process to assist in satisfying this requirement, including efforts in identification of historic places. Consultation with the appropriate State Historic Preservation Officers (SHPO), the ACHP, Native American tribes and Native Hawaiian organizations, the public, and state and federal agencies is required by Section 106 of the NHPA. Government-to-government consultation required by Executive Order 13007 will be accomplished concurrently with the preparation of this Environmental Impact Statement (EIS)/Overseas EIS (OEIS) for the portion of the Proposed Action within state territorial waters (within 12 NM). Scoping letters for this EIS/OEIS were sent to appropriate SHPO and federally recognized Native American tribes (refer to Chapter 8, Public Involvement and Distribution) on November 13, 2015.

There are Programmatic Agreements that ensure protocols are in place and in compliance with the NHPA and 36 CFR part 800. There is a 2003 Programmatic Agreement among the Commander Navy Region Hawaii, the ACHP, and the Hawaii SHPO regarding some Navy undertakings in Hawaii (U.S. Department of the Navy, 2003). There is a 2014 Programmatic Agreement among the Commander Naval Base Coronado and the California SHPO regarding Naval Base Coronado undertakings (U.S. Department of the Navy, 2014) and a 2008 Programmatic Agreement regarding operational and developmental undertakings at San Clemente Island, California (U.S. Department of the Navy, 2008a). Programmatic Agreements are prepared pursuant to 36 CFR section 800.14, and allow the U.S. Department of the Navy (Navy) to consult with interested parties and stakeholders on a program of management and reporting that substantially reduces the burden of consultation on routine individual or repetitive undertakings.

Additional regulations and guidelines for submerged historic resources include 10 U.S.C. section 113, Title XIV for the SMCA; the Abandoned Shipwreck Guidelines prepared by the National Park Service (National Park Service, 2007); and, for the purposes of conducting research or recovering Navy ship and

aircraft wrecks, the Guidelines for Archaeological Research Permit Applications on Ship and Aircraft Wrecks under the Jurisdiction of the Department of the Navy (36 CFR part 767) overseen by the Naval History and Heritage Command. The SMCA does not apply to actions taken by, or at the direction of, the United States. In accordance with the ASA of 1987, abandoned shipwrecks in state waters are considered the property of the U.S. government if the shipwreck meets the criteria for inclusion in the National Register of Historic Places. However, the federal government may transfer the title of an abandoned shipwreck to the state if the shipwreck falls within the jurisdiction of the state (Barnette, 2010). Warships or vessels owned or operated by a State for non-commercial purposes at the time of their sinking retain sovereign immunity (e.g., Japanese freighters). According to the principle of sovereign immunity, foreign warships sunk in U.S. territorial waters are protected by the U.S. government, which acts as custodian of the sites in the best interest of the sovereign nation (Neyland, 2001). In addition, the National Park Service Archeology Program, developed as a result of a presidential order, includes a collection of historical and archaeological resource protection laws to which federal managers adhere.

The U.S. government is a signatory to The Convention Concerning the Protection of the World Cultural and Natural Heritage, commonly known as the 1972 World Heritage Convention. The World Heritage Convention protects natural and cultural sites of outstanding universal value. Specifically, the purpose of the Convention is to identify and conserve sites and properties of outstanding cultural or natural importance to the common heritage of humanity and catalogue these properties and sites in an internationally recognized list known as the World Heritage List. In nominating sites to the World Heritage List, the U.S. government pledges to the international community to protect them in perpetuity. Accordingly, the Department of Defense's cultural resources policy and environmental regulations require compliance with the terms of the Convention. The addendum (addendum section 402) to the NHPA (recodified at 54 U.S.C. part 307101(e), Consideration of Undertaking on Property, International Federal Activities Affecting Historic Properties) requires an assessment by federal agencies of project effects on resources located outside U.S. territorial waters that are identified on the World Heritage List or on the applicable country's equivalent of the National Register of Historic Places.

No specific procedures for identification and protection of cultural resources in the open ocean have been defined by the international community (Zander & Varmer, 1996). No treaty offering comprehensive protection of submerged cultural resources has been developed and implemented. However, a few international conventions prepared by the United Nations Educational, Scientific, and Cultural Organization apply to submerged cultural resources, including the 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property; the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage; the 1982 Convention on the Law of the Sea; and the 2001 Convention on the Protection of the Underwater Cultural Heritage. Only the 1970 and 1972 conventions have been fully ratified by the United States.

3.10.1.3 Methods

3.10.1.3.1 Approach

The approach for establishing current conditions is based on different regulatory parameters defined by geographical location. Within U.S. territorial waters (within 12 NM of the coast), the National Environmental Policy Act (NEPA) is the guiding mandate. Areas beyond 12 NM in the open ocean will not be analyzed because obtaining data beyond 12 NM and at those depths are not practical, they are not associated with any state, and there are no SHPO consultation requirements. As such, impacts on

potential cultural resources in the open ocean are discussed as a programmatic analysis in terms of the potential impact a stressor could have on a historic property within the Study Area beyond 12 NM.

The implementing regulations of Section 106 of the NHPA require federal agencies to take into account the effects that a proposed action would have on cultural resources included in or eligible for inclusion in the National Register of Historic Places. "Historic properties" is synonymous with National Register-eligible or -listed archaeological, architectural, or traditional resources. Cultural resources that have not been formally evaluated (i.e., have not had a Consensus Determination in consultation with the SHPO) may be considered potentially eligible, and thus are afforded the same regulatory consideration as resources listed in the National Register. Evaluations and determinations of historic properties within the Study Area are the responsibility of the federal agency, in consultation with either the SHPO (California) or the SHPO (Hawaii).

Properties are evaluated for nomination to the National Register and for National Register eligibility using the following criteria (36 CFR section 60.4(a)–(d)):

- Criterion A: Be associated with events that have made a significant contribution to the broad patterns of American history
- Criterion B: Be associated with the lives of persons significant in the American past
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction
- Criterion D: Yield, or may be likely to yield, information important in prehistory or history

A historic property also must possess the following aspects of integrity: location, design, setting, materials, workmanship, feeling, and association to convey its significance and to qualify for the National Register. These seven aspects, in various combinations, define integrity. To retain integrity, a property will always possess several, and usually most, of these aspects.

Cultural resources in U.S. territorial waters (within 12 NM of the coast) are as follows:

- Resources listed on or eligible for listing on the National Register (Section 106 of the NHPA)
- Resources entitled to sovereign immunity (e.g., Japanese midget submarine)

3.10.1.3.2 Data Sources

Cultural resources information relevant to this EIS/OEIS was derived from a variety of sources, including previous environmental documents, national and international shipwreck databases, the National Register Information System (managed by the National Park Service), information repositories associated with SHPO, online maps and data, and published sources, as cited. Previous environmental documents used for general information include the Hawaii Range Complex EIS/OEIS (U.S. Department of the Navy, 2008b), Southern California Range Complex EIS/OEIS (U.S. Department of the Navy, 2008c), and Silver Strand Training Complex EIS (U.S. Department of the Navy, 2011). Previous cultural resources documents used for general information include the Oahu Integrated Cultural Resources Management Plan (U.S. Department of the Navy, 2008d), Integrated Cultural Resources Management Plan for Naval Base Coronado (U.S. Department of the Navy, 2012a) and Integrated Cultural Resources Management Plan for San Clemente Island (U.S. Department of the Navy, 2012b). Other sources of information on cultural resources in Hawaii included data from a report prepared by the Department of Ocean and Energy Management. The report, *The Unseen Landscape: Inventory and Assessment of Submerged*

Cultural Resources in Hawaii, provides cultural, environmental, and historic context to the database of known, reported, and potential submerged cultural resources inventory (Van Tilburg & Delgado, 2017).

The national and international shipwreck databases researched included the National Oceanic and Atmospheric Administration's Office of Coast Survey Advanced Wreck and Obstruction Information System, National Oceanic and Atmospheric Administration Aids to Navigation, California State Lands Commission Shipwrecks database, and the General Dynamics Global Maritime Wrecks Database, as well as secondary sources of shipwreck information. Many of the shipwreck databases and secondary sources overlap, generating data repetition. Many federal agencies "share" data as well as secondary sources. The intent of this analysis is not to provide a definitive number of shipwrecks, obstructions, or hazards within a defined area, however, but rather to provide an overview of the potential resources in an area.

The online National Register Information System was reviewed to identify National Register-listed properties, historic districts, and National Historic Landmarks. Appropriate information repositories associated with the SHPO and National Oceanic and Atmospheric Administration were contacted or their online databases were reviewed for information on shipwreck locations, types, and eligibility for listing on the state registers and National Register.

3.10.1.3.3 Cultural Context

Several types of cultural resources are associated with the Study Area: submerged prehistoric occupation sites along the continental shelf; wrecks of ships, submarines, aircraft, and barges; sunken navigational equipment, such as buoys; man-made obstructions; and Indian tribe and Native Hawaiian marine resource gathering areas (e.g., Traditional Cultural Properties such as traditional fishing, seaweed, mussel, abalone, and clam-gathering grounds, and whaling areas). Research suggests that the sea level rose steadily from about 18,000 years ago to about 7,500 years ago, whereupon it reached present-day levels. In California, PaleoIndian and Archaic period sites were submerged by the rising ocean. Many of these sites would not have been preserved as the encroaching ocean inundated, reworked, and redeposited sediments. In California, locations where PaleoIndian and Archaic period sites may have been preserved include back barrier deposits or mainland shore deposits located behind large, nearshore islands, estuaries, and portions of coastal floodplains.

3.10.1.3.3.1 Hawaii

Human colonization of the Hawaiian Islands occurred after sea levels stabilized, so no habitation sites are known to exist beyond the current coast lines. Traditional Hawaiian cultural resources, such as stone artifacts, sinkers, and octopus lures, may be located below the water surface; however, because of environmental factors, such as weathering, they are not eligible for listing on the National Register of Historic Places (Minerals Management Service, 1990; National Oceanic and Atmospheric Administration, 2012). Traditional Hawaiian settlement along the coast was focused on the ocean and collection of its resources. Midden deposits indicate that the Hawaiians were gathering nearshore shellfish, and fishing for both nearshore and deepwater fish. Artifacts include bone and shell fishhooks, basalt net sinkers, and adzes for carving outrigger canoes.

Archaeological evidence suggests that the first permanent settlements appeared in the Hawaiian Islands around approximately Anno Domini (A.D.) 1220–1261 with the arrival of Polynesian seafarers (Rieth et al., 2011). European contact with the Hawaiian Islands occurred when Captain James Cook landed in Waimea Harbor (Kauai) in 1778. Kamehameha I united the Hawaiian Islands in 1818. Hawaii assumed importance in the east-west fur trade during this period, and later became the focal point for the Pacific

whaling industry with whaling ships sailing throughout the northwest Hawaiian Islands. Honolulu and Lahaina became the principal ports for the whaling fleet in Hawaii. By the 1840s, approximately 600 whaling vessels were arriving in Hawaii each year (Kelley, 2006). Sunken vessels from this period and the later part of that century may be located near the coasts of the Hawaiian Islands.

Pearl Harbor is a historically important area in Hawaii. Traditionally, Pearl Harbor was called Ka-awa-lau-o-puuloa, which can be translated as the many harbored sea of Puuloa or the leaf-shaped lagoon of Puuloa. There are traditional references to fishponds that were constructed in the harbor as well as information about the abundant marine resources such as shellfish and fish. Traditional Hawaiian fishponds were constructed along the shores between the 14th and 19th centuries in fairly protected areas to raise fish (Kikuchi, 1976); (Athens et al., 2000; Athens, 2002; Athens et al., 2006). Pearl Harbor became an import harbor in the late 19th century and, in 1887, the U.S. Senate allowed the Navy to lease Pearl Harbor. The harbor was dredged in the early 20th century to accommodate large vessels and, in 1908, Pearl Harbor Naval Shipyard was established.

Construction of naval bases in the Pacific began in the late 1930s and early 1940s with the growing threat of Japanese conflict. During this period, Naval Air Station Midway was constructed. On December 7, 1941, the Japanese attacked Pearl Harbor and Naval Air Station Midway bringing the United States into World War II. Because of the importance of Hawaii and World War II, the Study Area could contain sunken vessels or other historic relics associated with the history of these areas. Within Pearl Harbor, the wreck sites of the USS Arizona and USS Utah are on the National Register of Historic Places. Sunken aircraft and ships are located around the island of Midway.

3.10.1.3.3.2 Southern California

The Late Prehistoric Period along the coast of Southern California was characterized by elaborate artifact inventories and distinctive local cultural complexes that lasted until contact with Europeans (Sutton, 2010). Artifacts from this period include circular fishhooks, whalebone markers, asphalt skirt weights, steatite ollas, shell beads, bone gorges, composite fishhooks, Cottonwood series projectile points, and spear points (Noah, 1998; Sutton, 2010). Evidence from numerous archaeological sites along the coast suggests an exploitation of bay and estuary kelp beds, rocky areas, and offshore environments. Bones from numerous species of fish and marine mammals have been recovered from middens. Coastal Late Prehistoric settlements were located near estuaries, along mouths of sloughs and rivers, and around bays, such as Mission Bay in San Diego. Prehistoric habitation sites are not commonly found outside of the inner continental shelf. During the Late Prehistoric Period, cultural traits associated with Kumeyaay, Luiseño, Cupeño, and Cahuilla peoples of the ethnographic period are found.

The maritime history along the west coast of the United States is a history of exploration, imperial competition, and commercial adventurism. The period of exploration began at least as early as the first Spanish voyages northward from Mexico in the 1530s, and by 1578 the British were encroaching on the Spanish monopoly along the coast of California. Undiscovered sunken vessels from early Spanish and British exploration, colonization, and trade may be present in coastal Southern California.

Prior to World War I, the Navy did not have a strong presence in San Diego. By 1921, the Navy acquired a site for the U.S. Destroyer Base, San Diego facility. During the 1930s, San Diego Harbor was dredged as a result of Public Works Administration projects, and San Clemente Island was purchased by the Navy as a firing range. The Navy base expanded considerably during World War II, with over 5,100 ships being serviced as a result of the war in the Pacific. Because of the importance and military history of Naval Base Coronado (which includes Naval Air Station North Island, Naval Amphibious Base Coronado, and

Silver Strand Training Complex), as well as Naval Base Point Loma and San Clemente Island, the region could contain sunken vessels that were associated with these facilities (Naval Base San Diego, 2012; U.S. Department of the Navy, 2012a).

3.10.1.4 Method for Impact Analysis

Impact analysis for cultural resources is based on different parameters defined by geographical location. Within U.S. territorial waters, Section 106 of the NHPA and NEPA evaluation are the guiding mandates. In general, impacts are assessed by the importance of the resource, the sensitivity of the resource to the proposed activities, and the duration of the effects on the environment.

3.10.2 AFFECTED ENVIRONMENT

The Study Area is divided into three distinct regions for cultural resources evaluation: Hawaii, Southern California, and the open ocean Transit Corridor between them (see Figure 2.1-1). The Study Area covers more than 355,000 square nautical miles (NM^2); however, only the regions that are located in the offshore waters of Hawaii and Southern California are being evaluated. In the Hawaii Operating Area (OPAREA) (235,000 NM^2), a component of the Hawaii Range Complex, there are a number of known wrecks, obstructions, and occurrences. These sites have not been evaluated as properties eligible for listing in the National Register of Historic Places, however, will be assumed eligible only for purposes of evaluating effects in this analysis. In the Southern California Range Complex within the Southern California OPAREA (120,000 NM^2), a few hundred such sites have been recorded. The Study Area could contain submerged prehistoric sites on the continental shelf.

3.10.2.1 Hawaii

3.10.2.1.1 Submerged Prehistoric Resources

A few submerged prehistoric resources are located in the waters surrounding the Hawaiian Islands. These resources primarily consist of old shoreline features, such as fishponds. Four extant fishponds lie within the boundaries of the Area of Potential Effects in Pearl Harbor. One fishpond, Pamoku/Puuloa, is filled in with boulders but is intact. The remaining three fish ponds, Paaiau, Okiokilepe, and Laulaunui, become submerged during tidal changes. These fishponds are filled with mangroves and are in waters too shallow for ships to safely navigate, so there would be no effect on these properties.

3.10.2.1.2 Known Wrecks, Obstructions, Occurrences, or "Unknowns"

A number of submerged cultural resources lie in the open, deep waters surrounding the Hawaiian Islands. Typical among these resources are wrecks of World War II submarines and ships, commercial fishing vessels and tankers, and aircraft. The most likely types of shipwrecks to occur around the Hawaiian Islands are 19th century cargo ships, submarines, old whaling and merchant ships, fishing boats, 20th century U.S. warships, and recreational craft. The Automated Wreck and Obstruction Information System, Region 16 (2010) records the approximate locations of some deep-water submerged shipwrecks.

A variety of submerged resources are located in the waters surrounding the Hawaiian Islands (U.S. Department of the Navy, 2008b; Van Tilburg & Delgado, 2017). Although the most common of these submerged resources are shipwrecks, junked vehicles, harbor features, and old shoreline features are also present. Figure 3.10-1 shows known submerged cultural resources near the Hawaiian Islands.

Shipwrecks located near the Island of Hawaii are concentrated along the northwestern coastline and within Hilo Bay. The numerous known wrecks in the waters surrounding Oahu include the largely intact

Sea Tiger, a World War II-era Japanese midget submarine; the Mahi, a Navy minesweeper/cable layer intentionally sunk off the Waianae Coast to create an artificial reef; and the YO-257, a Navy yard oiler built in the 1940s, intentionally sunk off Waikiki to create an artificial reef. The Mahi and the YO-257 are both artificial reefs, so they are not eligible for listing in the National Register of Historic Places. Within the Ewa Training Minefield, off of the southern coast of Oahu, there is one known shipwreck (Figure 3.10-1). The wreck is likely the USS Chittenden County. Because it was sunk as a target in 1958 by the Sargo SS 583, this shipwreck is not eligible for listing in the National Register. Submerged cultural resources in Pearl Harbor are discussed in Section 3.10.2.1.3 (Cultural Resources Eligible for Listing or Listed in the National Register).

The Battle of Midway occurred on July 4 through 7, 1942 and marked the shift in the balance of power between the United States and Japan in the Pacific during World War II. The Papahanaumokuakea Marine National Monument boundaries include the Midway Atoll which has been designated as a National Memorial to the Battle of Midway (Figure 3.10-1). Aircraft and shipwrecks that are sunken from the Battle of Midway are considered war graves. None of the sites from the battle that are currently known are eligible for listing in the National Register.

3.10.2.1.3 Cultural Resources Eligible for Listing or Listed in the National Register

The data indicate that no shipwrecks in the State of Hawaii are listed in the National Register, excluding those at Naval Station Pearl Harbor. At Pearl Harbor, which is listed in the National Register as a National Historic Landmark, an abundance of submerged cultural resources are associated with World War II. Major shipwrecks include the USS Arizona and the USS Utah, both of which are listed in the National Register. The whaleship *Two Brothers*, located in the Papahanaumokuakea Marine National Monument, is also listed in the National Register (82 FR 32870).

3.10.2.1.4 Cultural Resources Eligible for or Listed on the State Inventory of Historic Places

The *Two Brothers* shipwreck located in the Papahanaumokuakea Marine National Monument was listed on March 24, 2017 on the Hawaii State Register. Excluding the *Two Brothers* shipwreck and Pearl Harbor, the Study Area contains no Hawaii State Register-listed or -eligible sites.

3.10.2.1.5 World Heritage Sites

The Hawaii Range Complex contains one World Heritage Site, the Papahanaumokuakea Marine National Monument (Figure 3.10-1). This area encompasses 583,000 square miles of ocean and 10 islands and atolls northwest of Kauai. This World Heritage Site is the single largest fully-protected conservation area in the United States (bigger than all U.S. National Parks combined), and one of the largest marine conservation areas in the world. Attributes of the Papahanaumokuakea Marine National Monument that contribute to its cultural significance include notable features such as seamounts and submerged banks, coral reefs, and lagoons. The monument is significant to the cultural heritage of the Native Hawaiians not only for the unique ecosystem and geological features, but also voyaging and wayfinding. Wayfinding, which relies on celestial, biological, and natural signs, plays an important role within the cultural voyaging seascape of the Hawaiian Archipelago.

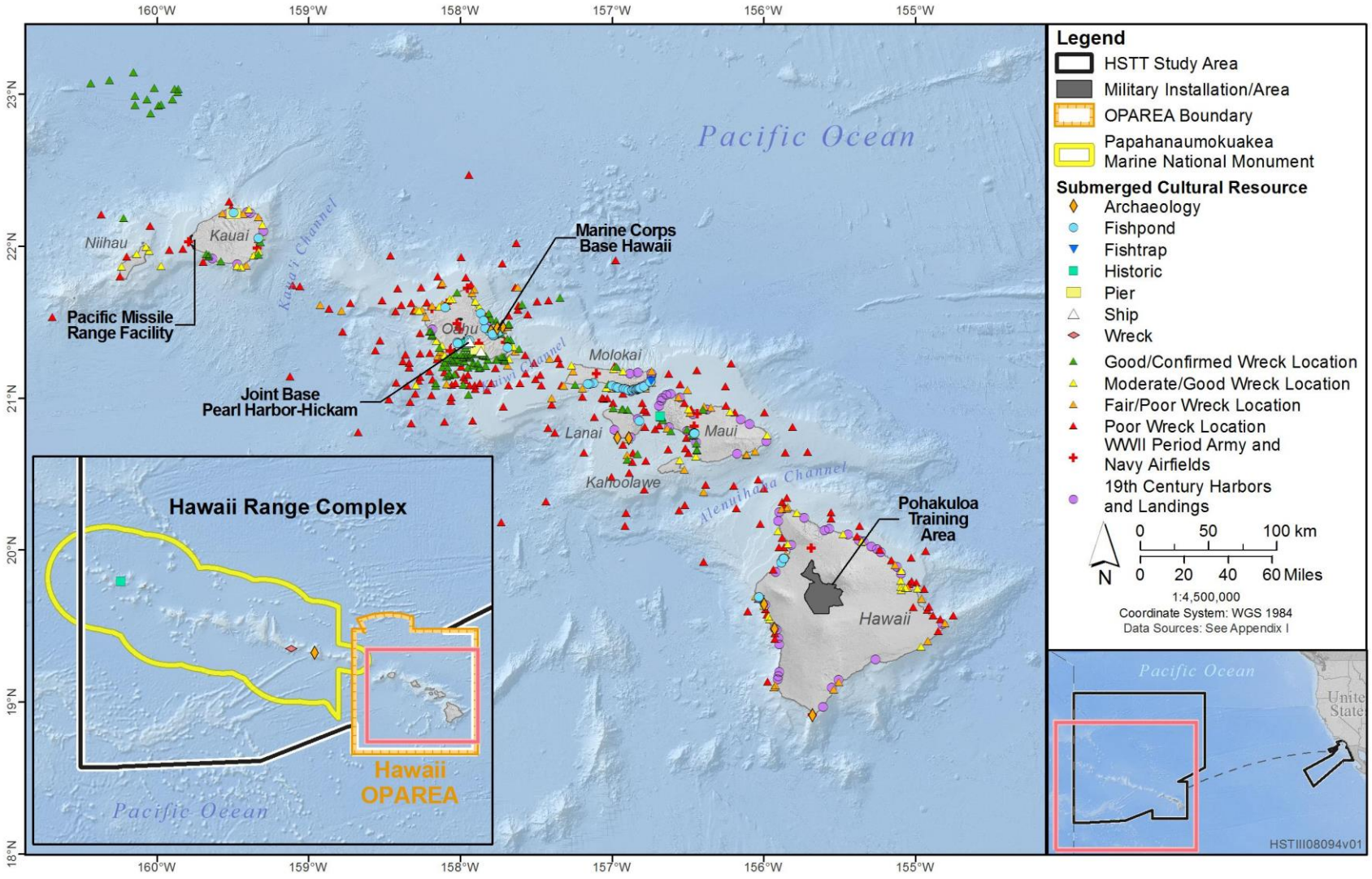


Figure 3.10-1: Known Submerged Cultural Resources near the Hawaiian Islands

The Papahanaumokuakea Marine National Monument includes the island of Midway, which was designated as a National Memorial to the Battle of Midway (Figure 3.10-1). This battle was one of the most decisive naval battles of World War II. Aircraft and ships sunk during the battle, such as P-40K Warhawks, F2A-3 Buffalos, and F4U Corsairs, are located in the waters around Midway.

3.10.2.1.6 Resources with Sovereign Immunity

Sovereign immunity is a principle of international law which recognizes each nation's sovereignty over its warships and vessels that are owned or operated by the nation for non-commercial service. The Study Area contains at least one resource with sovereign immunity: a World War II-era Japanese Midget "A" submarine that was sunk by the USS Ward (New South Wales, 2012).

3.10.2.1.7 Cultural/Traditional Practices and Beliefs

Native Hawaiians have a strong spiritual belief that all life is tied together. Their creation myth, the Kumulipo, which is presented in a chant, starts at the beginning of the world and life itself and describes the origin of the Hawaiian people. The early settlers to Hawaii traveled to the islands on voyaging canoes, colonizing the islands about 800 years ago. The importance of the ocean, which is sacred to Native Hawaiians, is paramount in Hawaiian creation stories and legends. The ocean channel between Maui, Kauai, and Kahoolawe is known as Kealaikahiki, or the Way to Tahiti. This ocean channel is considered a main ancient voyaging route between Hawaii and Tahiti and is tied to the Kumulipo. Kahoolawe is the most proximate Hawaiian island to the Hawaii end of the channel. The Section 106 consultation participants indicated that Kahoolawe has navigational significance related to the channel. The channel is considered both a literal and figurative link between the Hawaiian Island chain and Native Hawaiian's ancestral home. In response to questions raised about what activities occur in the area of the channel near Kaahoolawe, consultation participants noted their concern for the spiritual "hewa" (wrong or sin) associated with certain activities that they felt might affect their tie to the ancestral homeland.

Traditional Hawaiian cultural resources, such as ko'a (fishing areas and stone markers for fishing grounds) and freshwater seeps are located in the nearshore waters. Since these sites are considered sacred and secret, their locations were not disclosed during consultation. Traditional Hawaiian settlements along the coast focused on the ocean and collection of its resources, and Native Hawaiians view their relationship to all things living as connected; this includes the plants and animals that live in the mountains, those that live in and along the streams, the sea creatures that live in the waters that flow into the ocean. Na aumakua are deities who Native Hawaiians believe they are connected to through their family lineage. Aumakua may manifest as animals, places, plants, and even other people. The relationship Native Hawaiians have with their aumakua is described as symbiotic; caring for or providing tribute to one's aumakua in turn brings comfort, protection, and even vengeance on those who menace the aumakua's kin. Native Hawaiians who participated in the Section 106 consultation are concerned about any harm the Navy's Proposed Action would bring to the natural world, including harm to Kanaloa, who manifests as the ocean itself.

Training and testing activities within the Hawaii OPAREA both by the Navy and other branches of the military are believed by Native Hawaiians to hinder their cultural beliefs and their ability to practice cultural traditions. The presence of naval ships is believed to alter the behavior of marine life in traditional fishing grounds. It is said to affect not only traditional fishing methods, but also the manner that fishing is taught to younger generations. In addition, training and testing activities utilizing sonar or explosives may negatively impact their cultural interactions with marine life. Due to the close relationship Native Hawaiians have with aumakua living in the ocean, Native Hawaiians believe they are

able to sense distress felt by marine life due to the Navy's in-water training and testing activities. The presence of Navy warships and submarines in the waters around Hawaii is viewed as causing an elemental imbalance in nature. The Navy's presence in and around the Hawaiian Islands is also viewed as disrespectful and in contrast to the Native Hawaiian belief that they are a peaceable and neutral nation. During consultation, it was consistently conveyed that Naval training and testing in waters within the Study Area causes the Hawaiians emotional and at times physical distress.

3.10.2.2 Southern California

3.10.2.2.1 Submerged Prehistoric Resources

PaleoIndian and Archaic period sites occur on the continental shelf off the coast of California. Approximately 110 submerged artifacts and sites from the Archaic period have been identified in Southern California (Masters, 2003). However, they are located outside of Navy training and testing areas and outside of the Area of Potential Effect. Prehistoric cultural materials, such as stone bowls and mortars, are also common off the coast of San Diego County (Masters & Schneider, 2000). A concentration of this cultural material is located off La Jolla and Point Loma and within the Study Area (Masters, 2003)

3.10.2.2.2 Known Wrecks, Obstructions, Occurrences, or "Unknowns"

3.10.2.2.2.1 Offshore

From the early period of Spanish exploration to the intense commercialization of the 19th and 20th centuries, there has been a great variety of shipwrecks in the Pacific Ocean. The earliest known shipwreck was the Manila galleon San Agustin that sank off the northern coast of California in 1595. Since that time, thousands of vessels of varying types and descriptions have sunk off the coast of California. Various databases of these shipwrecks have been compiled, including the Automated Wreck and Obstruction Information System database (Automated Wreck and Obstruction Information System Database, 2010). As part of a Minerals Management Service study (Minerals Management Service, 1990), a database was compiled that documents 4,676 shipwrecks off the coast of California, with 876 wrecks in Southern California. The Automated Wreck and Obstruction Information System database (Automated Wreck and Obstruction Information System Database, 2010) documents 292 wrecks just in San Diego, Orange, Los Angeles, and Ventura Counties.

Submerged cultural resources in the waters around San Clemente Island include pleasure craft, sport and commercial fishers, and cargo and military vessels (U.S. Department of the Navy, 2008c). Of these 68 submerged cultural resources, 22 are within 12 NM of San Clemente Island and seven are beyond the territorial limit. Submerged aircraft are also reported off San Clemente Island. Figure 3.10-2 illustrates known submerged cultural resources near San Clemente Island. Submerged cultural resources identified include 35 shipwrecks, 17 aircraft, an anchor, and the abandoned Sea Lab (an old Navy asset).

The waters surrounding San Clemente Island is considered a high-energy intertidal environment and over the period of rising sea level during the Pleistocene it is likely that any submerged archaeological resources have since been destroyed.

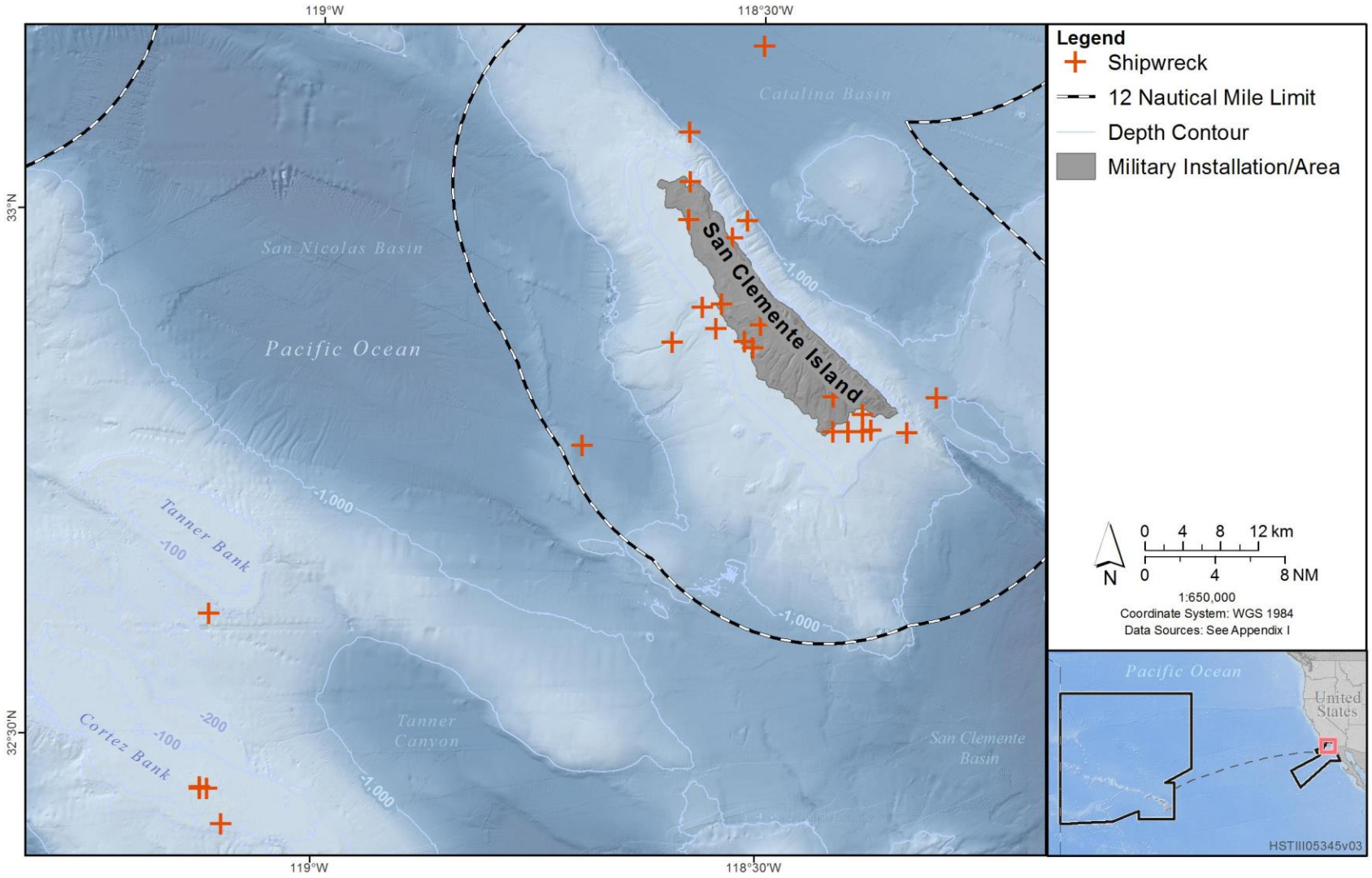


Figure 3.10-2: Known Submerged Cultural Resources and Obstructions near San Clemente Island

3.10.2.2.2.2 Silver Strand

On the bay side of the Silver Strand peninsula, three shipwrecks are in or near the training beaches. Unnamed wrecks are recorded in shallow water at the northern end of Delta South beach, in the middle of San Diego Bay, and at the mouth of Fiddler's Cove. The ages and cultural value of these wrecks are not known (U.S. Department of the Navy, 2008c).

On the ocean side of the peninsula, three shipwrecks are located near the Silver Strand Training Complex training areas: the bark (a three- or four-masted sailing vessel) Narwhal (sank in 1934), the submarine S-37 (SS-142) which was decommissioned and sunk as target in 1945, and the Subchaser YC689 (sank in 1943). The destroyer USS Hogan (DD178), a military aircraft (S2F Tracker), and a sunken sailboat are located offshore, south of Silver Strand Training Complex and west of the City of Imperial Beach (U.S. Department of the Navy, 2008c). Figure 3.10-3 illustrates known submerged cultural resources in the vicinity of the Silver Strand Training Complex.

3.10.2.2.2.3 San Diego Bay

Known cultural resources in San Diego Bay have not been inventoried. However, cultural resources were reviewed for the San Diego Deepening at Tenth Avenue Marine Terminal project (EDAW, 2005). This review identified three known submerged cultural features: a shipwreck (the Della), an 1887 marine utility cable, and a sunken Ford Model T. The EDAW study identified 24 cultural resources with unknown location, but known to be lost in the San Diego area, including schooners, barges, a submarine, clippers, gas and oil screws, a yacht, a bark, a ferry, a ship, and a steamer. Figure 3.10-3 illustrates known submerged cultural resources in San Diego Bay.

3.10.2.2.3 Cultural Resources Eligible for or Listed on the National Register

Based on a literature search and previous consultations, the Southern California portion of the Study Area contains no National Register-listed or -eligible sites.

3.10.2.2.4 Cultural Resources Eligible for or Listed on the California Register

Based on a literature search and previous consultations, the Southern California portion of the Study Area contains no California Register-listed or -eligible sites

3.10.2.2.5 World Heritage Sites

The Southern California portion of the Study Area contains no World Heritage Sites.

3.10.2.2.6 Resources with Sovereign Immunity

The Southern California portion of the Study Area contains no resources with sovereign immunity.

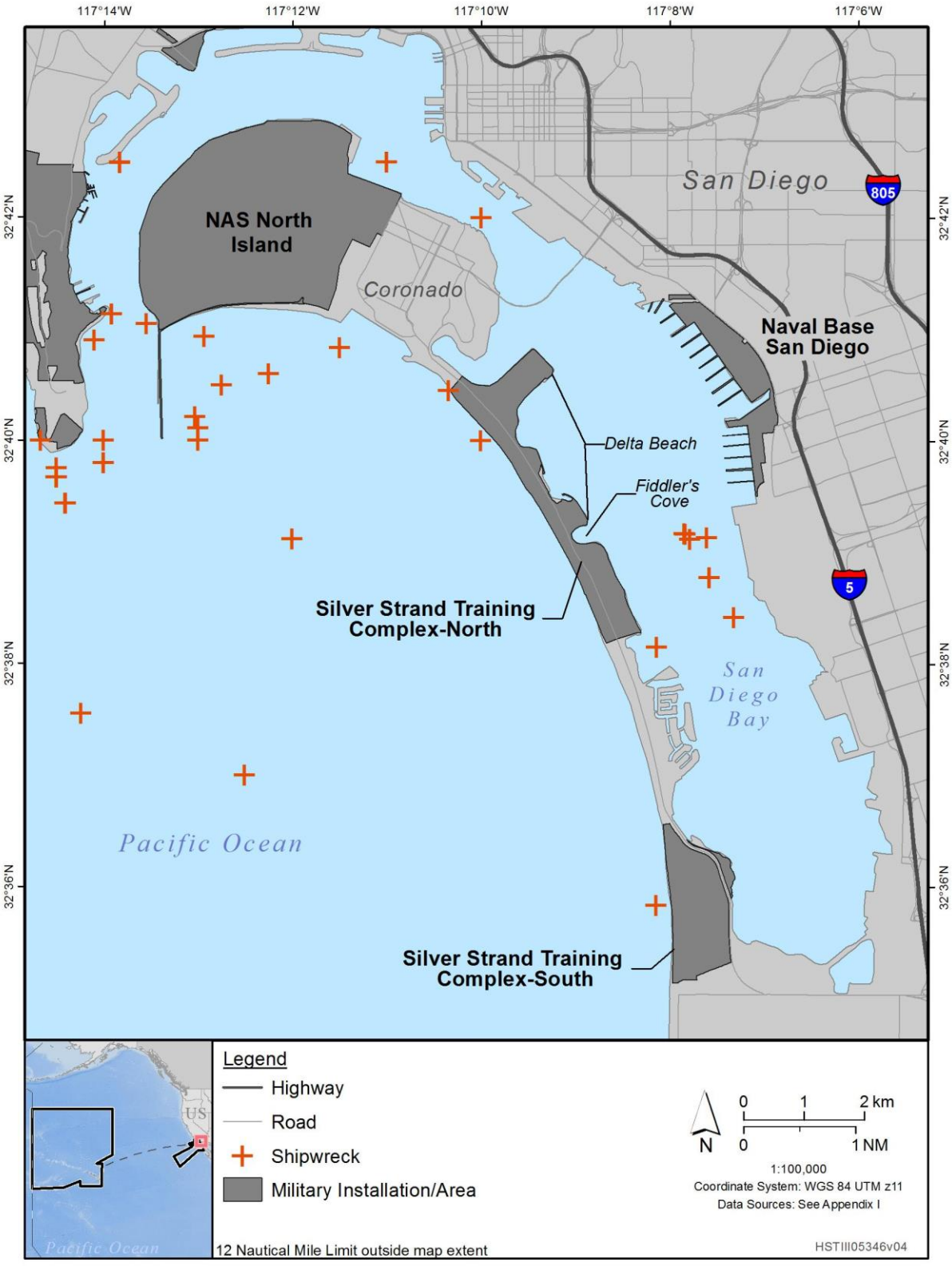


Figure 3.10-3: Known Submerged Cultural Resources and Obstructions in San Diego Bay and Silver Strand

Note: NAS = Naval Air Station

3.10.2.3 Hawaii-Southern California Training and Testing Transit Corridor

The length and variable width of the HSTT transit corridor creates such a vast area that it precludes a systematic survey for submerged historic resources. Waters along the HSTT transit corridor are deep, sometimes over 18,000 feet (ft.); thus, identifying cultural resources on the ocean floor in the corridor is difficult. However, in accordance with the addendum to the NHPA (16 U.S.C. 470a-2) regarding international federal activities affecting historic properties, the World Heritage List was reviewed and no resources on the list were identified within the HSTT transit corridor.

3.10.2.4 Programmatic Agreement on Navy Undertakings in Hawaii

A programmatic agreement was executed for Navy undertakings in Hawaii, and the area of responsibility encompasses Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility; outlying Oahu installations; and Pacific Missile Range Facility at Barking Sands, Kauai (U.S. Department of the Navy, 2003). The Programmatic Agreement covers Navy installations undertakings on land up to 3 NM from shore, but not the at-sea training and testing activities. The Section 106 Consultation will address Navy undertaking at-sea within the Hawaii Range Complex. The Programmatic Agreement includes stipulations for development of an integrated cultural resources management plan, determinations of areas of potential effects, identification of historic properties, access to historic sites and interpretative activities, review of project effects, monitoring of ground disturbing activities, annual reporting requirements, and consultation with Native Hawaiians and other consulting parties. Submerged resources are specifically identified under Stipulation X.D (Ground Disturbing Activities: Any undertakings in areas known to have a potential for submerged cultural resources will be planned in consultation with the National Park Service, SHPO, and Office of Hawaiian Affairs as appropriate to develop a work plan and monitoring plan that will ensure avoidance of effects on the resource) and Stipulation XI.A (Discoveries and Emergencies: If during the performance of an undertaking, historic properties, including submerged archaeological sites and traditional cultural properties, are discovered or unanticipated effects are found, or a previously unidentified property which may be eligible for listing on the National Register is discovered, Commander, Navy Region Hawaii would take all reasonable measures to avoid harm to the property until it concludes consultation with the SHPO and any Native Hawaiian organization, including Oahu Council of Hawaiian Civic Clubs, which has made known to Commander, Navy Region Hawaii that it attaches religious and cultural significance to the historic property).

3.10.2.5 Programmatic Agreement on Operational and Developmental Undertakings in Southern California, California

Within the Southern California Range Complex, programmatic agreements have been established to address impacts on cultural resources for Naval Base Coronado (which includes Silver Strand Training Complex) and San Clemente Island, off-island ranges, and operational training areas within the respective territorial and administrative jurisdictions of the United States and the State of California (U.S. Department of the Navy, 2008a). A letter of concurrence was received from the California SHPO (California State Historic Preservation Office, 2012; U.S. Department of the Navy, 2012a). The programmatic agreements include stipulations for the review of both range sustainability and operational training and support activities; determinations of areas of potential effects; identification of historic properties through survey; National Register evaluations through pro-active testing of selected resources; findings of effect; preparation of an integrated cultural resources management plan; treatment of archaeological historic properties including mitigation, monitoring, and protective signage;

preparation of annual reports; and consultation with Native American Tribes and other consulting parties.

3.10.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact cultural resources within U.S. territorial waters and the World Heritage Site located in the Study Area. Tables 2.6-1 through 2.6-5 present the proposed training and testing activities and locations for each alternative. Additional details of the proposed training and testing activities are provided in Appendix A (Navy Activity Descriptions). Appendix B (Activity Stressor Matrices) describes the warfare areas and associated stressors that were considered for analysis of cultural resources. The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to cultural resources in the Study Area that are analyzed include:

- **Explosive** (explosives – shock [pressure] waves from underwater explosions, explosives – cratering)
- **Physical disturbance and strikes** (in-water devices, military expended materials, seafloor devices, pile driving, and vibration from sonic booms)

The use of sonar does not affect the structural elements of historic shipwrecks. Archaeologists regularly use multi-beam sonar and side-scan sonar to explore shipwrecks without disturbing them. Based on the physics of underwater sound, the shipwreck would need to be very close (less than 22 ft.) to the sonar sound source for the shipwreck to experience any slight oscillations from the induced pressure waves. Any oscillations experienced at a depth of less than 22 ft. would be negligible up to within a few yards from the sonar source. This distance is smaller than the typical safe navigation and operating depth for most sonar sources, and is not expected to impact historic shipwrecks. Therefore, sonar is not considered a stressor that would result in an impact on cultural resources and will not be analyzed further in this document.

The analysis includes consideration of the mitigation that the Navy will implement to avoid potential impacts on cultural resources from explosives and physical disturbance and strike stressors. In the event that the Navy impacts a submerged historic or prehistoric resource, consultation would be reinitiated with the appropriate SHPO in accordance with 36 CFR section 800.13(a)(3).

3.10.3.1 Explosive Stressors

Explosive stressors that could impact cultural resources are vibration, shock waves, and explosive cratering from underwater explosions. A shock wave and oscillating bubble pulses resulting from any kind of underwater explosion, such as explosive torpedoes, missiles, bombs, projectiles, mines, and certain sonobuoys and explosive sonobuoys, could impact the exposed portions of submerged historic resources if such resources were located nearby. Shock waves (pressure) generated by underwater explosions would be periodic rather than continuous, and could create overall structural instability and eventual collapse of architectural features of submerged historic resources. The amount of damage would depend on factors such as the size of the charge, the distance from the submerged cultural resource, the water depth, and the topography of the ocean floor.

3.10.3.1.1 Impacts from Explosives—Shock Waves from Underwater Explosions

Anti-surface missiles and projectiles explode at or immediately below the ocean surface (within 1 meter). Shock waves (pressure) from these types of explosions within the water column would not reach historic resources on the ocean floor. Underwater detonations of improved extended echo

ranging sonobuoys and high explosives would occur below the surface and detonate in the mid-water column. Shock waves from nearby underwater detonations may affect the exposed portions of submerged historic properties if such resources were located in the area and near the depth of the explosive. Impacts on previously identified cultural resources from underwater explosions generating vibration and shock waves within the Study Area would not impact any cultural resources because (1) detonations at or near the surface from missiles and projectiles all occur in deep water, and the shock waves would not reach historic resources on the seafloor; and (2) detonations that occur in the mid-water column from explosive sonobuoys would also occur in deep water, well beyond the seafloor, so the shock waves would not reach historic resources on the seafloor; and (3) underwater detonations placed by Navy divers occur only in specially designated areas (see Section 2.3.3.9, Underwater Detonation Safety), far from any historic resources.

3.10.3.1.1.1 Impacts of Explosive Shock Waves from Underwater Explosions under Alternative 1

Impacts of Explosive Shock Waves from Underwater Explosions under Alternative 1 for Training Activities

Under Alternative 1, training activities would continue within the OPAREAs in the offshore waters of Hawaii and Southern California. Shock waves created from underwater explosives are not expected to result in impacts on cultural resources or the World Heritage Site within the Study Area because the Navy routinely avoids locations of known obstructions, which include submerged historic resources. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of shipwrecks (except in designated locations). Also, overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-21) and the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources.

Impacts of Explosive Shock Waves from Underwater Explosions under Alternative 1 for Testing Activities

Under Alternative 1, testing activities would continue within the OPAREAs in the offshore waters of Hawaii and Southern California. Shock waves created from underwater explosions are not expected to result in impacts on cultural resources or the World Heritage Site within the Study Area because the Navy routinely avoids locations of known obstructions, which include submerged historic resources. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of known shipwrecks (except in designated locations). Also, overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-22), and the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources.

3.10.3.1.1.2 Impacts of Explosive Shock Waves from Underwater Explosions under Alternative 2

Impacts of Explosive Shock Waves from Underwater Explosions under Alternative 2 for Training Activities

Under Alternative 2, training activities would remain the same as those described under Alternative 1 and would continue to occur within designated OPAREAs in the offshore waters of Hawaii and Southern California. Shock waves created from underwater explosions are not expected to result in impacts on

cultural resources or the World Heritage Site within the Study Area because the Navy routinely avoids locations of known obstructions, which include submerged historic resources. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of known shipwrecks (except in designated locations). Also, overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-21) and the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources.

Impacts of Explosive Shock Waves from Underwater Explosions under Alternative 2 for Testing Activities

Under Alternative 2, testing activities would remain the same as those described under Alternative 1 and would continue to occur within designated OPAREAs in the offshore waters of Hawaii and Southern California. Shock waves created from underwater explosions are not expected to result in impacts on cultural resources or the World Heritage Site within the Study Area because the Navy routinely avoids locations of known obstructions, which include submerged historic resources. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of known shipwrecks (except in designated locations). Overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-22) and the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources.

3.10.3.1.1.3 Impacts of Explosive Shock Waves from Underwater Explosions under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various explosive stressors (e.g., explosive shockwaves) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.3.1.2 Impacts from Explosives—Cratering

Underwater explosions near or on the seafloor could create sediment displacement in the form of cratering and could affect submerged prehistoric sites and unrecorded historic resources at or near the explosive impact. Cratering of unconsolidated soft bottom habitats would result from charges set on or near the bottom. For a specific explosive charge size, crater depths and widths would vary depending on depth of the charge and sediment type. However, crater dimensions generally decrease as bottom depth increases.

As discussed in Section 2.3.3.9 (Underwater Detonation Safety), underwater detonation training takes place in specially designated areas, and bottom-placed explosives are laid by divers who are able to observe bottom conditions and avoid sensitive areas. In addition, all other explosives would detonate near the surface and would occur in deep water.

3.10.3.1.2.1 Impacts from Explosives – Cratering under Alternative 1

Impacts from Explosives – Cratering under Alternative 1 for Training Activities

In Hawaii, cratering would be associated with underwater detonations at Puuloa Underwater Range, Barbers Point Underwater Range, Naval Inactive Ship Maintenance Facility, Lima Landing, Kingfisher, Shallow Water Minefield, Sonar Training Area, and Ewa Training Minefield (U.S. Department of the Navy, 2003). In Southern California, cratering would be associated with diver-placed underwater detonations in shallow water at San Clemente Island (Northwest Harbor, Horse Beach Cove, Kingfisher), Southern California Anti-Submarine Warfare Range, Shallow Water Training Range, Shallow Water Minefield, Camp Pendleton Amphibious Assault Area, and at Silver Strand Training Complex (Boat Lanes 1-14). Cratering created by deep underwater explosions is not expected to disturb or damage artifacts on the seafloor and archaeological deposits buried in the ocean sediments in the Study Area because bottom-placed explosives are laid by divers who are able to observe bottom conditions and avoid sensitive areas and all other explosives would detonate near the surface in deep water. There are standard operating procedures related to underwater detonation safety that provides secondary benefits to known wrecks (see Section 2.3.3.9, Underwater Detonation Safety). Because standard operating procedures provide secondary benefits to known wrecks, overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-21), and because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, effects on underwater cultural resources are not anticipated within the Study Area. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area (U.S. Department of the Navy, 2008a). For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of known shipwrecks (except in designated locations).

Impacts from Explosives – Cratering under Alternative 1 for Testing Activities

Under Alternative 1, high-explosive rounds associated with mine warfare activities would occur within the OPAREAs in the offshore waters of Hawaii and Southern California. Cratering created by deep underwater explosions is not expected to disturb or damage artifacts on the seafloor and archaeological deposits buried in the ocean sediments in the Study Area because bottom-placed explosives are laid by divers who are able to observe bottom conditions and avoid sensitive areas and all other explosives would detonate near the surface in deep water. Because standard operating procedures provide secondary benefits to known wrecks, overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-22), and because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, effects on underwater cultural resources are not anticipated within the Study Area. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of known shipwrecks (except in designated locations).

3.10.3.1.2.2 Impacts from Explosives – Cratering under Alternative 2

Impacts from Explosives – Cratering under Alternative 2 for Training Activities

Under Alternative 2, underwater detonations would remain the same as those described under Alternative 1. Cratering created by deep underwater explosions is not expected to disturb or damage artifacts on the seafloor and archaeological deposits buried in the ocean sediments in the Study Area

because bottom-placed explosives are laid by divers who are able to observe bottom conditions and avoid sensitive areas and all other explosives would detonate near the surface in deep water. Because standard operating procedures provide secondary benefits to known wrecks, overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-21), and because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, effects on underwater cultural resources are not anticipated within the Study Area. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of known shipwrecks (except in designated locations).

Impacts from Explosives – Cratering under Alternative 2 for Testing Activities

Under Alternative 2, the number of high-explosive rounds associated with mine warfare activities would remain the same as those described under Alternative 1 and would continue to occur within designated OPAREAs along the offshore waters of Hawaii and Southern California. Cratering created by deep underwater explosions is not expected to disturb or damage artifacts on the seafloor and archaeological deposits buried in the ocean sediments in the Study Area because bottom-placed explosives are laid by divers who are able to observe bottom conditions and avoid sensitive areas and all other explosives would detonate near the surface in deep water. Because standard operating procedures provide secondary benefits to known wrecks, overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-22), and because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, effects on underwater cultural resources are not anticipated within the Study Area. As discussed in Section 5.4.1 (Mitigation Areas for Seafloor Resources), the Navy will avoid impacts from explosives on seafloor resources in mitigation areas throughout the Study Area. For example, the Navy will not conduct explosive mine countermeasure and neutralization activities within a specified distance of known shipwrecks (except in designated locations).

3.10.3.1.2.3 Impacts from Explosives – Cratering under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various explosive stressors (e.g., cratering) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.3.2 Physical Disturbance and Strike Stressors

Any physical disturbance on the continental shelf and seafloor, such as ship anchoring, targets or mines resting on the seafloor, moored mines, bottom-mounted tripods, unmanned underwater vehicles, or bottom crawlers, could inadvertently damage or destroy submerged prehistoric sites and historic resources. In-water devices are operated to avoid obstructions such as submerged objects to minimize damage to the device. Therefore, a towed system or vessel is very unlikely to encounter a submerged historic resource inadvertently. Expended materials such as chaff, flares, projectiles, casings, target or missile fragments, non-explosive practice munitions, rocket fragments, ballast weights, sonobuoys, torpedo launcher accessories, or mine shapes could be deposited on the ocean bottom on or near submerged prehistoric sites or historic resources. Heavier expended materials could damage intact fragile shipwreck features if they landed with velocity on a resource.

3.10.3.2.1 Impacts from In-Water Devices under Alternative 1

Impacts from In-Water Devices under Alternative 1 for Training Activities

Under Alternative 1, training activities using in-water devices would occur within existing designated OPAREAs in offshore waters of Hawaii and Southern California. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California. However, because in-water devices are operated in a manner to avoid obstructions, overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-18), and because the Navy's Section 106 compliance under the programmatic agreements includes the protection of cultural resources, effects on underwater cultural resources are not anticipated within the Study Area, and the World Heritage Site would not be affected.

Impacts from In-Water Devices under Alternative 1 for Testing Activities

Under Alternative 1, testing activities using in-water devices would occur within existing designated OPAREAs in offshore waters of Hawaii and Southern California. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California. However, because in-water devices are operated in a manner to avoid obstructions, overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-18), and because the Navy's Section 106 compliance under the programmatic agreements includes the protection of cultural resources, effects on underwater cultural resources are not anticipated within the Study Area, and the World Heritage Site would not be affected.

3.10.3.2.1.1 Impacts from In-Water Devices under Alternative 2

Impacts from In-Water Devices under Alternative 2 for Training Activities

Under Alternative 2, the number of training activities using towed in-water devices would remain the same as those described under Alternative 1 and would continue to occur within designated OPAREAs in the offshore waters of Hawaii and Southern California. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California. However, because in-water devices are operated in a manner to avoid obstructions, overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-18), and because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, no impacts on cultural resources are expected within the Study Area, and the World Heritage Site would not be affected.

Impacts from In-Water Devices under Alternative 2 for Testing Activities

Under Alternative 2, the number of testing activities using towed in-water devices would remain the same as those described under Alternative 1 and would continue to occur within designated OPAREAs in the offshore waters of Hawaii and Southern California. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California. However, because in-water devices are operated in a manner to avoid obstructions, overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-18), and because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, no impacts on

cultural resources are expected within the Study Area, and the World Heritage Site would not be affected.

3.10.3.2.1.2 Impacts from In-Water Devices under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., in-water devices) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.3.2.2 Impacts from Military Expended Materials

The deposition of non-explosive practice munitions, sonobuoys, and military expended materials other than munitions could impact submerged cultural resources if such resources are located nearby. Most of the anticipated expended munitions (e.g., large-caliber explosive munitions) would be small objects and fragments that would slowly drift to the seafloor after striking the ocean surface. Larger and heavier objects (e.g., non-explosive practice munitions) could displace sediments and artifacts upon impacting the ocean floor despite a reduction in their descent velocity. Additionally, impacts on sites could occur should expended material fall on or near them. However, the likelihood of these materials either impacting or landing on submerged cultural resources is very low because of the size of the Study Area.

If expended materials should sink on or in the vicinity of or on a submerged cultural resource, the expended materials would likely not adversely affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource that would contribute to their eligibility for the National Register of Historic Places.

3.10.3.2.2.1 Impacts from Military Expended Materials under Alternative 1

Impacts from Military Expended Materials under Alternative 1 for Training Activities

Under Alternative 1, the use of expended materials from training activities would occur within designated OPAREAs along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber and are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and historic resources. However, because the Study Area is so large and because the Navy avoids areas with known submerged obstructions, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink on or in the vicinity of either type of cultural resource, the expended materials would likely not alter the archaeological or historic characteristics or integrity of the submerged prehistoric site or the historic resource.

Impacts from Military Expended Materials under Alternative 1 for Testing Activities

Under Alternative 1, the use of expended materials from testing activities would occur within designated OPAREAs along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber and are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and historic resources. However, because the Study Area is so large, and because the Navy avoids areas with known submerged obstructions, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink on or in the vicinity of either type of cultural resource, the expended materials would likely not alter the archaeological or historic characteristics or integrity of the submerged prehistoric site or the historic resource.

3.10.3.2.2.2 Impacts from Military Expended Materials under Alternative 2

Impacts from Military Expended Materials under Alternative 2 for Training Activities

Under Alternative 2, the number of expended materials from training activities would remain the same as those described under Alternative 1 and would continue to occur within designated OPAREAs along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber and are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and historic resources. However, because the Study Area is so large, and because the Navy avoids areas with known submerged obstructions, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink on or in the vicinity of either type of cultural resource, the expended materials would likely not alter the archaeological or historic characteristics or integrity of the submerged prehistoric site or the historic resource.

Impacts from Military Expended Materials under Alternative 2 for Testing Activities

Under Alternative 2, the number of expended materials from testing activities would remain the same as those described under Alternative 1 and would continue to occur within designated OPAREAs along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber and are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and historic resources. However, because the Study Area is so large and because the Navy avoids areas with known submerged obstructions, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink on or in the vicinity of either type of cultural resource, the expended materials would likely not alter the archaeological or historic characteristics or integrity of the submerged prehistoric site or the historic resource.

3.10.3.2.2.3 Impacts from Military Expended Materials under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., military expended material) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.3.2.3 Impacts from Seafloor Devices

Physical disturbances on the continental shelf and seafloor, such as precision anchoring, targets or mines resting on the ocean floor, moored mines, bottom-mounted tripods, and bottom crawlers (unmanned underwater vehicles) could damage or destroy submerged prehistoric sites or historic resources if such resources are located nearby. The Navy will not conduct precision anchoring within shallow coral reefs, live hardbottom, artificial reefs, and known shipwrecks (see Section 5.4.1, Mitigation Areas for Seafloor Resources). Regarding targets, mines, and similar seafloor devices, because the Study Area is so large, and because the Navy avoids areas with known submerged obstructions, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. Because of their size and weight, if they should settle on or in the vicinity of either type of cultural resource, the seafloor devices would not alter the archaeological or historic characteristics or integrity of the submerged prehistoric site or the historic resource. The Navy operates bottom crawlers (unmanned underwater vehicles) only where the safety of the equipment and the success of the mission

would be assured. Therefore, the Navy does not deploy these devices where there is a risk of snagging the vehicle on obstacles, such as known wrecks.

Impacts on previously identified cultural resources from seafloor devices within the Study Area are not anticipated because (1) precision anchoring does not occur near known shipwrecks; (2) obstructions, and archaeological sites are routinely avoided during training and testing; and (3) most submerged cultural resources are located at substantial depths and distributed over large areas of the seafloor.

3.10.3.2.3.1 Impacts from Seafloor Devices under Alternative 1

Impacts from Seafloor Devices under Alternative 1 for Training Activities

Under Alternative 1, training activities using seafloor deployed devices would occur within the offshore waters of the Hawaii and Southern California OPAREAs. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California; therefore, unrecorded historic resources could be disturbed by seafloor devices. The Navy will implement mitigation that includes not conducting precision anchoring (except in designated anchorages) within the anchor swing circle of known shipwrecks to avoid potential impacts from seafloor devices on cultural resources in mitigation areas throughout the Study Area (see Section 5.4.1, Mitigation Areas for Seafloor Resources). Most sea-floor devices would not be used in deep water, but because bottom and moored mine anchors are laid by divers who are able to observe bottom conditions and avoid sensitive areas; therefore, cultural resources would not be impacted by bottom and moored mine anchors. Overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-27). Mitigation for precision anchoring would be implemented during training activities. Because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, no impacts on cultural resources are expected within the Study Area, and the World Heritage Site would not be affected.

Impacts from Seafloor Devices under Alternative 1 for Testing Activities

Under Alternative 1, testing activities using seafloor deployed devices would occur within the offshore waters of the Hawaii and Southern California OPAREAs. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California; therefore, unrecorded historic resources could be disturbed by seafloor devices. However, because seafloor devices associated with testing activities would not be used in deep water, overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-27), and because the Navy's Section 106 compliance under the programmatic agreements includes the protection of cultural resources, no impacts on cultural resources are expected within the Study Area, and the World Heritage Site would not be affected.

3.10.3.2.3.2 Impacts from Seafloor Devices under Alternative 2

Impacts from Seafloor Devices under Alternative 2 for Training Activities

Under Alternative 2, the number of annual training activities using seafloor deployed devices would remain the same as those described under Alternative 1 and would continue to occur within offshore waters of the Hawaii and Southern California OPAREAs. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California; therefore, unrecorded historic resources could be disturbed by seafloor devices. The Navy will implement mitigation that includes not conducting precision anchoring (except in designated anchorages) within the anchor swing circle of known shipwrecks to avoid potential impacts from seafloor devices on cultural resources in mitigation areas throughout the Study Area (see Section

5.4.1, Mitigation Areas for Seafloor Resources). Most seafloor devices would not be used in deep water, but because bottom and moored mine anchors are laid by divers who are able to observe bottom conditions and avoid sensitive areas; therefore, cultural resources would not be impacted by bottom and moored mine anchors. Overall types and locations of training activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-27). Mitigation for precision anchoring would be implemented during training activities. Because the Navy's Section 106 compliance under the Navy's programmatic agreements includes the protection of cultural resources, no impacts on cultural resources are expected within the Study Area, and the World Heritage Site would not be affected.

Impacts from Seafloor Devices under Alternative 2 for Testing Activities

Under Alternative 2, the number of annual testing activities using seafloor deployed devices would remain the same as those described under Alternative 1 and would continue to occur within offshore waters of the Hawaii and Southern California OPAREAs. No comprehensive survey or evaluation of submerged historic resources has occurred in the OPAREAs along the offshore waters of Hawaii and Southern California. However, because seafloor devices associated with testing activities would not be used in deep water, overall types and locations of testing activities are not expected to change from those currently conducted by the Navy (refer to Table 3.0-27), and because the Navy's Section 106 compliance under the programmatic agreements includes the protection of cultural resources, no impacts on cultural resources are expected within the Study Area, and the World Heritage Site would not be affected.

3.10.3.2.3.3 Impacts from Seafloor Devices under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., seafloor devices) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.3.2.4 Impacts from Pile Driving

3.10.3.2.4.1 Impacts from Pile Driving under Alternative 1

Impacts from Pile Driving under Alternative 1 for Training Activities

Under Alternative 1, a total of four elevated causeway system training events would occur at the Silver Strand Training Complex. Pile driving would not occur in Hawaii. Pile driving for elevated causeway system training at the Silver Strand Training Complex would subject nearshore sediments to vibration, disruption, and compaction. Elevated causeway system training at the Silver Strand Training Complex would occur only in the Oceanside Boat Lanes 1–10 and in the bayside Bravo training area. A bark built in 1883, the Narwhal, lies in Boat Lane 1; however, it is not listed in the NRHP. On the bayside of the Silver Strand Training Complex, sediments are periodically dredged, and the potential for encountering submerged historic resources that retain their integrity is low. Surveys of the planned location of the elevated causeway system training would be conducted to ensure there are no obstructions prior to construction and to ensure no impact would occur on a submerged resource.

Impacts from Pile Driving under Alternative 1 for Testing Activities

Pile driving is not associated with any testing activities under Alternative 1.

3.10.3.2.4.2 Impacts from Pile Driving under Alternative 2

Impacts from Pile Driving under Alternative 2 for Training Activities

Under Alternative 2, the number of elevated causeway system training events would not increase relative to Alternative 1. Therefore, the potential for affecting submerged historic resources would be the same as described under Alternative 1.

Impacts from Pile Driving under Alternative 2 for Testing Activities

Pile driving is not associated with any testing activities under Alternative 2.

3.10.3.2.4.3 Impacts from Pile Driving under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., pile driving) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.3.2.5 Impacts from Vibration from Sonic Booms

Impulsive noise, such as that resulting from supersonic overflights (sonic booms) can create intense shock waves that cause airborne vibration. Repeated vibration, over time, has the potential to degrade or destroy sensitive structural or cultural elements. Supersonic aircraft flights can occur and are usually limited to altitudes above 30,000 ft. and in locations more than 30 NM from shore. Several factors influence sonic booms: weight, size, and shape of the aircraft; altitude; flight paths; and atmospheric conditions. A larger and heavier aircraft displaces more air and creates more lift to sustain flight, compared with small, light aircraft. Therefore, larger aircraft create sonic booms that are stronger and louder than those of smaller, lighter aircraft.

3.10.3.2.5.1 Impacts from Vibration from Sonic Booms under Alternative 1

Impacts from Vibration from Sonic Booms under Alternative 1 for Training and Testing Activities

The Papahanaumokuakea Marine National Monument, which is also designated as a World Heritage Site, is located within the Temporary Operating Area of the Hawaii Range Complex in the offshore waters of Hawaii that could be susceptible to sonic booms. However, no activities are proposed to occur within the Papahanaumokuakea Marine National Monument, and current airspace activities that may occur in designated Special Use Airspace are fully in compliance with Federal Aviation Administration regulations and recommendations applicable to this area. There are no cultural resources within the OPAREAs in the offshore waters of Hawaii and Southern California that could be susceptible to sonic booms. Therefore, no impacts on cultural resources are expected from vibrations from sonic booms within the Study Area under Alternative 1.

3.10.3.2.5.2 Impacts from Vibration from Sonic Booms under Alternative 2

Impacts from Vibration from Sonic Booms under Alternative 2 for Training and Testing Activities

Under Alternative 2, the Papahanaumokuakea Marine National Monument, which is also designated as a World Heritage Site, is located within the Temporary Operating Area of the Hawaii Range Complex in the offshore waters of Hawaii, could be susceptible to sonic booms. However, no activities are proposed to occur within the Papahanaumokuakea Marine National Monument, and current airspace activities that may occur in designated Special Use Airspace are fully in compliance with Federal Aviation Administration regulations and recommendations applicable to this area. There are no cultural resources within the OPAREAs in the offshore waters of Hawaii and Southern California that could be

susceptible to sonic booms. Therefore, no impacts on cultural resources are expected from vibrations from sonic booms within the Study Area under Alternative 2.

3.10.3.2.5.3 Impacts from Vibration from Sonic Booms under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., vibration from sonic booms) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.4 Summary of Potential Impacts on Cultural Resources

3.10.4.1 Combined Impacts of All Stressors under Alternative 1

Explosive and physical disturbance and strike stressors associated with training and testing activities would not impact cultural resources.

3.10.4.2 Combined Impacts of All Stressors under Alternative 2

Explosive and physical disturbance and strike stressors associated with training and testing activities would not impact cultural resources.

3.10.4.3 Combined Impacts of All Stressors under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities. Baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

3.10.5 National Historic Preservation Act

The Navy has considered the importance of the Papahanaumokuakea Marine National Monument World Heritage site in the analysis of potential impacts in light of the United States' obligations under the World Heritage Convention. In accordance with 50 CFR Part 404.9(c), all activities and exercises of the Armed Forces shall be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on Monument resources and qualities. In addition, as required by Proclamation 9478, the Navy shall ensure, by the adoption of appropriate measures not impairing operations or operation capabilities, that its vessels and aircraft act in a manner consistent, so far as is practicable, with the Proclamation.

Papahanaumokuakea Marine National Monument plays a critical role for traditional Native Hawaiians in regards to voyaging and wayfinding and is considered a sacred site (81 FR 60225). No activities are proposed to occur within the Papahanaumokuakea Marine National Monument, and current airspace activities that may take place in designated Special Use Airspace overlaying the monument are in full compliance with Federal Aviation Administration regulations and recommendations applicable to these areas. The Proposed Action and alternatives would not result in changes that would alter the marine national monument. Potential effects within the marine national monument could include disruptions to cultural voyaging and wayfinding; however, these would be considered a temporary impact on cultural navigation because both Navy and cultural voyaging activities are considered transitory, and there would be minimal to no overlap.

Table 3.10-1 summarizes the potential effects on submerged cultural resources in accordance with Section 106 of the NHPA for Alternative 1, Alternative 2, and the No Action Alternative. The Navy has

determined that the Proposed Action will have no effect on historic properties within the Study Area. The Navy's programmatic agreements include the protection and management of cultural resources.

The Navy consulted with the California and Hawaii SHPO, ACHP, National Park Service, Office of Hawaiian Affairs, Native Hawaiian Organizations, and other interested parties under Section 106 of the NHPA. The Navy determined that the proposed training and testing activities will have no effect on historic properties within the HSTT Study Area. The California SHPO concurred with the Navy's determination of no historic properties affected within the Southern California portion of the HSTT Study Area (letter dated October 20, 2017).

During Section 106 consultation in Hawaii, the Navy held seven meetings, which included in-person meetings on four islands (Oahu, Kauai, Maui, and Hawaii) over a period of five months. Following the consultation meetings, the Navy determined there are historic properties present in the Hawaii Range Complex, but the proposed training and testing will have no effect upon them. The Navy sent out a determination of no historic properties affected on October 4, 2018, to the SHPO and consulting parties. Copies of agency correspondence are found in Appendix J (Agency Correspondence).

Table 3.10-1: Summary of Section 106 Effects of Training and Testing Activities on Cultural Resources

Alternative and Stressor	Section 106 Effects
Alternative 1	
Explosive Stressors	Explosive stressors resulting from underwater explosions creating shock waves and cratering of the seafloor would not affect known submerged cultural resources; mitigation measures would continue to be implemented to protect known shipwrecks.
Physical Disturbance and Strike Stressors	Physical stressors resulting from in-water devices, military expended materials, seafloor devices, pile driving, and vibration from sonic booms during training and testing activities would not affect known submerged cultural resources; mitigation measures would continue to be implemented to protect known shipwrecks.
Regulatory Determination	*No effect on submerged historic properties would occur.*
Alternative 2	
Explosive Stressors	Explosive stressors resulting from underwater explosions creating shock waves and cratering of the seafloor would not affect known submerged cultural resources; mitigation measures would continue to be implemented to protect known shipwrecks.
Physical Disturbance and Strike Stressors	Physical stressors resulting from in-water devices, military expended materials, seafloor devices, pile driving, and vibration from sonic booms during training and testing activities would not affect known submerged cultural resources; mitigation measures would continue to be implemented to protect known shipwrecks.
Regulatory Determination	*No effect on submerged historic properties would occur.*

Table 3.10-1: Summary of Section 106 Effects of Training and Testing Activities on Cultural Resources (continued)

Alternative and Stressor	Section 106 Effects
No Action Alternative	
Explosive Stressors	Explosive stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.
Physical Disturbance and Strike Stressors	Physical disturbance and strike stressors would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities.

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3.11 Socioeconomic Resources

Final
Environmental Impact Statement/Overseas Environmental Impact Statement
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3.11 SOCIOECONOMIC RESOURCES

PREFERRED ALTERNATIVE SYNOPSIS

The United States Department of the Navy considered all potential stressors that socioeconomic resources could be exposed to from the Proposed Action. The following conclusions have been reached for the Preferred Alternative (Alternative 1):

- Accessibility: Limits on accessibility to marine areas used by the public (e.g., fishing areas) in Navy training and testing areas would be temporary and of short duration (hours). Restrictions would be lifted, and conditions would return to normal upon completion of training and testing activities. Minimal impacts on commercial and recreational fishing and tourism may occur; however, limits on accessibility would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience. No impacts on commercial transportation and shipping, and subsistence fishing are anticipated.
- Airborne Acoustics: Because the majority of Navy training and testing activities are conducted far from where tourism and recreational activities are concentrated, the impact of airborne noise would be negligible. The public may intermittently hear noise from transiting ships or aircraft overflights if they are in the general vicinity of a training or testing activity, but these occurrences would be infrequent. The infrequent exposure to airborne noise would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience. No impacts on commercial transportation and shipping, and subsistence fishing are anticipated.
- Physical Disturbance and Strike: Because the majority of Navy training and testing activities are conducted farther from shore than where most recreational activities are concentrated, the potential for a physical disturbance or strike affecting recreational fishing and tourism in offshore areas is negligible. In locations where Navy training or testing occurs in nearshore areas (e.g., San Diego Bay), the Navy coordinates with civilian organizations to assure safe and unimpeded access and use of those areas. Based on the Navy's standard operating procedures and the large expanse of the testing and training ranges, the likelihood of a physical disturbance or strike disrupting commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism would be negligible. Therefore, direct loss of income, revenue or employment, resource availability, or quality of experience would not be expected.

3.11.1 INTRODUCTION AND METHODS

This section provides an overview of the characteristics of socioeconomic resources in the Hawaii-Southern California Training and Testing (HSTT) Study Area and describes in general terms the methods used to analyze potential impacts on these resources from the Proposed Action.

The Council on Environmental Quality regulations implementing the National Environmental Policy Act state that when economic or social effects and natural or physical environmental effects are interrelated, the Environmental Impact Statement (EIS)/Overseas EIS will discuss these effects on the human environment (40 Code of Federal Regulations [CFR] section 1508.14). The Council on Environmental Quality regulations state that the "human environment shall be interpreted

comprehensively to include the natural and physical environment and the relationship of people with that environment." To the extent that the ongoing and proposed United States (U.S.) Department of the Navy (Navy) training and testing activities in the Study Area could affect the natural or physical environment, the socioeconomic analysis evaluates how elements of the human environment might be affected. The Navy identified four broad socioeconomic topics based on their association with human activities and livelihoods in the Study Area. Each of these socioeconomic resources is an aspect of the human environment that involves economics (e.g., employment, income, or revenue) and social conditions (i.e., enjoyment and quality of life) associated with the marine environment of the Study Area. Therefore, this evaluation considered potential impacts on four elements:

- Commercial transportation and shipping
- Commercial and recreational fishing
- Subsistence fishing
- Tourism

The baseline for identifying the socioeconomic conditions in the Study Area was derived using relevant published information from sources that included federal, state, regional, and local government agencies and databases; academic institutions; conservation organizations; technical and professional organizations; and private groups. Previous environmental studies were also reviewed.

The alternatives were evaluated based on the potential for and the degree to which training and testing activities could impact socioeconomic resources. The potential for impacts depends on the likelihood that the testing and training activities would interface with public activities or infrastructure. Factors considered in the analysis include whether there would be temporal or spatial interfaces between the public or infrastructure and Navy testing and training. If there is potential for this interface, factors considered to estimate the degree to which an exposure could impact socioeconomic resources include whether there could be an impact on livelihood, quality of experience, resource availability, income, or employment. If there is no potential for the public to interface with an activity, then no impacts would be expected.

3.11.2 Affected Environment

This section describes the four socioeconomic resources associated with human activities and livelihoods in the Study Area. The primary area of interest for assessing potential impacts on socioeconomic resources is the U.S. territorial waters of Hawaii and Southern California (seaward of the mean high water line to 12 nautical miles [NM]). Limited socioeconomic resources outside this area of interest (i.e., that portion of the U.S. Exclusive Economic Zone between 12 and 200 NM from shore) are also described when relevant to human activities.

The relative density of military vessel traffic in the HSTT Study Area shows that most vessel traffic is centered on Pearl Harbor, Oahu (Figure 3.11-1) and San Diego, California (Figure 3.11-2). The data are representative and based on a three year average (2012–2014) of military vessel tracking data acquired from the National Oceanic and Atmospheric Administration's Marine Cadastre Track Builder application. Only vessels broadcasting their location using the Automatic Identification System are tracked, which excludes many military vessels at times during their transits for security reasons; however, the data are generally representative, and useful for the analysis of impacts on socioeconomic resources by comparing similar data acquired from recreational and commercial vessels in the HSTT Study Area, many of which do use the Automatic Identification System. Also, military vessels are not exclusively Navy vessels and include vessels from other services (e.g., U.S. Coast Guard).

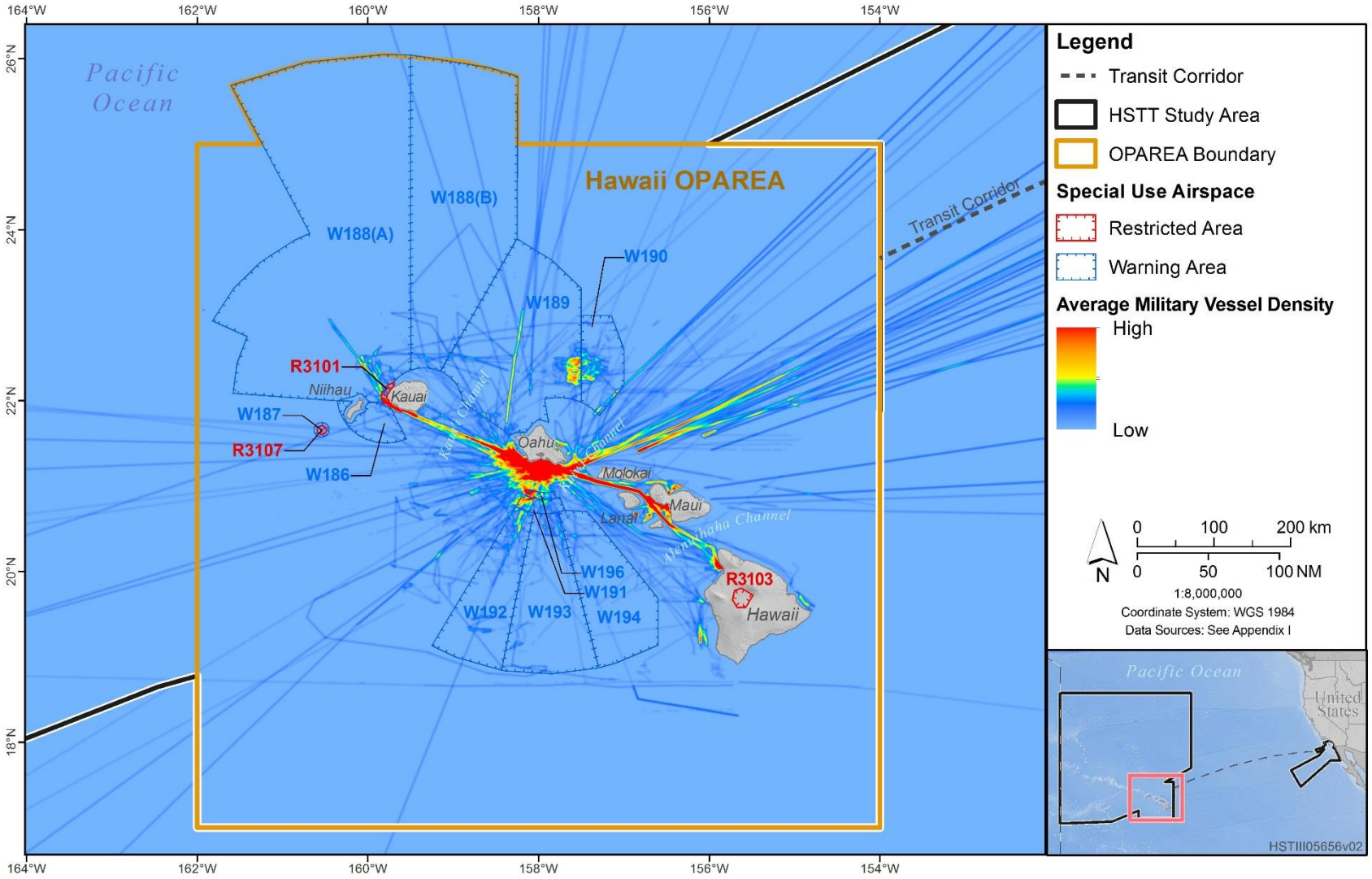


Figure 3.11-1: Relative Density of Military Vessel Traffic in the Hawaii Range Complex

Notes: HSTT = Hawaii-Southern California Training and Testing, OPAREA = Operating Area

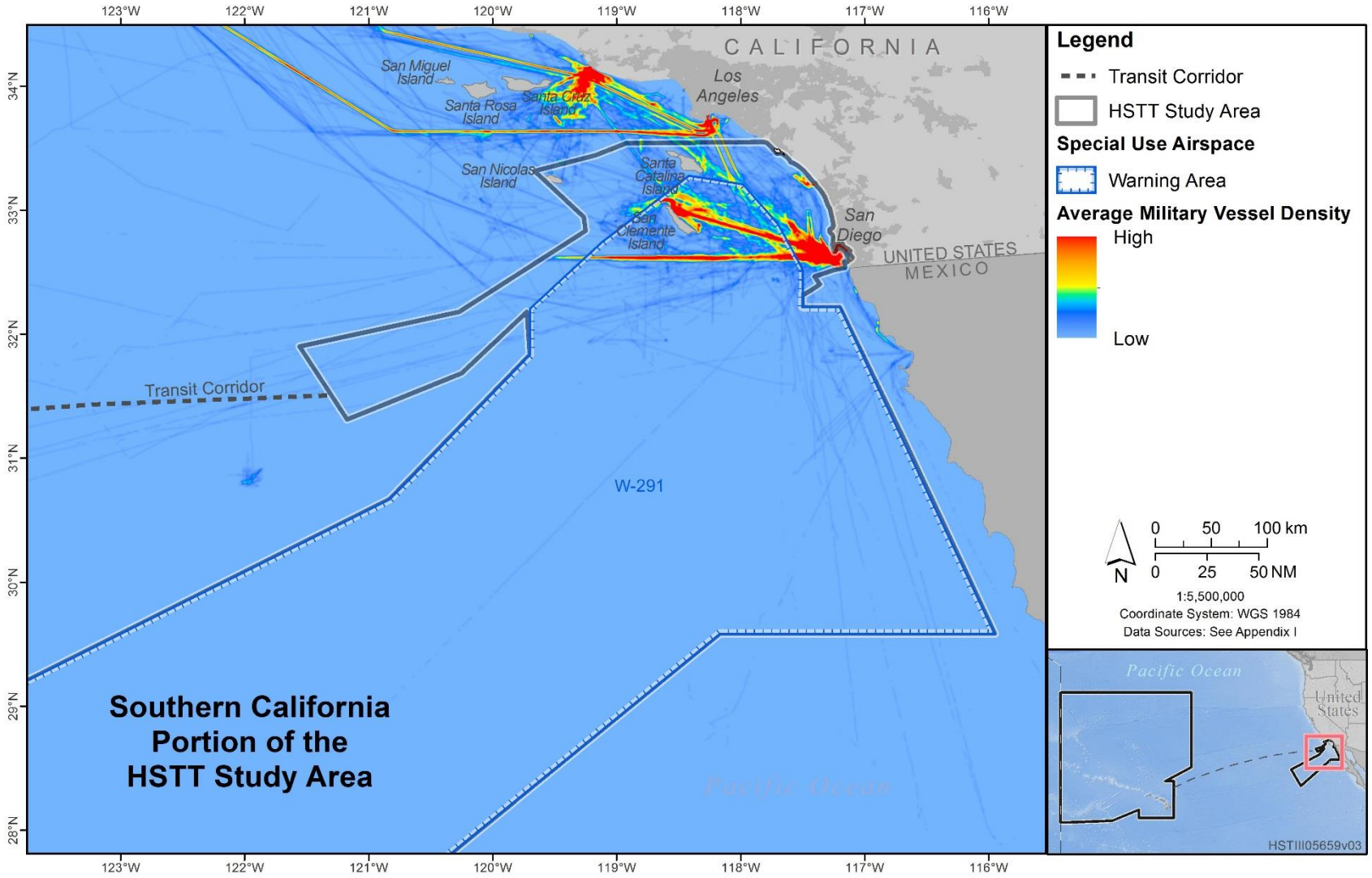


Figure 3.11-2: Relative Density of Military Vessel Traffic in the Southern California Portion of the HSTT Study Area

Notes: HSTT = Hawaii-Southern California Training and Testing, OPAREA = Operating Area

For the purposes of comparing vessel densities by vessel type (e.g., Figure 3.11-1 and Figure 3.11-2), the average relative density of military vessels in the Hawaii Range Complex was calculated as 0.0012 vessels per square kilometer (km^2). In the Southern California Portion of the HSTT Study Area, the density of military vessels was 0.0033 vessel per km^2.

3.11.2.1 Commercial Transportation and Shipping

Current military and civilian use of the offshore sea and air space is generally compatible, with Navy ships accounting for approximately 10 percent of the total ship presence out to 200 NM (Mintz, 2012). The Navy conducts training and testing activities in operating areas (OPAREAs) away from commercially used waterways and within special use airspace (Mintz & Filadelfo, 2011; Mintz, 2012). Upcoming training and testing activities are announced to commercial vessel and aircraft operators by use of Notices to Mariners issued by the U.S. Coast Guard, Notices to Airmen issued by the Federal Aviation Administration, and marine band radio, as needed. The Navy procedures for planning and management of activities are provided in the Chief of Naval Operations Instruction 3770.2L*, Airspace Procedures and Planning Manual* (U.S. Department of the Navy, 2017). The Department of Defense also publishes separate Notices to Airmen about runway closures, missile launches, special traffic management procedures, and malfunction of navigational aids.

3.11.2.1.1 Ocean Transportation

Ocean transportation is the transit of commercial, private, and military vessels at sea, including submarines.

Most of the waterways in the Study Area are accessible to commercial vessels; however, some areas are restricted. These restrictions can be permanent or temporary. The National Oceanic and Atmospheric Administration issues nautical charts that reflect designated restricted zones. In accordance with Title 33 CFR part 72, the U.S. Coast Guard and Department of Homeland Security publish marine information pertaining to waterways (i.e., danger zones and restricted areas; see below). Notices to Mariners provide information to private and commercial vessels on temporary closures. These navigational warnings are disseminated by broadcast notices on maritime frequency radio, weekly publications by the appropriate U.S. Coast Guard Navigation Center, and Global Positioning System navigation charts. They provide information about duration and location of closures due to activities that are potentially detrimental to surface vessels. Vessels are responsible for being aware of designated danger areas in surface waters and any Notices to Mariners that are in effect. Operators of recreational or commercial vessels have a duty to abide by maritime requirements as administered by the U.S. Coast Guard.

The flow of vessel traffic in congested waters, especially near coastlines, is controlled by the use of directional shipping lanes for large vessels, including cargo ships, container ships, and tankers, and flow controls for all vessels in harbors, bays, and ports to ensure that ports-of-entry remain as uncongested as possible. Navy vessels and non-military vessels alike adhere to regulations governing shipping traffic in these areas. There are fewer restrictions controlling open-ocean vessel traffic. In most cases, the factors that influence vessel traffic include: adequate depth of water, weather conditions (primarily affecting smaller recreational vessels), availability and location of fish for commercial and recreational fishing vessels, and hazards to navigation. Large commercial shipping vessels generally follow well-established routes that enable efficient transport of goods between ports. Recreational boating activities fluctuate seasonally, with increased activity in summer when warmer weather and more daylight hours offer more opportunity for recreational boating activities.

Certain areas of surface water within the Study Area are designated as danger zones, safety zones, security zones, or restricted areas as described in the CFR and established by the U.S Coast Guard and the U.S. Army Corps of Engineers. These areas may limit access to non-military activities on either a fulltime or temporary timeframe. Detailed information on these areas is provided in the CFR as referenced in the following brief descriptions.

Information on danger zones and restricted areas is found in 33 CFR part 334 (Navigation and Navigable Waters, Danger Zone and Restricted Area Regulations). A danger zone is a defined water area (or areas) used for target practice, bombing, rocket firing, or other especially hazardous activities. Danger zones may be closed to the public on a fulltime or intermittent basis, as stated in the regulations specific to individual danger zones. A restricted area is a defined water area prohibiting or limiting public access to provide security for government property and to protect the public from risk of injury or damage to property arising from the government's use of the area.

Information on safety zones and security zones is found in 33 CFR part 165 (Regulated Navigation Areas and Limited Access Areas). Safety zones are specifically addressed in 33 CFR part 165.20 subpart C (Safety Zones). A safety zone is defined as a water area, shore area, or a combination of water and shore area to which, for safety or environmental purposes, access is limited to authorized persons, vehicles, or vessels. A safety zone may be stationary and described by fixed limits, or it may be described as a zone around a vessel in motion. Security zones are defined in 33 CFR part 165.30 subpart D (Security Zones). A security zone is defined as an area of land, water, or a combination of land and water areas that are designated by the Captain of the Port or District Commander for a time period deemed necessary to prevent damage or injury to any vessel or waterfront facility; to safeguard ports, harbors, territories, or waters of the United States; or to ensure that the rights and obligations of the United States are observed.

In addition to the regulations described above, a naval vessel protection zone as described in 33 CFR part 165.20 subpart G (Protection of Navy Vessels) states that no vessel or person is allowed within 100 yards of a large U.S. Navy vessel unless authorized by the U.S. Coast Guard, the senior naval officer present in command, or an official patrol.

Furthermore, all vessels shall operate at the minimum speed necessary to maintain a safe course, unless required to maintain a greater speed by navigational rules, and shall proceed as directed by the U.S. Coast Guard, the senior naval officer present in command, or the official patrol.

When a vessel is within a naval vessel protection zone the following rules apply:

- To request authorization to operate within 100 yards of a large U.S. Navy vessel, contact the U.S. Coast Guard, the senior naval officer present in command, or the official patrol on VHF-FM channel 16.

When conditions permit, the U.S. Coast Guard, senior naval officer present in command, or the official patrol should:

- Give advance notice on VHF-FM channel 16 of all large U.S. naval vessel movements;
- Permit vessels constrained by their navigational draft or restricted in their ability to maneuver to pass within 100 yards of a large U.S. naval vessel in order to ensure a safe passage in accordance with the navigation rules;

- Permit commercial vessels anchored in a designated anchorage area to remain at anchor when within 100 yards of passing large U.S. naval vessels; and
- Permit vessels that must transit via a navigable channel or waterway to pass within 100 yards of a moored or anchored large U.S. naval vessel with minimal delay consistent with security.

Danger zones, restricted areas, safety zones, and security zones located in the Study Area are shown in Figure 3.11-19, Figure 3.11-23, and Figure 3.11-24.

3.11.2.1.1.1 Hawaii Range Complex

Ocean shipping is an important component of Hawaii's economy. Major inter-island ports include Honolulu, Barbers Point, Hilo, Kawaihae, and Kahului (Figure 3.11-3). The U.S. Army Corps of Engineers ranks the top 150 U.S. ports by cargo volume (U.S. Army Corps of Engineers, 2017). Based on 2016 rankings, Honolulu (Oahu) ranked 42 in total trade (domestic and foreign) with nearly 14 million tons of goods transferred. Other ranked ports in Hawaii were Barbers Point (Oahu) at 51, Kahului (Maui) at 84, Hilo (Hawaii) at 107, and Kawaihae at 114 (Table 3.11-1). While the majority of domestic trade in the Hawaii Islands went through Honolulu, Barbers Point serviced the majority of foreign trade. The port of Kawaihae on the Island of Hawaii is used exclusively for transporting goods between the Hawaiian islands (Table 3.11-1).

The density of commercial vessel traffic is shown in Figure 3.11-4. Similar to military vessel traffic, commercial vessel traffic is also centered around Oahu, but more commercaial vessels use intra-island routes more frequently than military vessels. The highest densities of commercial vessel traffic are also mainly outside or along the perifery of military warning areas (Figure 3.11-4). The average relative density of commercial vessels in the Hawaii Range Complex was calculated as 0.0175 vessels per km^2, approximately 14 times greater than the average relative density of military vessels.

Table 3.11-1: U.S. Port Rankings and Cargo Volume for Hawaii Ports in 2016

Port Name	*National Rank*	*(Total Trade: Domestic and Foreign)*	*Total Domestic Trade*	*Total Foreign Trade*
		Volume (short tons)	*Volume (short tons)*	*Volume (short tons)*
Honolulu, Oahu	42	13,727,392	12,419,163	1,308,229
Barbers Point, Oahu	51	10,225,588	2,979,616	7,245,972
Kahului, Maui	84	3,858,176	3,837,241	20,935
Hilo, Hawaii	107	2,158,236	2,127,265	30,971
Kawaihae, Hawaii	114	2,009,661	1,994,854	14,807

Source: U.S. Army Corps of Engineers (2017)
Note: Rankings are out of a total of 150 ports.

The level of activity at a port and its economic benefit can also be measured by the number of vessel calls or port calls the port receives annually. A port call is the act of a vessel docking at a port to offload or take on cargo or passengers. In 2015, 723 port calls from privately owned, ocean-going merchant vessels over 1,000 gross tons and transporting various types of cargo occurred at four ports in Hawaii: Honolulu, Barbers Point, Kahului, and Hilo (U.S. Maritime Administration, 2016) (Table 3.11-2). No data on port calls at Kawaihae were available.

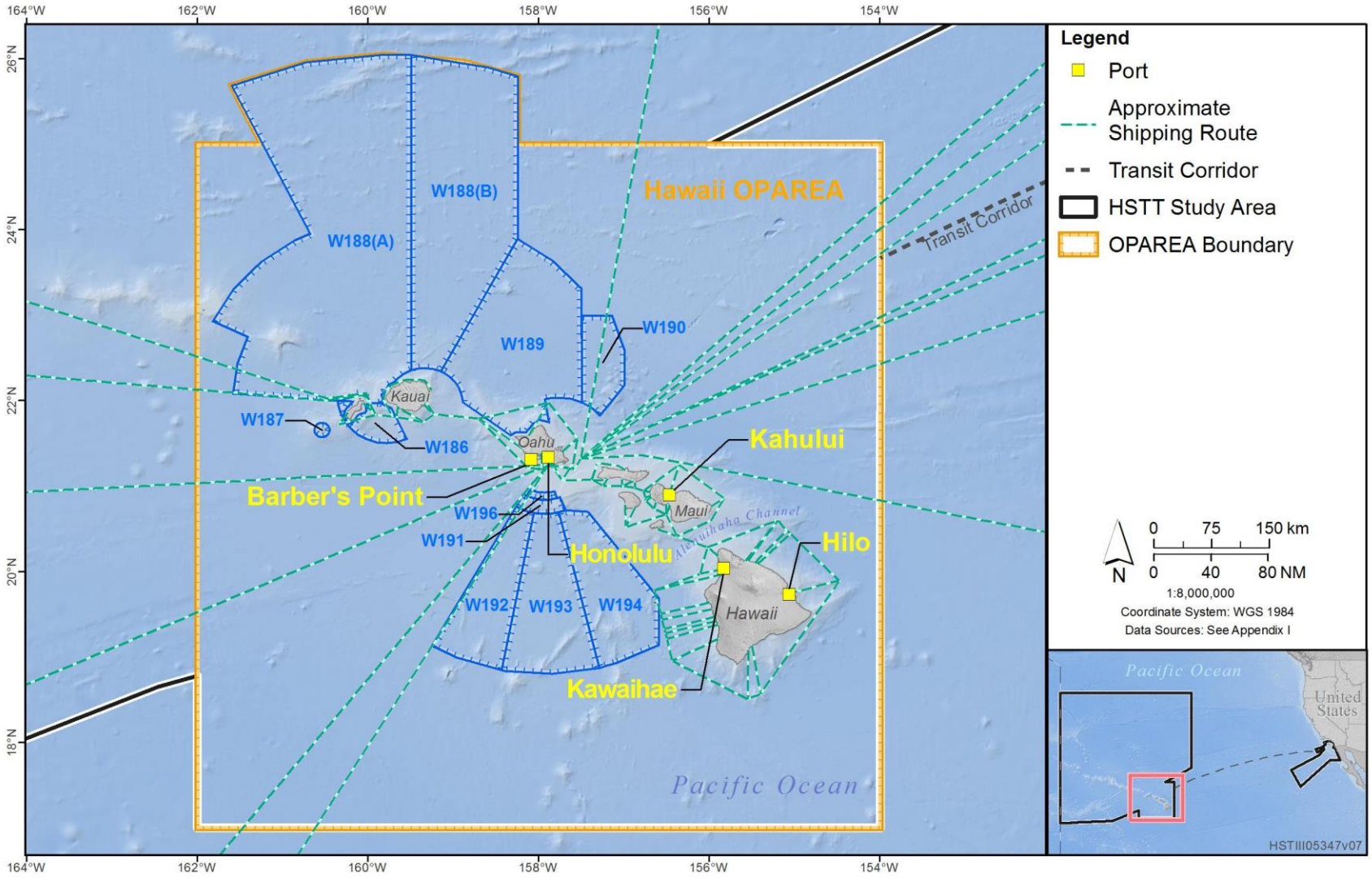


Figure 3.11-3: Main Hawaiian Islands Shipping Routes and Major Ports

Notes: OPAREA = Operating Area, HSTT = Hawaii-Southern California Training and Testing

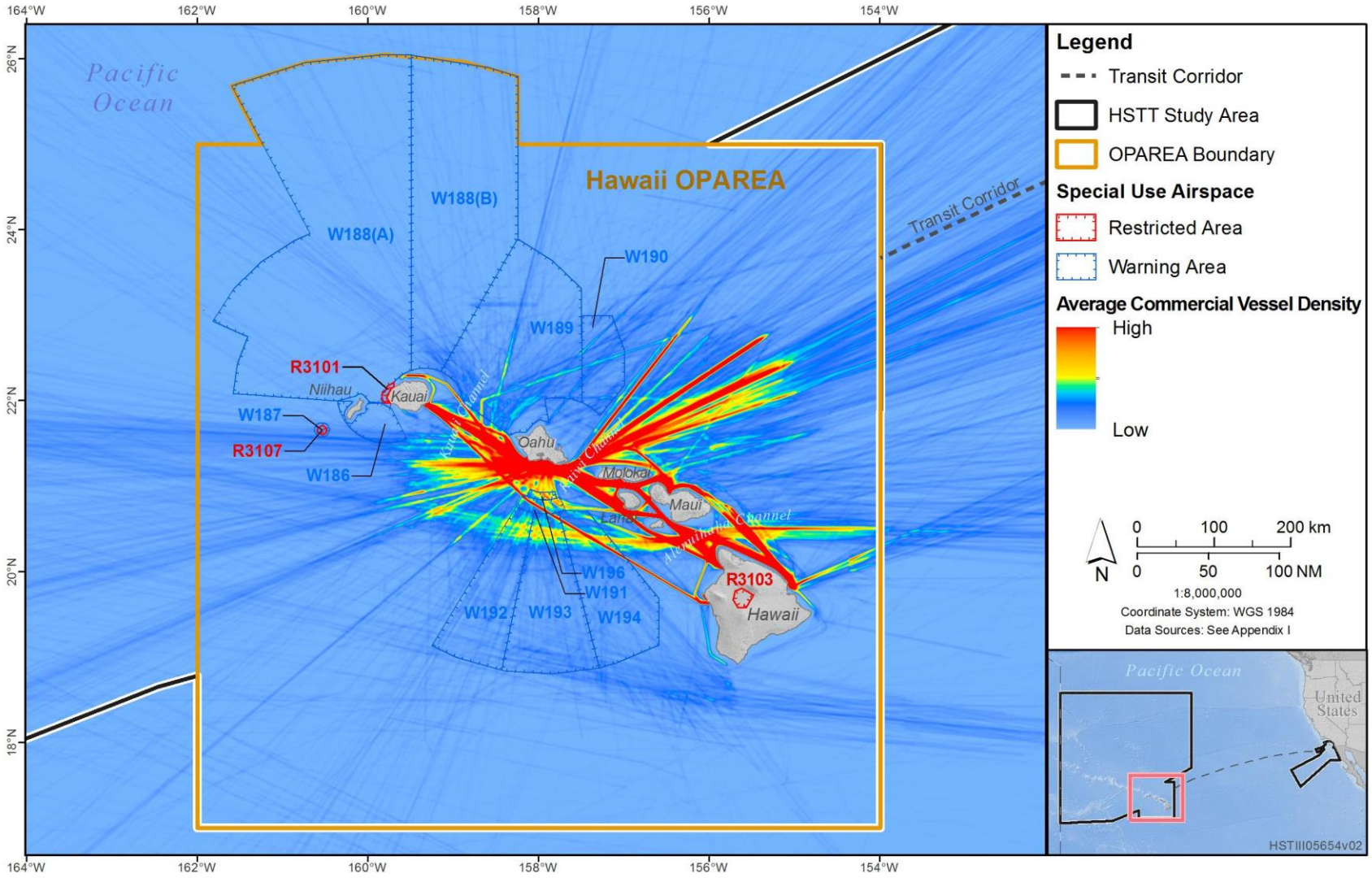


Figure 3.11-4: Relative Density of Commercial Vessel Traffic in the Hawaii Range Complex

Notes: OPAREA = Operating Area, HSTT = Hawaii-Southern California Training and Testing

Table 3.11-2: Ship Transits to and from Hawaii Ports by Privately Owned Ocean-Going Merchant Vessels over 1,000 Gross Tons in 2015

Port Name	*Total Ship Transits*	*Containers*	*Dry Bulk*	*Gas (LNG/LPG)*	*General Cargo*	*Roll-On/Roll Off*	*Tankers*
Honolulu	948	630	2	10	22	152	132
Barbers Point	382	0	76	22	0	0	284
Hilo	72	0	0	24	0	48	0
Kahului	44	0	0	0	0	44	
Total	**1,446**	**630**	**78**	**56**	**22**	**244**	**416**

Source: Ship transits based on port call data from U.S. Maritime Administration (2016)
Notes: LNG = Liquefied Natural Gas, LPG = Liquefied Petroleum Gas

Sixty-seven percent of port calls occurred at the port of Honolulu, with the vast majority of calls from container ships transporting twenty-foot container units containing various goods. The majority of port calls at Barbers Point were from tankers carrying petroleum products (U.S. Maritime Administration, 2016). The majority of port calls at Kahului and Hilo were roll-on/roll-off cargo, which consists of vehicles (e.g., cars, trucks, trailers) that can be driven on and off the vessel. The port of Honolulu processes the majority of Hawaii's domestic trade (e.g., from mainland U.S. ports), and the port of Barbers Point is the primary port used for foreign trade (Figure 3.11-5). The smaller ports on Maui and the island of Hawaii are used mainly for transporting goods between the islands. Primary shipping routes within the Main Hawaiian Islands and extending east to North America and west to Asia, primarily from Barbers Points, Oahu, are shown in Figure 3.11-3.

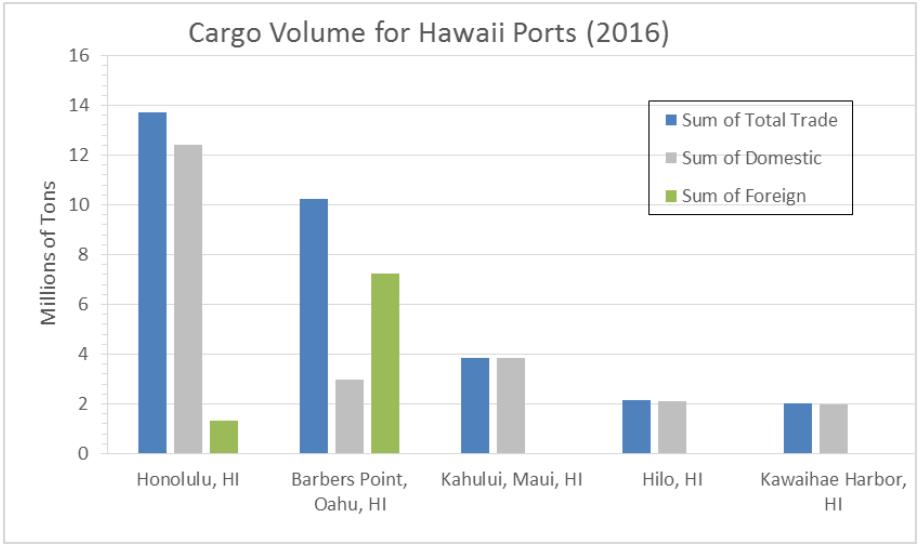


Figure 3.11-5: Cargo Volume of Hawaii Ports in 2016

Based on the assumption that every port call has two ship transits, one inbound and one outbound, over 1,400 ship transits of ocean-going merchant vessels occurred at the four Hawaii ports in 2015 (Table 3.11-2). Sixty-six percent of vessel transits were to and from Honolulu, 26 percent were routed through Barbers Point, and the remaining 8 percent were divided between the ports of Kahului and Hilo (U.S. Maritime Administration, 2016). The majority of vessel transits (66 percent) either to or from Honolulu were by container ships, followed by roll-on/roll-off vessels at 16 percent of the total number of transits. Nearly 75 percent of vessel vessels transiting through Barbers Point were tankers transporting bulk liquids and gas. Primarily roll-on/roll-off vessels transited to the ports of Kahului and Hilo (U.S. Maritime Administration, 2016).

3.11.2.1.1.2 Southern California Portion of the HSTT Study Area

Ocean shipping is a significant component of the Southern California regional economy. Key ports include Los Angeles, Long Beach, and, to a lesser degree, San Diego and Port Hueneme. Foreign trade far exceeds domestic trade at all four ports (Figure 3.11-6). Of 150 U.S. ports evaluated by the U.S. Army Corps of Engineers (2017), Long Beach and Los Angeles ranked seventh and ninth, respectively, in total trade (foreign and domestic) (measured in tons) in 2016. The Port of San Diego was ranked 125th and Port Hueneme ranked 124th in total trade. Total trade at Long Beach exceeded 77 million tons, and at Los Angeles was just over 62 million tons in 2016 (Figure 3.11-6 and Table 3.11-3). Total trade at San Diego and Port Hueneme was substantially lower at 1.6 million tons each in 2016. Even though trade volume was lower than Long Beach Los Angeles, foreign trade volume was substantially higher than domestic trade at Port Hueneme and San Diego. U.S. dependence on foreign trade emphasizes the importance of international shipping routes.

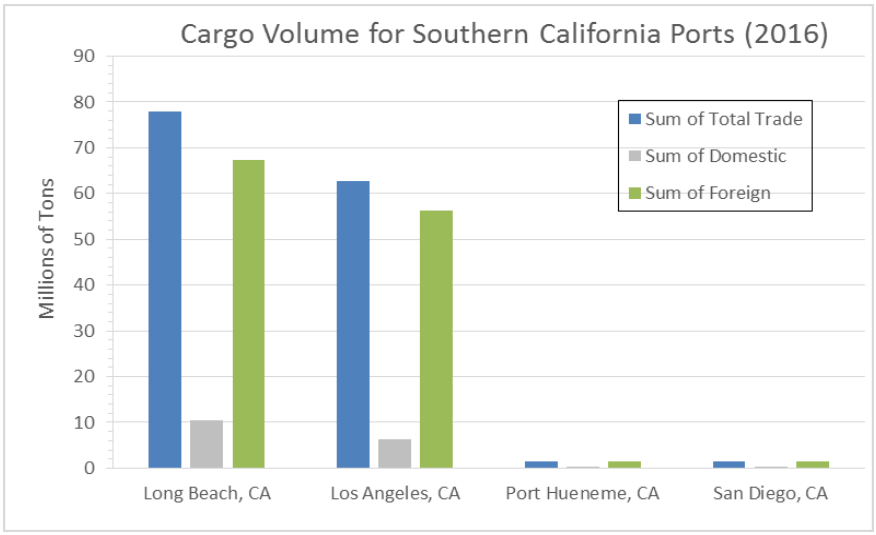


Figure 3.11-6: Cargo Volume of Southern California Ports in 2016

Table 3.11-3: U.S. Port Rankings and Cargo Volume for Southern California Ports in 2016

Port Name	*Total Trade (Domestic and Foreign)*		*Total Domestic Trade*	*Total Foreign Trade*
	Rank	*Volume (short tons)*	*Volume (short tons)*	*Volume (short tons)*
Long Beach	7	77,813,233	10,403,764	67,409,469
Los Angeles	9	62,615,644	6,329,811	56,285,833
Port Hueneme	124	1,581,649	12,991	1,568,658
San Diego	125	1,574,868	212,002	1,362,866

Source: U.S. Army Corps of Engineers (2017)
Notes: (1) Rankings are out of a total of 150 ports. (2) NR = Not Ranked

In 2015, nearly 4,500 port calls from privately owned, ocean-going merchant vessels over 1,000 gross tons and transporting various types of cargo occurred at four ports in Southern California: Long Beach, Los Angeles, San Diego, and Port Hueneme (U.S. Maritime Administration, 2016). Based on the assumption that every port call has two ship transits, one inbound and one outbound, approximately 9,000 ship transits of ocean-going merchant vessels occurred at the four ports in 2015 (Table 3.11-4 and Figure 3.11-7). Eighty-two percent of vessel transits were split equally between Long Beach and Los Angeles, and the remaining 18 percent were split almost evenly between San Diego and Port Hueneme. The majority of vessel (67 percent) transiting either to or from Los Angeles were container ships followed by tankers at 17 percent of the total number of transits. Port calls at Long Beach were more

diversified, with 50 percent from container ships, 27 percent from tankers, and 10 percent each from bulk carriers and roll-on/roll-off ships. Port Hueneme and San Diego make up only 17 percent of port calls in Southern California; however, more than 65 percent of roll-on/roll-off cargo ships use those two ports than to either Long Beach or Los Angeles.

Container ships, which make up half of the ship transits in Southern California, have been increasing steadily in size and capacity over the past 50 years (World Shipping Council 2016). The largest and newest container ships are over 1,300 ft. long and 180 ft. wide and capable of transporting over nineteen thousand 20-foot equivalent units or TEUs. These vessels are larger than the largest aircraft carriers, the Nimitz class, which are just over 1,000 ft. long, and can travel at approximately 23 knots. As discussed later in this section, over 4,500 transits of large container vessels far exceeds all Navy ship movements within San Diego Bay, including transits to the Southern California Range Complex.

Table 3.11-4: Ship Transits to and from Southern California Ports by Privately Owned Ocean-Going Merchant Vessels over 1,000 Gross Tons in 2015

Port Name	*Total Ship Transits*	*Containers*	*Dry Bulk*	*Gas (LNG/LPG)*	*General Cargo*	*Roll-On/Roll Off*	*Tankers*
Long Beach	3,670	1,840	376	0	118	358	978
Los Angeles	3,706	2,480	226	0	188	168	644
Port Hueneme	822	110	0	0	204	480	28
San Diego	770	158	18	0	78	494	22
Southern California	**8,968**	**4,588**	**620**	**0**	**588**	**1,500**	**1,672**

Source: Ship transits based on port call data from (U.S. Maritime Administration, 2016)
Notes: LNG =Liquefied Natural Gas, LPG = Liquefied Petroleum Gas

Both large and small vessels transit through the Southern California Range Complex to mainland ports and the Channel Islands. Major commercial shipping routes parallel the coastline, extending north to San Francisco, Seattle, Alaska, and Canadian ports and south to Central and South America. Transoceanic shipping routes extend westward from the major ports of San Diego, Long Beach, and Los Angeles to Hawaii. Shorter routes run perpendicular to the coastline and connect smaller ports with the major shipping routes and the offshore islands (Thomas et al., 2015) (Figure 3.11-7).

The majority of commercial shipping routes providing access to Long Beach and Los Angeles are located north of the Southern California Range Complex, including the most direct route to Hawaii. Shipping routes extending south from Long Beach and Los Angeles to and from the Panama Canal and South America pass through the nearshore portion of the Southern California Range Complex as do routes providing access to San Diego (U.S. Department of the Navy, 2015).

Smaller commercial and recreational vessels are more commonly found within several miles from shore and less frequently transit the offshore shipping lanes or to San Clemente Island, with the exception of recreational fishing (i.e., charter) and commercial fishing vessels traveling to deep water fishing sites. Recreational fishing is described in Section 3.11.2.2 (Commercial and Recreational Fishing).

Maritime vessel traffic routes in the Southern California portion of the HSTT Study Area access major Southern California ports (e.g., Long Beach) as well as numerous smaller ports along the U.S. coast. In addition to routes traveled by large commercial vessels, other routes provide access to and from marinas, mooring locations, fishing harbors, and military installations located both along the mainland and on offshore islands (Figure 3.11-7). San Diego Bay is bordered by the cities of San Diego, National City, Chula Vista, Imperial Beach, and Coronado, all of which provide vessels with access to the Bay. The

Silver Strand Boat Lanes located on the ocean side of the Silver Strand portion of the Southern California Range Complex are commonly used by sport fishing charters, bait fishing in support of sport fishing, lobster fishing, and competition sailing regattas. Vessels enter and exit the harbor through the mouth of the Bay located at the north end of the Bay or through the many marinas and boat launch facilities located along the perimeter of the Bay.

The density of commercial vessel traffic is shown in Figure 3.11-8. The highest densities of commercial vessel traffic are centered on the ports of Long Beach and Los Angeles which are located north of the Southern California portion of the HSTT Study Area, and the highest density of military vessel traffic is centered on the port of San Diego (Figure 3.11-2). Commercial vessels appear to follow three primary routes to and from the ports of Long Beach and Los Angeles, two of which pass either north or south of the Channel Islands and proceed north. The thrd heavily traveled route with high a high density of vessel traffic leads south along the coastline approximately 25 NM from shore (Figure 3.11-8). The average relative density of commercial vessels in the Southern California portion of the HSTT Study Area was calculated as 0.5003 vessels per km^2, approximately 150 times greater than the average relative density of military vessels.

The Port of San Diego records port calls by commercial vessels that are not captured in the U.S. Maritime Administration (2016) data, which only reports on vessels over 1,000 gross tons. From 2011 through 2015, the Port of San Diego recorded an average of 557 port calls (or 1,114 vessel transits) of commercial vessels accessing the port. The number of annual transits over the five-year period has remained consistent; however, some trends by vessel category are apparent, including a decline in the number of barges and passenger vessels using the port, and an increase in the number of bulk carriers and vehicle carriers (Holles et al., 2013).

From 2011 through 2015, an average of 1,898 Navy ship transits occurred between Navy piers in San Diego Bay and the Southern California Range Complex as well as within San Diego Bay (e.g., from one pier to another). Overall, there was a slight decline in the number of annual ship transits and movements by Navy vessels within the Bay over the five-year period. In addition to commercial and military vessels, San Diego Bay supports a large number of privately owned vessels that travel within the Bay and into offshore waters. In 2014, nearly 52,000 boats were registered in San Diego County as pleasure craft (Laland et al., 2003). Additional information on recreational fishing and tourism activities are discussed below.

3.11.2.1.1.3 Transit Corridor

Major commercial shipping vessels use the transit corridor for shipping goods between Southern California and Hawaii, because it is the shortest distance between these two points (see Description of Proposed Action and Alternatives, Figure 2.1-1). Vessels using this corridor are outside of military training areas and typically follow all U.S. Coast Guard maritime regulations. The Navy also uses this corridor for training and testing activities while en route between Southern California and Hawaii.

3.11.2.1.2 Air Transport

Air transport refers to movements of aircraft through airspace. Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. Accordingly, regulations applicable to all aircraft are set by the Federal Aviation Administration to define permissible uses of designated airspace, and to control that use. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation.

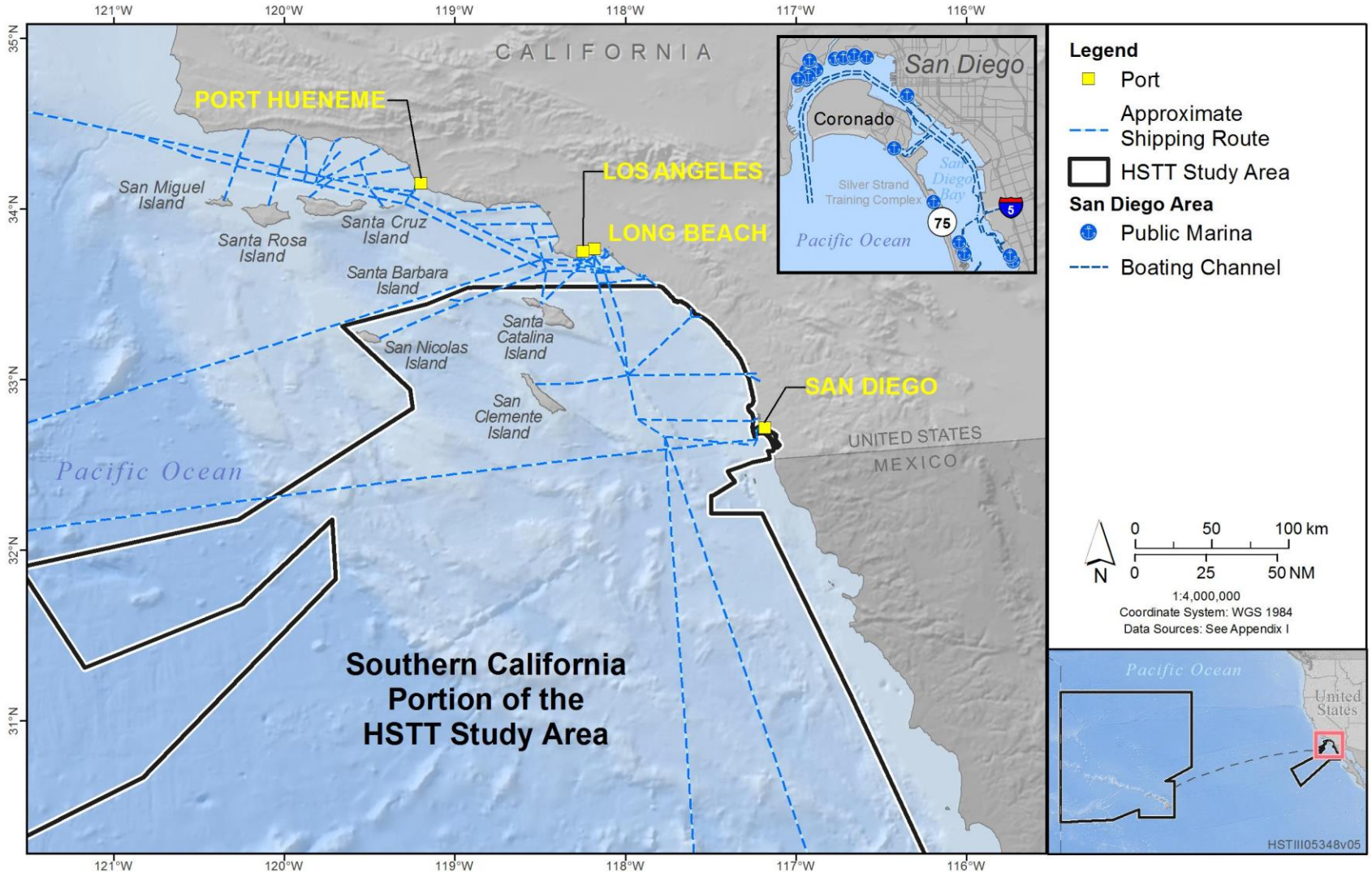


Figure 3.11-7: Shipping Routes and Major Ports in the Southern California Portion of the HSTT Study Area

Note: HSTT = Hawaii-Southern California Training and Testing

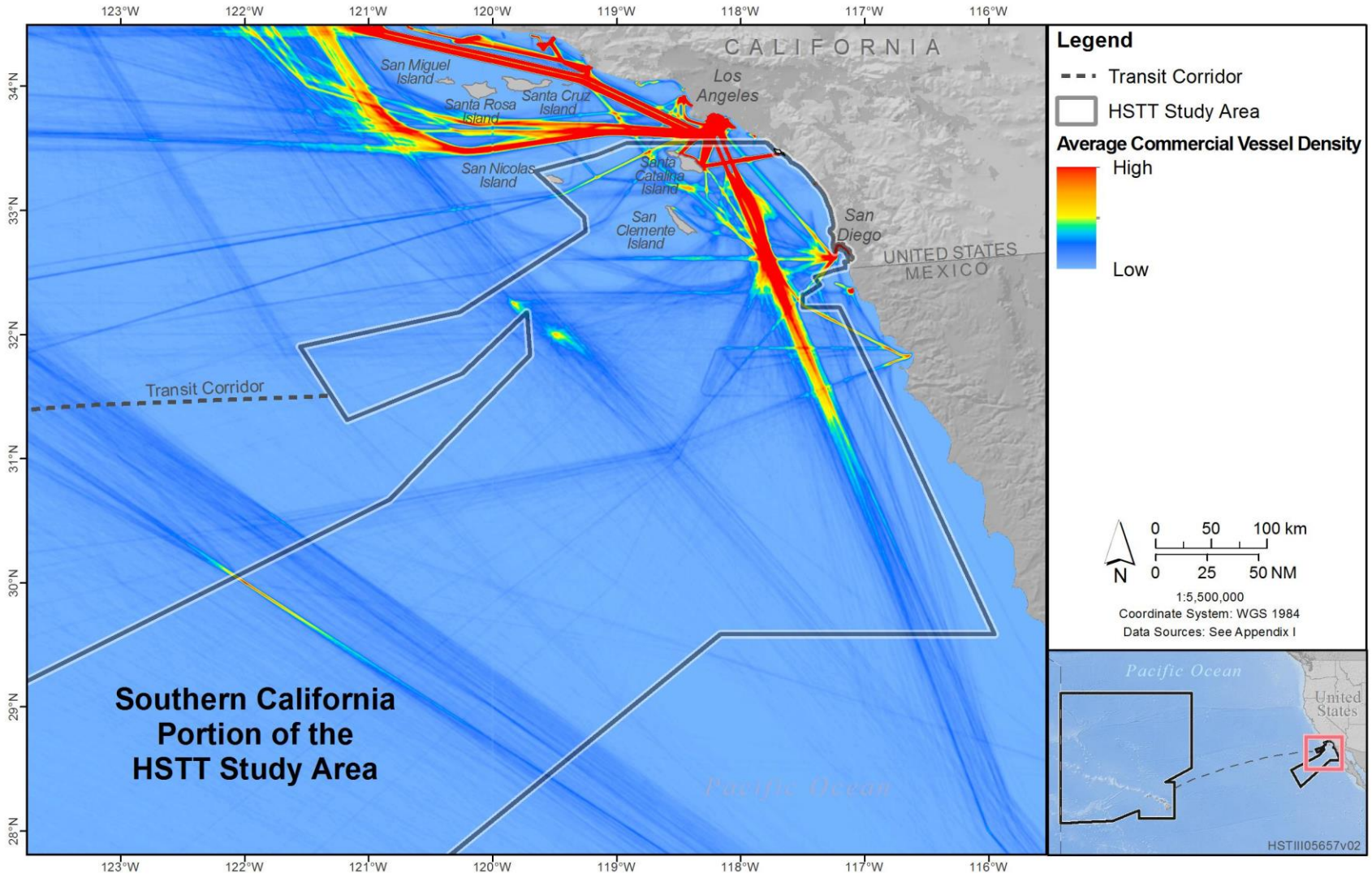


Figure 3.11-8: Relative Density of Commercial Vessel Traffic in the Southern California Portion of the HSTT Study Area

Note: HSTT = Hawaii-Southern California Training and Testing

The system of airspace designation uses various definitions and classifications of airspace in order to facilitate control. Airspace is categorized generally as either "controlled" airspace or "uncontrolled" airspace. Controlled airspace is further organized into several different classes of airspace distinguished by altitude range, use (e.g., commercial or military), and proximity to a major airport. Controlled airspace means that services are available to support aircraft flying under Instrument. Such services include air-to-ground radio communication, navigational aids, and air traffic control services for maintaining separation between aircraft. Controlled airspace does not mean that all flights are controlled by air traffic control.

Special use airspace consists of both controlled and uncontrolled airspace and has defined dimensions where flight and other activities are confined because of their nature and the need to restrict or prohibit non-participating aircraft for safety reasons. Special use airspace is established under procedures outlined in 14 CFR part 73.1. The majority of special use airspace is established for military flight activities and, with the exception of prohibited areas (e.g., over the White House), may be used for commercial or general aviation when not reserved for military activities. There are multiple types of special use airspace, including prohibited, restricted, warning, alert, and military operations areas (Sterling & Summers, 1978). One type of special use airspace, of particular relevance to the Study Area, is a warning area, which is defined in 14 CFR part 1 as follows:

> "A warning area is airspace of defined dimensions, extending from 3 NM outward from the coast of the United States that contains activity that may be hazardous to non-participating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."

Warning areas are established to contain a variety of hazardous aircraft and non-aircraft activities, such as aerial gunnery, air and surface missile firings, bombing, aircraft carrier operations, surface and subsurface operations, and naval gunfire. When these activities are conducted in international airspace, the Federal Aviation Administration regulations may warn against, but do not have the authority to prohibit, flight by non-participating aircraft. A restricted area is a type of special use airspace within which non-military flight activities are closely restricted.

While some special use airspace is available for daily use by the military for a designated time period (e.g., from 6:00 am to 6:00 pm), other airspace is only activated by issuing Notices to Airmen several hours in advance of the military activity.

Open-ocean Air Traffic Control Assigned Airspace within the Study Area is used for military training and testing activities, from unit-level training to major joint exercises. Air Traffic Control Assigned Airspaces are activated for short periods to cover the time frames of training and testing activities (U.S. Department of the Navy, 2015).

3.11.2.1.2.1 Hawaii Range Complex

Military Air Transit

Several types of special use airspace are designated in the Hawaii Range Complex (Figure 3.11-9). Warning area W-188 and restricted airspace R-3101 are located north and west of Kauai, and W-186 is located southwest of Kauai. These airspaces are controlled by the Pacific Missile Range Facility located on the western shores of Kauai. The warning areas W-188 A/B, W-189 and W-190 north of Oahu; W-187 and R-3107 surrounding Kaula Island; and W-191, W-192, W-193, W-194, and W-196 south of Oahu are scheduled through the Navy Fleet Area Control and Surveillance Facility Pearl Harbor, which coordinates with commercial air traffic control facilities.

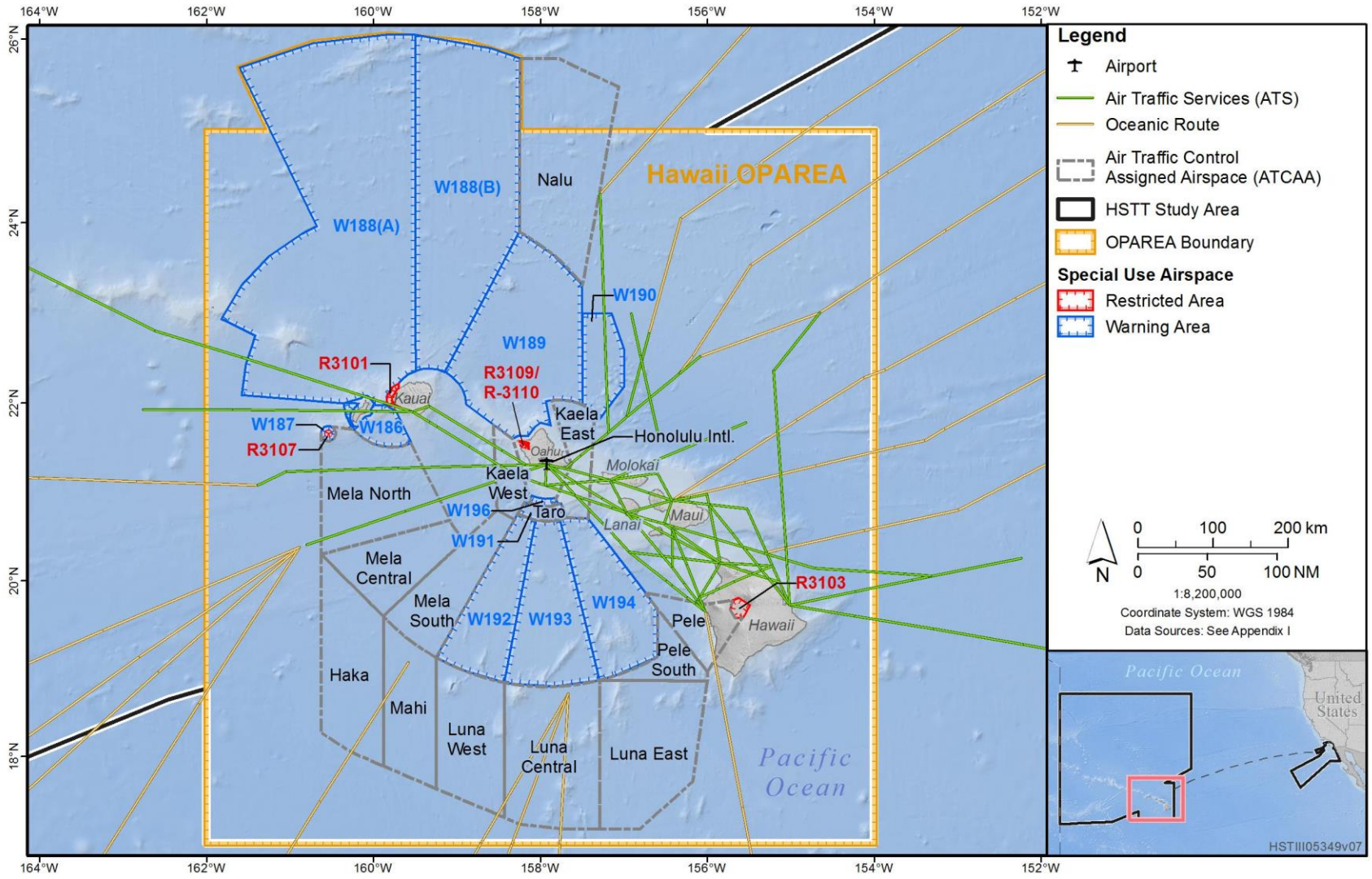


Figure 3.11-9: Air Traffic Routes and Special Use Airspace in the Hawaii Range Complex

Special use airspace often has altitude limitations. The following warning areas and restricted area airspace are available from the surface to an unlimited altitude: W-188, W-189, W-190, W-192, W-193, W-194, and R-3101. Warning area W-191 is available from the surface to 3,000 ft. above sea level, and W-196 is used only for surface and helicopter operations and is available from the surface to 2,000 ft. Warning area W-187 and R-3107 are available from the surface to 18,000 ft., and W-186 is available up to 9,000 ft. R-3103 is available from the surface to 30,000 ft.

There are also 12 Air Traffic Control Assigned Airspace areas within the Hawaii Range Complex, which provide additional controlled airspace adjacent to and between the warning areas for military use. While there is some overlap with warning areas, most civilian and commercial air traffic routes approach from the east and west of the Main Hawaiian Islands, while airspace used by the military is located north and south of the islands (Figure 3.11-9).

Commercial and General Aviation

Airspace within the Hawaii Range Complex includes several high-altitude commercial air traffic routes (Figure 3.11-9). Most oceanic routes used by commercial aircraft enter the Hawaii Range Complex from the northeast and southwest and are generally outside the warning areas described above. The Air Traffic Services routes used by smaller aircraft for transit between the islands are concentrated along the Main Hawaiian Islands and also have limited overlap with warning areas.

Most of the airspace within the Study Area is considered international airspace, and air traffic is managed by the Federal Aviation Administration Honolulu Control Facility, which is comprised of the Air Route Traffic Control Center, the Honolulu Control Tower, and the Combined Radar Approach Control collocated in a single facility.

3.11.2.1.2.2 Southern California Range Complex

Military Air Transit

The Southern California Range Complex contains three warning areas: W-290, W-291, and a small portion of W-289. Each warning area extends from the surface to 80,000 ft. above sea level (Figure 3.11-10). The warning areas can be activated by the Federal Aviation Administration at the Navy's request when operations that would pose a hazard to non-participating aircraft are being conducted. Other special use airspace within W-291 includes nine tactical maneuvering areas and two missile ranges.

Military pilots travel under Instrument Flight Rules from local air bases until they reach W-291 and proceed under Visual Flight Rules to their instructed tactical maneuvering areas or missile range OPAREA. Activation by the Federal Aviation Administration is performed by notifying the controlling air traffic agency of the change in status in the area. This allows the agency to issue notices to pilots to alter their courses to avoid military activities.

In the annual utilization report issued by the Fleet Area Control and Surveillance Facility San Diego for fiscal year 2015 (October 1, 2014 through September 30, 2015) there were 30,800 air and surface operations in Southern California warning areas, excluding operations that use the Naval Auxiliary Landing Field at San Clemente Island (see Figure 3.11-10).

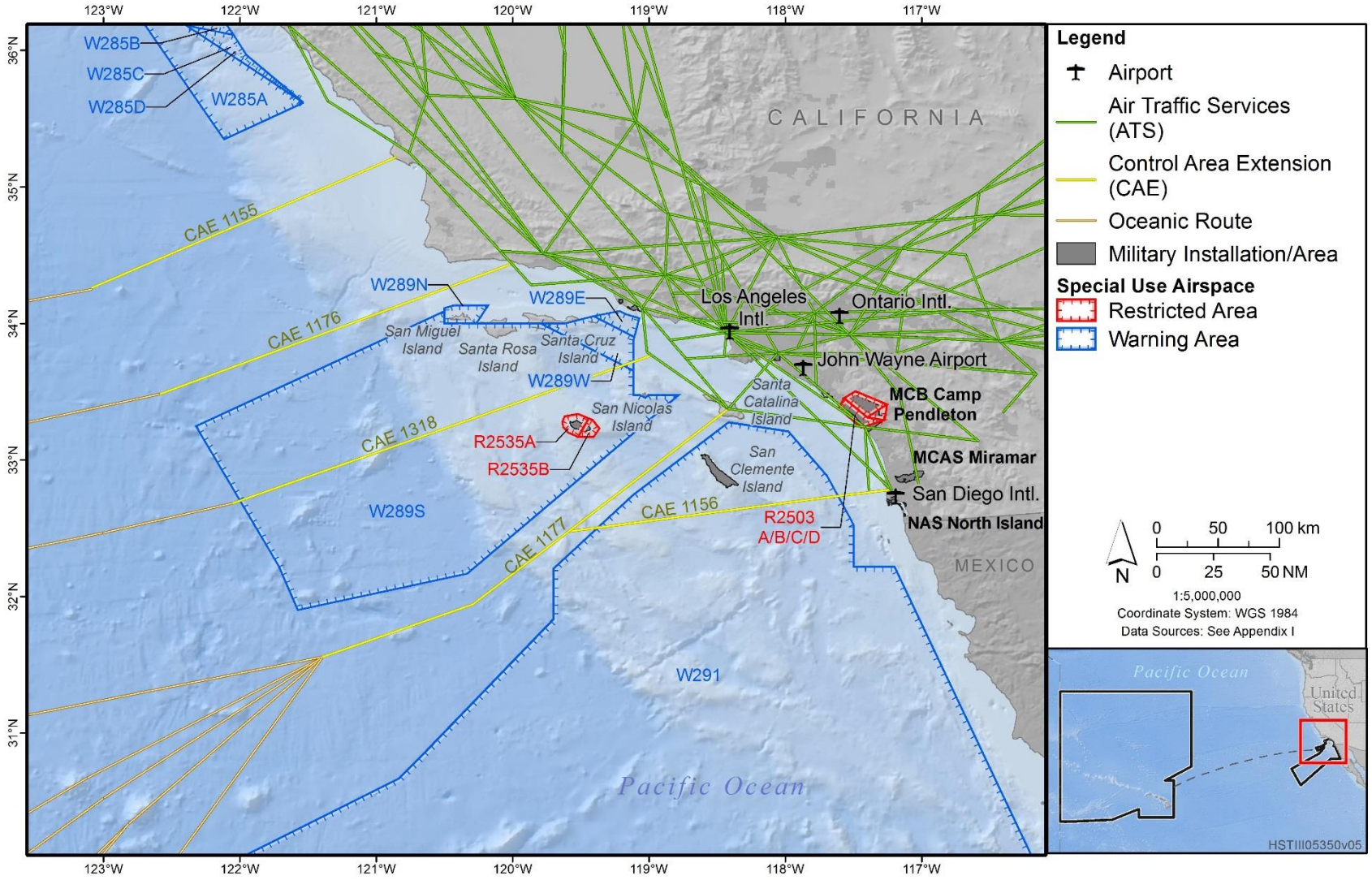


Figure 3.11-10: Air Traffic Routes and Special Use Airspace in the Southern California Portion of the HSTT Study Area

Notes: NAS = Naval Air Station, MCAS = Marine Corps Air Station, MCB = Marine Corps Base, Intl. = International

The Study Area off the coast of Southern California contains a restricted area over San Nicolas Island, R-2535 A/B, which is located within the Pt. Mugu Sea Range. Restricted area R-2535 A/B is designated from the surface to 100,000 ft. Restricted area R-2503 A/B/C/D overlays Marine Corps Air Station Camp Pendleton, but is located outside of the Study Area. Other types of special use airspace are found within the Southern California Range Complex OPAREAs, including missile ranges and tactical maneuvering areas. The Naval Auxiliary Landing Field at San Clemente Island is located within W-291 airspace. Class D airspace has been established to support safe and efficient air transit to Naval Auxiliary Landing Field San Clemente Island. Class D airspace is airspace tailored to the specific needs of the airport to ensure separation between aircraft. The airspace above San Clemente Island is defined by a 5 NM radius circle centered on the Fleet Area Control and Surveillance Facility and includes the airspace from the surface to 2,700 ft.

Military overflights in support of activities at the Silver Strand portion of the Southern California Range Complex are based out of Naval Air Station North Island and Navy Outlying Landing Field Imperial Beach. The airspace over both facilities is classified as Class D airspace defined by a 5 NM radius and extending to 2,800 ft. over Naval Air Station North Island and to 1,500 ft. over Navy Outlying Landing Field Imperial Beach. The two airspaces, which are under Navy control, extend over the Silver Strand portion of the Southern California Range Complex and much of San Diego Bay and the surrounding area. Air operations in support of training at the Southern California Range Complex, including helicopter insertions and extractions as well as decelerator/parachute drops into designated drop zones, must comply with the Navy Air Operations Manual. Flight paths servicing nearby San Diego Airport are geographically separate from helicopter sorties bound for training areas at the Silver Strand portion of the Southern California Range Complex and approach and departure patterns for fixed-wing aircraft into Naval Air Station North Island.

Commercial and General Aviation

Aircraft operating under Visual Flight Rules can fly along the coast between San Diego and Orange County and out to Santa Catalina Island largely unconstrained, except by safety requirements and mandated traffic flow requirements. Aircraft operating under Instrument Flight Rules clearances, authorized by the Federal Aviation Administration, normally fly on the airway routes. In Southern California, these include both high and low altitude routes between San Diego and Los Angeles and offshore to Santa Catalina Island (Figure 3.11-10).

Control area extension air routes from Southern California provide access to overseas air routes to Hawaii and onto other transpacific locations. Control area extension 1156 extends west from San Diego through the northern portion of W-291. When W-291 is active, control area extension 1156 is normally closed. Control area extension 1318 extends west from Los Angeles and Los Angeles International Airport and crosses airspace in the Point Mugu Sea Range, north of the HSTT Study Area. Control area extension 1177 extends from Santa Catalina Island southwest between W-291 and W-289S, crossing the northernmost part of the Southern California portion of the HSTT Study Area. Control area extension 1177 is closed only when weapons hazard patterns extend into the area, and this closure is fully coordinated with the Federal Aviation Administration. Established air routes enable general aviation and commercial air traffic to coordinate air travel with military operations.

When W-291 is active, aircraft on Instrument Flight Rules clearances are precluded from entering W-291 by the Federal Aviation Administration. However, since W-291 is located entirely over international waters, non-participating aircraft operating under Visual Flight Rules are not prohibited from entering the area. Examples of aircraft flights of this nature include light aircraft, fish spotters, and whale watchers, which occur under Visual Flight Rules throughout W-291 on a variable basis.

San Diego International Airport is located north of Naval Air Station North Island. Commercial and general aviation air traffic is controlled by the San Diego Air Route Traffic Control Center, and Navy Air Traffic Control manages military air traffic in the region. Approach and departure routes servicing San Diego International Airport are separate from routes used by Navy aircraft traveling to training areas at the Silver Strand portion of the Southern California Range Complex and Naval Air Station North Island.

Congestion in the Southern California Range Complex airspace is projected to increase over the next the next 25 years as the demands on commercial, military, and general aviation aircraft continue to expand. Commercial air traffic at San Diego International Airport and Los Angeles International Airport, the two largest airports in the region, is expected to grow by approximately 2 percent per year through 2040. Navy air operations in the Southern California Range Complex are also projected to increase over the next five years as the requirements for unmanned aerial system training flights, hellfire missile exercises, and bombing exercises increase to meet mission requirements (U.S. Department of the Navy, 2015).

3.11.2.1.2.3 Transit Corridor

There are numerous commercial air routes over the transit corridor between Southern California and Hawaii. Commercial aircraft typically fly above 30,000 ft. during transoceanic flight. These air routes are controlled by the Federal Aviation Administration.

3.11.2.2 Commercial and Recreational Fishing

Commercial and recreational fishing takes place throughout much of the Study Area from waters adjacent to the mainland and offshore islands to offshore banks and deep waters far from land. Many different types of fishing gear are used by commercial and recreational fishers in the Study Area, such as gillnets, longline gear, troll gear, trawls, seines, traps or pots, harpoons, and hook and line (U.S. Department of the Navy, 2005, 2015). Many fishing activities are seasonal and occur at varying degrees of intensity and duration throughout the year.

Commercial and recreational fishing is subject to state and federal regulations and laws. The U.S. Coast Guard enforces regulations of the U.S. commercial fishing fleet. The National Oceanic and Atmospheric Administration's Office of Law Enforcement enforces domestic laws and international treaty requirements designed to ensure global fisheries resources are maintained at healthy levels for the future. As part of that effort, the National Marine Fisheries Service assesses the status of fisheries stocks to assist marine resources managers in maintaining sustainable fisheries as well as healthy ecosystems and productive coastal communities. Fisheries stock assessment reports contain information on the status of the stock, such as the annual and historic catch, and, if a stock is depleted, the steps required to rebuild a healthy stock capable of sustaining commercial and recreational fisheries.

The management of fisheries is conducted on a regional basis to allow participatory governance by knowledgeable people with a stake in fishery management. Eight regional fishery management councils are responsible for developing fishery management plans (or fishery ecosystem plans, depending on the region) for the fisheries in their jurisdiction. The plans focus on the status of the fishery in waters seaward of state waters within each region. Fishery management plans describe a variety of

management tools, including geographic and seasonal fishery closures, catch limits and quotas, size and age limits, gear restrictions, and access controls to manage the fishery resources. Nationwide, 44 fishery management plans provide a framework for managing the harvest of 230 major fish stocks or stock complexes that make up 90 percent of the commercial harvest. Other species, designated as highly migratory species in fisheries regulations, such as tunas, swordfish, sharks, and billfish are found throughout the Pacific Ocean and migrate across council jurisdictional boundaries. Regional offices of the National Marine Fisheries Service manage these species and engage stakeholders and governmental groups in the management of these species at both domestic and international levels.

Although the goals are similar, a fishery ecosystem plan uses an ecosystem-based management approach to control harvests of marine resources, including fisheries, based on information describing the structure and function of the ecosystem where harvesting occurs. The National Oceanic and Atmospheric Administration defines an ecosystem approach as "management that is adaptive, specified geographically, takes account of ecosystem knowledge and uncertainties, considers multiple external influences, and strives to balance diverse social objectives." Fisheries in the SOCAL portion of the Study Area are managed by the Pacific Fishery Management Council and use a fishery management plan. Fisheries in the Hawaii portion of the Study Area are managed by the Western Pacific Fishery Management Council under a fisheries ecosystem plan.

Determining whether a catch is considered a commercial or recreational catch depends on how the catch is used. A catch is considered commercial if sold for profit at the port (e.g., to a processor). While a chartered recreational fishing trip results in a commercial gain for a charter boat captain, the catch is retained by the fisher and is not sold at the port for a profit. Therefore, the catch is considered recreational. Commercial fishers often target more than one species and land their catch in multiple ports, depending on the season, to maximize their economic return. Recreational fishers primarily use hook and line (also referred to as rod and reel or pole and line), and a small number also use spearfishing gear (Southwick Associates, 2013).

The National Marine Fisheries Service (NMFS) Office of Science and Technology maintains commercial landing data derived from comprehensive surveys of all coastal states' landings (National Marine Fisheries Service, 2015c).

3.11.2.2.1 Hawaii Range Complex

3.11.2.2.1.1 Commercial Fishing

The data that individual fishers report on commercial fishing reports are confidential, protected by Hawaii state law (189-3, Hawaii Revised Statutes), and can only be released to the public in summarized form. Major fisheries in Hawaiian waters include tuna, billfish, bottom fish, other species of pelagic fish, and a smaller invertebrate fishery. Commercial landings for all fisheries in 2015 in Hawaiian waters exceeded 36 million pounds (lb.) and were valued at $111 million (Table 3.11-5). Landings can be different from the catch, because the catch may include discarded fish that are not brought to port. The value of commercial landings has increased dramatically since the late 1980s (Figure 3.11-11). Between 1948 and 1980, the value for all fisheries combined was less than $1 per pound, and reached a peak of approximately $13 million by 1978. Between 1988 and 1993 the value of landings for all species increased from approximately $22 million to $73 million—an increase of over 230 percent over five years—and the price per pound increased to $2.51. After plateauing in the mid to late 1990s, the total value of all fisheries has increased steadily since 2001, peaking in 2012 at $112 million, which equates to

about $3.50 per lb. (Figure 3.11-11). The increasing value of commercial fisheries over the past two decades is indicative of its increasing importance to the Hawaiian economy.

Table 3.11-5: Commercial Landings (Pounds) and Value (Dollars) Organized by Major Species Groups for Hawaii in 2015

Major Species[1]		*Landings (pounds)*
Pelagic Fish Species	Tuna (yellowfin, skipjack, albacore, bigeye, other scombrids)	23,612,899
	Billfish (blue marlin, striped marlin, swordfish)	4,709,062
	Other (mahi, mackerel scad, bigeye scad, wahoo)	2,898,055
Benthic Fish Species	Bottomfish (opakapaka, onaga, uku)	260,718
All Other Fish Species		5,142,959
	Total Fish	**36,604,432**
Invertebrates	Spiny Lobster	4,314
	Saltwater Shrimp	14,947
Totals	**Total Invertebrates**	**19,261**
	Combined Total	**36,642,954**
	Dollar Value of Combined Total	**$110,884,644**

[1]Species specific data are not available for all pelagic and bottomfish species (e.g., sharks). Totals for these species are captured under All Other Fish Species. Source: Pacific Islands Fisheries Science Center (2016)

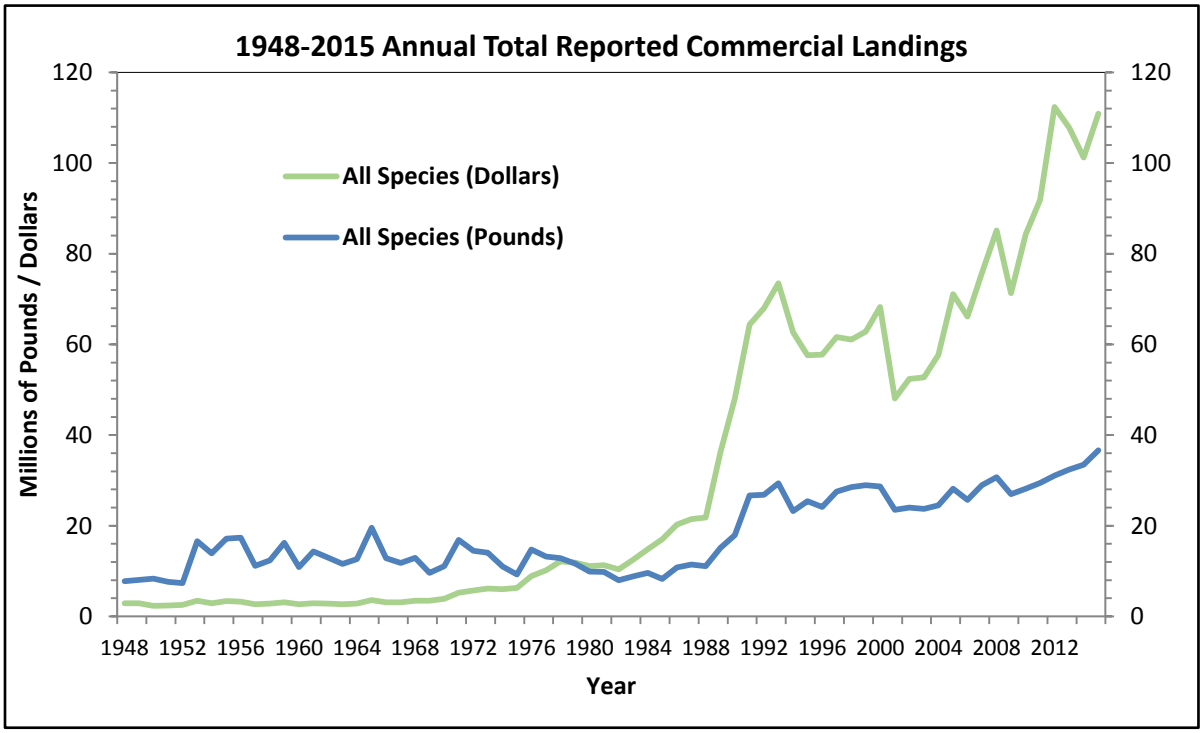


Figure 3.11-11: Annual Reported Commercial Landings for All Species in Hawaii (1948–2015)

Fishing regulations in Hawaii restrict the use of different types of fishing gear geographically and seasonally. Longline fishing gear can only be used beyond 50 NM from shore off the islands of Maui, Lanai, Kahoolawe, and Hawaii and beyond 75 NM from shore around the islands of Kauai and Oahu (National Marine Fisheries Service, 2010). However, from October through January, the boundaries of the fishing exclusion areas shift landward, and longline fishing gear is only restricted out to 25 NM off the windward side of all Hawaiian Islands, with the exception of Oahu where longline fishing is restricted out to 50 NM from shore. Trolling generally occurs within 20 NM of shore and can occur year round off every Hawaiian Island but can be limited by weather in fall and winter. Popular trolling areas include seamounts, convergence zones (where ocean currents come together and drive productivity), near weather buoys, and fish aggregating devices. Hook and line fishing from boats occurs year round off all major islands from shore out to about 20 NM. Bottom fishing primarily occurs in state waters (within 3 NM) where the slope of the seafloor drops off. Beyond 3 NM, bottom fishing occurs at banks, which rise up from the seafloor and attract target species (e.g., snapper species). Popular bottom fishing sites include Penguin Bank, located west of the island of Molokai, and Middle Bank, located northwest of Kauai. Bottom fishing can occur year round, but destructive gear, including trawl nets and bottom set gill nets, are prohibited, and bottom fishing vessels must be registered (50 CFR 665.206). Lobster fishing is prohibited within 20 NM of Laysan Island and landward of 10 fathoms as shown on the National Ocean Survey Charts, numbers 19022, 19019, and 19016 (50 CFR 665.251, Closed Areas). The Papahanaumokuakea Marine National Monument in the Northwest Hawaiian Islands has closed all Northwest Hawaiian Islands Fisheries within its boundaries (0–200 NM) since it was expanded in August 2016.

3.11.2.2.1.2 Recreational Fishing

Hawaii has not consistently collected data on recreational marine fishing, although surveys have been conducted. In 2001, NMFS and the Hawaii Division of Aquatic Resources began collecting data on recreational fishing in Hawaii using the Marine Recreational Fishing Survey. Hawaii does not have a mandatory recreational marine fishing license as many other coastal states do and does not have mandatory reporting of recreational catches (Hawaii Division of Aquatic Resources, 2015). The NMFS Office of Science and Technology maintains a database of statistical data on recreational fishing practices in coastal states (National Marine Fisheries Service, 2018). The data are acquired through a variety of surveys which are tailored to the different types of recreational fishing conducted in each state or region. The surveys collect data from those who fish from shore using hook and line, off private boats, and boats for hire, which includes charter boats, party boats, and guide boats.

From 2013 through 2017, recreational fishers caught over 19 million fish in marine and estuarine waters in Hawaii (Figure 3.11-12). Approximately 17.5 million were harvested for consumption or to be used as baitfish, and 2 million were released live after being caught. The total catch and harvest increased steadily from 2013 through 2015, but then decreased by almost half in 2016. Preliminary data for 2017 show an increase over the 2016 harvest. The percent released each year fluctuated between 7 and 13 percent of the total catch and is apparently independent of the trend in the overall catch (e.g., over 13 percent of the catch was released in 2016 despite the steep decline in the total catch).

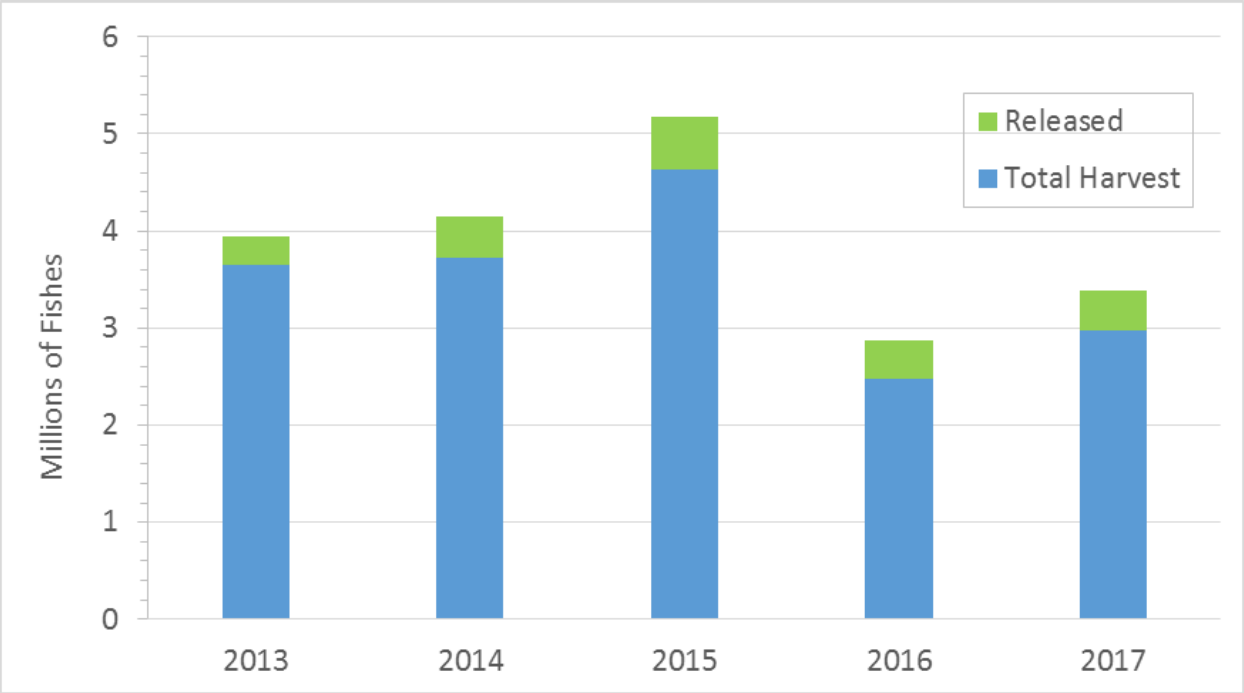


Figure 3.11-12: Annual Recreational Catch in Hawaii (2013–2017)

The five species caught most often by recreational fishers from 2013 to 2017, measured by the number of fish, were: Bigeye scad, yellowstripe goatfish, goldspot herring, skipjack tuna, and bluefin trevally (Table 3.11-6) (National Marine Fisheries Service, 2018). Excluding the scad and herring, which are considered baitfish, the top five species harvested for consumption include the yellowfin tuna and mackerel scad, sixth and seventh overall in number of fish caught. Measured by weight, the largest harvests were for yellowfin tuna, skipjack tuna, dolphinfish, wahoo, bigeye tuna, and bigeye scad (National Marine Fisheries Service, 2015b). The catch data show that the tuna fishery, in particular, is important to both commercial and recreational fishers.

Changes from year to year in the number of fish caught does not vary consistently across species. While the overall catch of all species increased steadily through 2015 before declining in 2016 (Figure 3.11-12), the top five species don't necessarily follow the same trend, indicating that target species may vary from year to year. For example, even though the overall catch increased from 2013 to 2014, the catch for bigeye scad, yellowstripe goatfish, and skipjack tuna all decreased (Table 3.11-6). Contributing factors influencing the number of each species caught in any given year may include changes in oceanic conditions that affect species abundance and availability, the selection of fishing destinations, fluctuations in tourism, species preference, and local or federal regulations affecting access to fishing spots.

Table 3.11-6: Annual Catch by Recreational Fishers in Hawaii of the Top Species Ranked by Number of Fish Caught from 2013 to 2017

Year	*Catch (Number of Fish)*						
	Bigeye Scad	*Yellowstripe Goatfish*	*Goldspot Herring*	*Skipjack Tuna*	*Bluefin Trevally*	*Yellowfin Tuna*	*Mackerel Scad*
2013	812,303	791,789	32,315	380,206	124,597	149,878	79,117
2014	731,985	380,072	366,878	199,118	269,168	220,200	166,886
2015	1,036,362	761,752	504,200	268,506	294,649	293,579	209,361
2016	545,664	208,559	319,513	89,790	122,855	85,975	147,769
2017	1,058,850	383,073	289,770	113,807	144,329	80,297	106,363
Total	**4,185,164**	**2,525,245**	**1,512,676**	**1,051,427**	**955,598**	**829,929**	**709,496**

Source: (National Marine Fisheries Service, 2018)

3.11.2.2.2 Southern California Range Complex

3.11.2.2.2.1 Commercial Fishing

In Southern California, many species of fish and invertebrates are targeted by both commercial and recreational fishers. Groundfishes (e.g., flatfishes, skates, some sharks, and rockfishes), highly migratory species (e.g., tuna, billfish, some sharks, dolphinfish, and swordfish), and coastal pelagic species (anchovies, mackerel, and sardines) are harvested and sold commercially and many of the same species are also sought after by recreational fishers. Invertebrate species, including the California spiny lobster, several crab species, and market squid are very important commercial fisheries, and far exceed the catch and value of the finfish fishery (Table 3.11-7).

The National Marine Fisheries Service and the California Department of Fish and Wildlife maintain data on commercial fisheries landings for California ports, including major and minor ports in Southern California (California Department of Fish and Wildlife, 2015). Commercial landing data most relevant to the Study Area include data from the major ports of Santa Barbara, Los Angeles, and San Diego. These data also represent landings from smaller ports within the vicinity of these three major ports. For example, landings for the Port of San Diego include landings from the ports of Mission Bay, Oceanside, Point Loma, and National City.

In 2017, over 141 million lb. of fish and invertebrates valued at $105 million were harvested in Southern California, which accounted for 68 percent of all California fish and invertebrate landings and 54 percent of the value of all landings (California Department of Fish and Wildlife, 2018). Relative to each other, the catch of major species and species groups (e.g., crustaceans, echinoderms, finfish, and molluscs) has remained fairly consistent even though the total catch has been declining in recent years, reaching a low in 2015 of 67 million lb. Increases in the catch in 2016 and 2017 indicate that commercial landings may be trending upward; the 2017 catch equals the total landings from 2014 (Figure 3.11-13).

Based on landings (pounds), tuna and mackerel are the species harvested most by commercial fishers in Southern California (Table 3.11-7). Landings of billfish (Swordfish), northern anchovy, Pacific sardine, and rockfish are all substantially lower, but still totaled over 500,000 lb. in 2017. The most highly valued

finfish were the tuna species, worth $6.7 million in 2017. While the tuna catch had the highest value, rockfish brought the highest price at an average of $6.44 per lb. (calculated as value/landings).

Table 3.11-7: Commercial Landings (Pounds) and Value (Dollars) Organized by Species Group within the Southern California Range Complex for 2017

Major Species		*Landings (pounds)*	*Value (dollars)*
Pelagic Fish Species	Tuna (albacore, bigeye, bluefin, skipjack, and yellowfin)	7,963,499	6,692,222
	Billfish (swordfish)	694,103	2,756,941
	Mackerel (Pacific and jack)	5,226,923	689,041
	Northern Anchovy	533,532	103,703
	Pacific Sardine	557,089	32,499
Groundfish	Rockfish (50 species or species groups)	503,488	3,241,230
	Sharks,[1] rays, and skates (e.g., thresher shark)	260,876	477,148
All Other Fish Species		1,983,984	5,037,152
	Total Fish	**17,723,494**	**19,029,936**
Invertebrates	Molluscs (e.g., squid, snails, clams, and whelk)	116,564,690	58,301,745
	California Spiny Lobster	695,548	13,137,986
	Echinoderms (sea Urchins, sea stars, sea Cucumbers, and sand dollars)	3,847,349	6,616,780
	Prawns and Shrimp (e.g., ridgeback prawn, spot prawn, ghost shrimp)	710,977	5,583,698
	Crabs (e.g., brown rock, red rock, yellow rock)	1,235,822	2,175,271
	All Other Invertebrates	3,489	4,088
Totals	**Total Invertebrates**	**123,057,875**	**85,819,568**
	Combined Total	**140,781,369**	**104,849,504**

[1]Not all sharks are goundfish (i.e., dwell and feed primarily at or near the seafloor), but for simplicity the catch of all sharks are included with other cartilaginous species under Groundfish.
Source: (California Department of Fish and Wildlife, 2018)

California waters support a large and economically important invertebrate fishery as well, which, at a value of over $123 million in 2017, was 4.5 times greater than the value of finfish landings (Table 3.11-7). Molluscs, specifically the market squid, made up 95 percent of the total invertebrate landings by weight and brought nearly $58 million into the economy in 2017. Any fluctuations in the market squid harvest dominate total annual landings (pounds) and the value of those landings at Southern California ports (Figure 3.11-13 and Figure 3.11-14). The value of the mollusc (market squid) landings decreased steadily from $60 million in 2010 to just $11 million in 2015, consistent with the decrease in the amount (lb.) of molluscs landed at Southern California ports. Another important species, California spiny lobster, made up less than 1 percent by weight of the 2017 invertebrate landings but contributed over 15 percent of the total value making it the highest priced species at an average of $19 per lb. (calculated as

value/landings). Overall, four of the top five highest-valued species (or species groups) in 2017 were invertebrates, which remains consistent with previous years despite fluctuations in the total value of the landings (Figure 3.11-14).

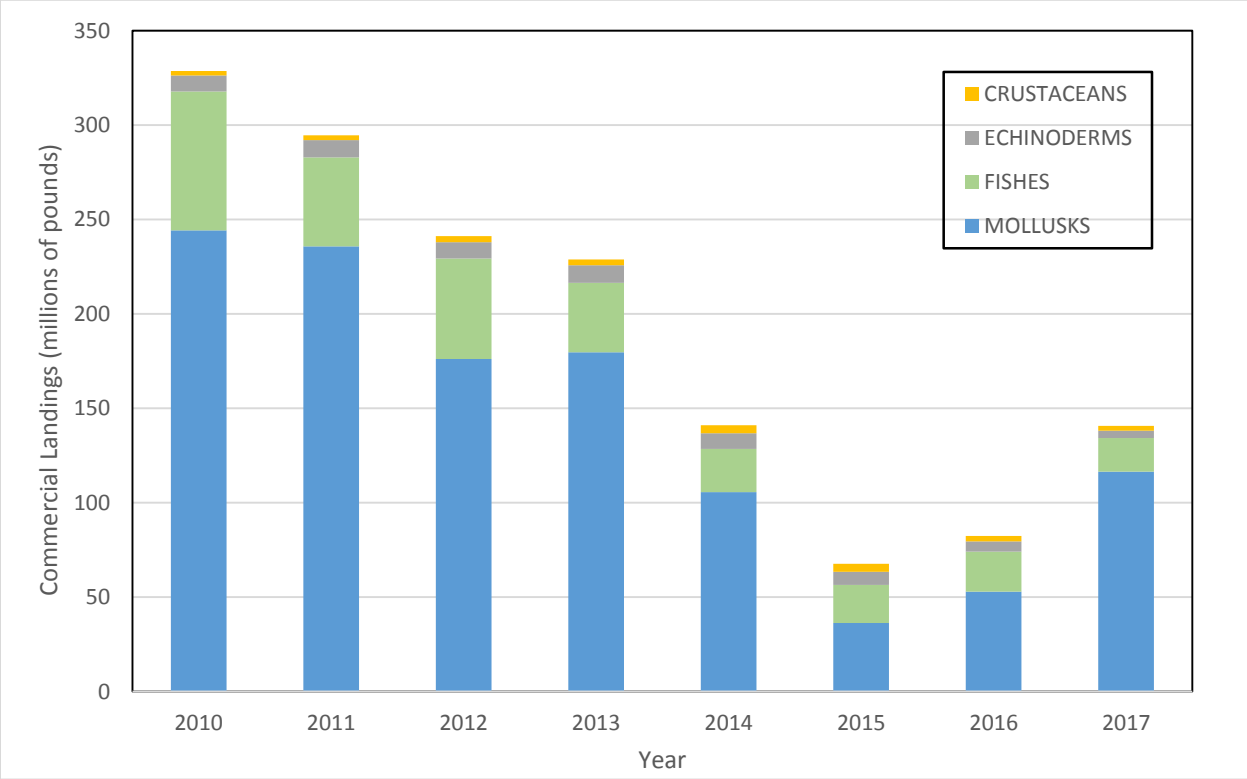


Figure 3.11-13: Commercial Landings (Pounds) in Southern California (2010–2017)

Over the eight-year period from 2010 through 2017, the value of the echinoderm catch remained consistent with little variability, and the value of the finfish catch remained consistent through 2015 and then increased in 2016 and 2017. The crustacean catch increased from $15 to $27 million between 2010 and 2014, before decreasing to $21 million in 2017 (California Department of Fish and Wildlife, 2018).

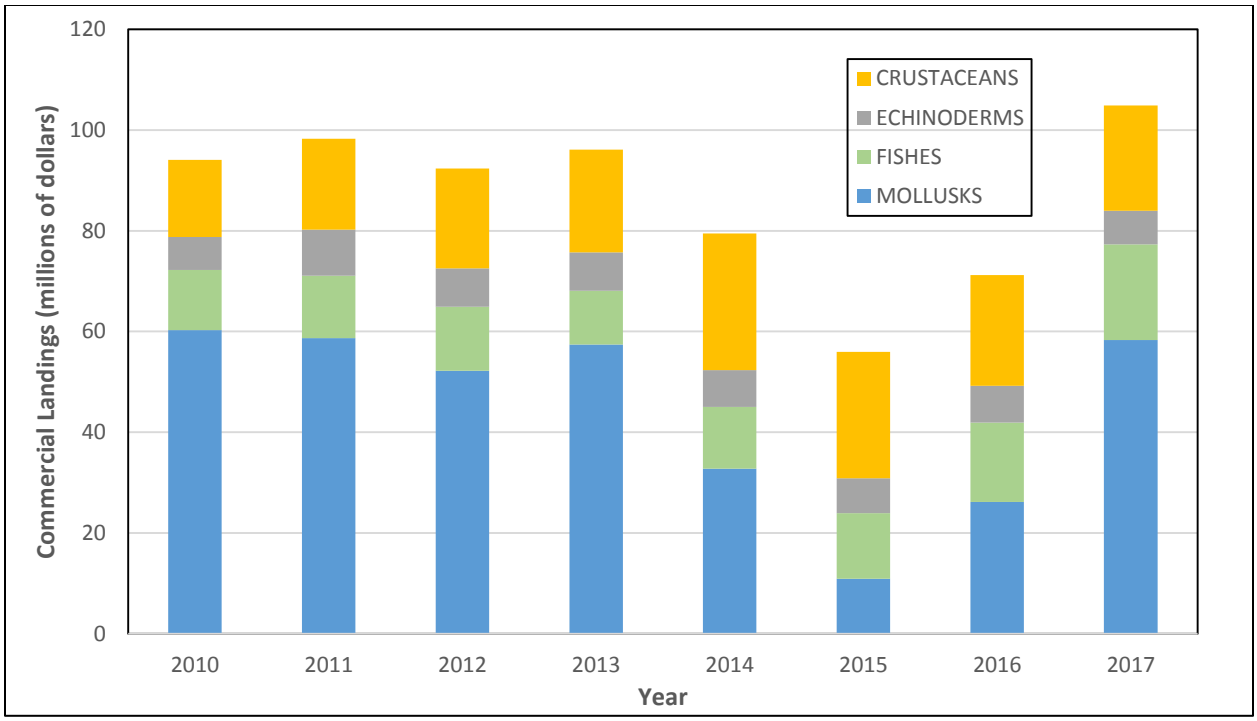


Figure 3.11-14: Value of Commercial Landings in Southern California by Major Species Group (2010–2017)

3.11.2.2.2.2 Recreational Fishing

The Southern California coastal marine environment, including portions of the Southern California Range Complex, supports a popular and thriving recreational fishing industry. The economic impact of recreational fishing is considerable. In 2013, expenditures on for-hire and private boats in the region from San Diego to Los Angeles exceeded $155 million, and shore fishing exceeded $161 million in expenditures (National Marine Fisheries Service, 2014). The recreational and commercial fishing industries are important statewide (National Marine Fisheries Service, 2015a), but particularly in the Southern California region where over 3.3 million angler days were recorded (more than half of the state total) in 2013 and 2,950 jobs were supported (National Marine Fisheries Service, 2014).

More than 200 for-hire fishing vessels (e.g., charter boats) operate between Point Conception and the U.S.–Mexico border (California Marine Life Protection Act Initiative, 2009). These vessels operate from ports including San Diego, Oceanside, Dana Point, Newport Beach, Long Beach, Los Angeles, and from many other locations along the coast. Fishing destinations are generally fluid, changing in response to changing fishing conditions, but numerous charter boats fish the waters of the Southern California portion of the HSTT Study Area on a routine basis. Sport fishers pursue various fish species with almost exclusively rod and reel gear (hook and line); some divers also spearfish or take invertebrates (mainly lobster) by hand within the Southern California portion of the HSTT Study Area. The recreational fishing season can be influenced by changes in oceanographic conditions that affect the presence or absence of target species, but recreational fishing generally occurs in late spring through the fall (Pacific Fishery Management Council, 2007).

Charter boats and privately operated boats enter the Southern California Range Complex and water surrounding San Clemente Island for salt-water sport fishing, recreational diving, and other boating

activities. Commercial passenger fishing vessels servicing recreational fishing are more likely to travel farther offshore to target fish than private boats, due to the increased cost of longer trips, the ability of the larger for-hire vessels to go father, and the greater experience of professional captains. For-hire fishing vessels typically conduct day-long trips, returning to port in the evening; however, some charter boats occasionally spend nights at sea (Naval Undersea Warfare Center, 2009).

Offshore recreational fishing and diving are centered primarily around San Clemente Island and secondarily in the shallower waters over Tanner and Cortes banks. These banks are inherently more hazardous due to their distance from shore and open-ocean diving conditions. Additional information on recreational activities is provided in Section 3.11.2.4 (Tourism).

Species popular with sport fishers include albacore and yellowfin tuna, black rockfish, yellowtail rockfish, kelp bass, California sheepshead, ocean whitefish, dolphin fish, marlin, barracuda, swordfish, and lingcod (National Marine Fisheries Service, 2015b; SportfishingSanDiego.com, 2015). From 2010 to 2014, the species most commonly caught by commercial fishers (measured by number of fish) was mackerel, which are used as bait by commercial and recreational fishers (Table 3.11-7). The most commonly caught targeted species were kelp bass, barred surfperch, Pacific sanddab, California scorpionfish, and California lizardfish. By weight, the largest harvests were for lingcod, black rockfish, yellowtail, yellowfin tuna, albacore, and vermilion rockfish (National Marine Fisheries Service, 2018). Species most often targeted by recreational anglers in the vicinity of San Clemente Island and other offshore islands and on Tanner and Cortes banks were bluefin tuna, yellowfin tuna, yellowtail rockfish, and rock cod.

The catch from recreational fishing remained fairly consistent from 2012 through 2014 at nearly 10 million fish per year (Figure 3.11-15). A reduction in the recreational catch occurred in 2015, and the catch continued to decline in 2016. Preliminary results for 2017 (not shown) indicated that the trend may be continuing. (Recreational Fisheries Information Network, 2015). California sport fishers release a substantial portion of their catch. An average of 35 percent of chub mackerel were released each year between 2012 and 2016. Over 80 percent of kelp bass were released during the same timeframe with 90 percent released in 2014. On the opposite end of the spectrum, approximately 83 percent of all Pacific sardines are harvested and less than 5 percent of most rockfish species are released (95 percent harvested). The majority of sharks are released, and for several species, like the blue shark, horn shark, and white shark, nearly 100 percent are released. Sport fishers most often harvest albacore, Pacific sanddab, yellowfin tuna, and many of the rockfish species, releasing less than 10 percent.

Fishing destinations are generally fluid, in response to changing fishing conditions, but many charter boats fish waters of the Southern California Range Complex on a routine basis. Sport fishers pursue various fish species with almost exclusively rod and reel gear (hook and line); some divers also spearfish or take invertebrates (mainly lobster) by hand within the Southern California Range Complex. The recreational fishing season can be influenced by oceanographic conditions that may affect the presence or absence of target species, but generally occurs in late spring through the fall (Pacific Fishery Management Council, 2007).

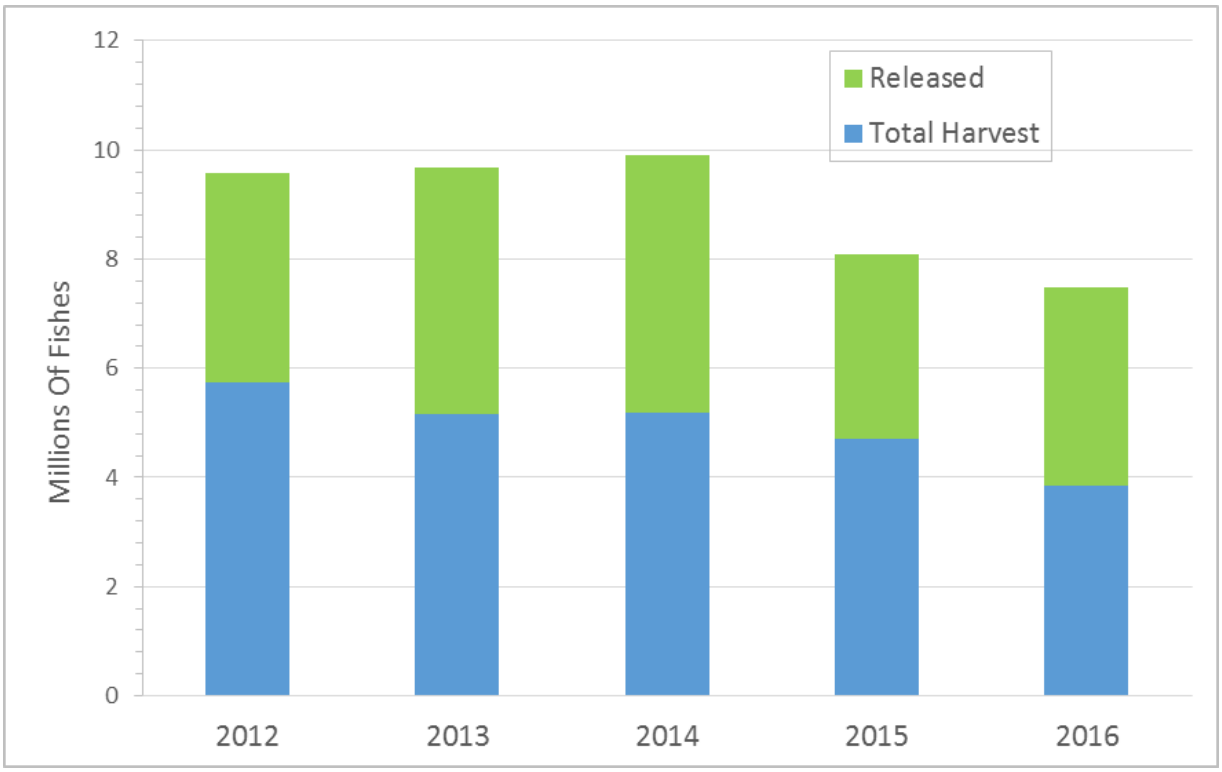


Figure 3.11-15: Annual Recreational Catch in Southern California (2012–2016)

3.11.2.2.3 Transit Corridor

There are no data on commercial or recreational fishing within the transit corridor. Little or no fishing activity is likely to occur in the transit corridor because of the great distance from shore.

3.11.2.3 Subsistence Fishing

The U.S. Environmental Protection Agency considers subsistence fishers to be people who rely on non-commercial fish as a major source of protein. Schumann and Macinko (2007) discuss the difficulties in defining "subsistence" and who meets the definition of a subsistence fisher. The lack of a clear and consistent definition often leads to fisheries management policies that fail to recognize the importance of subsistence fisheries in coastal communities (Schumann & Macinko, 2007). Much of the research supporting the limited policy and regulation of subsistence fishing in the United States is based on the practices of Native Alaskans, which is not necessarily applicable to other communities (Schumann & Macinko, 2007).

Subsistence fishers tend to consume fish and shellfish at higher rates than other fishers, and for a greater percentage of the year, because of cultural and economic factors. There are no particular criteria or thresholds (such as income level or frequency of fishing) that define subsistence fishers; however, survey-based studies indicate that Native Americans, lower income urban populations, and Asian-Americans are more likely to be subsistence fishers (Gassel, 1997; Schumann & Macinko, 2007). Regions with a high percentage of individuals below the poverty line or a high percentage classified as Native American or Asian may have a greater number of subsistence fishers.

Low-income populations would have limited means and opportunity to travel offshore into federal waters (i.e., beyond 3 NM from shore) to fish. Thus, it is assumed that the majority of subsistence fishing

would occur in waters close to the coastline. A variety of fish are caught mainly by hook and line from beaches, piers, and small boats (Pitchon & Norman, 2012; Stevenson et al., 2012). Inshore fishing usually occurs within sight of the shoreline in bays, flats, and marshes or under piers, bridges, or near the jetties where water is generally less than 100 ft. deep. Boats used by subsistence fishers are generally smaller, affordable, and designed for use in nearshore, relatively shallow waters.

3.11.2.3.1 Hawaii Range Complex

There have been no comprehensive surveys of subsistence-fishing activities in Hawaii; however, the contribution to local economies and communities is considered substantial (Zeller et al., 2014) and has been an integral way of life for Native Hawaiians for centuries (McClenachan & Kittinger, 2013). The cultural and economic value of subsistence fishing to Native Hawaiians is considered an important component of many communities, particularly rural communities (Pooley, 1993), which strive to preserve a long-standing way of life (McClenachan & Kittinger, 2013; Steutermann-Rogers, 2015).

Recent efforts aimed at sustaining subsistence fishing practices have resulted in the establishment of community-based subsistence fishing areas (Levine & Richmond, 2014; Steutermann-Rogers, 2015). These areas were established through coordination between communities practicing subsistence or traditional fishing and state and local governments, an approach that recent studies have shown to be effective at achieving the regulatory goals of sustaining the fishery (Ayers & Kittinger, 2014; Steutermann-Rogers, 2015).

To aid in the preservation of this practice, Hawaii's Governor signed into law the first-ever Community-Based Subsistence Fishing Area rules for Hāena on the island of Kauai (Khon2, 2015; Steutermann-Rogers, 2015). The new rules set bag limits for lobster, octopus, and urchins; prohibit the taking of marine snails for two years because of their imperiled state; provide restrictions on the types of fishing gear and methods that may be used; and prohibit commercial fishing in the subsistence fishing area. The state is responsible for enforcement, but the community takes on a type of neighborhood-watch function and engages visitors in the practices and importance of preserving subsistence fishing.

It is difficult to separate data on subsistence fishing from other types of non-commercial fishing (e.g., recreational), because both types are often conducted on the same trip. Data reconstruction efforts estimate that the non-commercial, including subsistence, fishing in Hawaii has traditionally far exceeded commercial landings, particularly prior to European contact (McClenachan & Kittinger, 2013). The trend has continued into modern times, when, in 2000, McClenachan and Kittinger (2013) estimated that the non-commercial catch exceeded commercial landings by as much as 15 times by weight.

3.11.2.3.2 Southern California Range Complex

In Southern California, many people fish off piers and in local bays, harbors, and waterways for regular subsistence rather than for recreation (Pitchon & Norman, 2012; Stevenson et al., 2012). Nearshore waters surrounding the city of Coronado and the Silver Strand portion of the Southern California Range Complex provide fishing opportunities in San Diego Bay and along the Pacific coast. In Los Angeles County, where a high cost of living and low incomes have produced food insecurity among certain populations, subsistence fishing is common, particularly among people who have a non-white, non-European/American ethnicity (Stevenson et al., 2012). Pitchon and Norman (2012) reported results from a survey conducted at four piers in Los Angeles County that 43 percent of respondents were from Spanish, Hispanic, or Latino backgrounds. A large percentage of fishers of Asian descent were observed, including Samoan, Vietnamese, and Chinese; however, many declined to respond to the survey or did

not speak English proficiently enough to complete the survey. A number of respondents reported fishing for both recreational and subsistence purposes, which highlights the difficulty in obtaining data specific to just subsistence fisheries. Although the economic value of subsistence fisheries may often be low in Southern California, they may be critical for the livelihoods of many communities.

3.11.2.3.3 Transit Corridor

It is assumed that there is no subsistence fishing within the transit corridor. It is highly unlikely that any substantial fishing activity occurs in the transit corridor because of the great distance from shore.

3.11.2.4 Tourism

Coastal tourism and recreation include the full range of tourism, leisure, and recreationally oriented activities that take place in the coastal zone and the offshore coastal waters. These activities include coastal tourism development (e.g., hotels, resorts, restaurants, food industry, vacation homes, and second homes) and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, and recreational fishing facilities). Also included are ecotourism and recreational activities such as recreational boating, cruises, swimming, surfing, snorkeling, diving, and sightseeing (National Oceanic and Atmospheric Administration, 1998).

3.11.2.4.1 Hawaii Range Complex

Tourism represents the largest influx of private capital into the Hawaii economy (Hawaii Tourism Authority, 2015b). Tourism contributed $1.6 billion in tax revenue and generated $14.9 billion in visitor spending in 2014, which equates to an average of $40.6 million per day. Approximately $20 million is spent per day on Oahu. Tourism is also the biggest generator of jobs in Hawaii, supporting 165,000 jobs in 2014. Over 8 million visitors arrived in Hawaii in 2014, primarily by air; only 124,000 visitors arrived by cruise ship (Hawaii Tourism Authority, 2015a). On any given day, over 200,000 visitors are in Hawaii (Hawaii Tourism Authority, 2015a). Forecasts indicate that visitor arrivals will continue to increase each year through 2018, the last year for which estimates are projected. Visitor arrivals increased 1.7 percent in 2013, 2.3 percent in 2014, and are estimated to increase by 4.2 percent in 2015. Visitor arrivals are projected to increase from 2016 through 2018, but at lower annual rates of 1.5 percent in 2016, 0.9 percent in 2017, and 1.1 percent in 2018. Despite these more modest increases, visitation will continue to contribute to a steady increase in the State's gross domestic product (Department of Business Economic Development and Tourism, 2015; University of Hawaii, 2015).

The waters surrounding the Main Hawaiian Islands are used for a variety of recreational purposes including tourism. The intensity of use generally declines with increasing distance from shore, although specific resources in the open-ocean area may result in a concentration of use (e.g., seamounts are preferred fishing and diving locations). Offshore areas that are shielded by landmasses from the full force of wind and waves, such as the channels between Maui and adjacent islands, are preferred areas for recreational boating and diving. The highest densities of recreational vessel traffic is centered around southern Oahu, a popular tourist area, and along the leeward coasts of the other frequently visited islands. The average relative density of recreational vessels in the Hawaii Range Complex was calculated as 0.0019 vessels per km^2, approximately 1.5 times greater than the average relative density of military vessels (Figure 3.11-16).

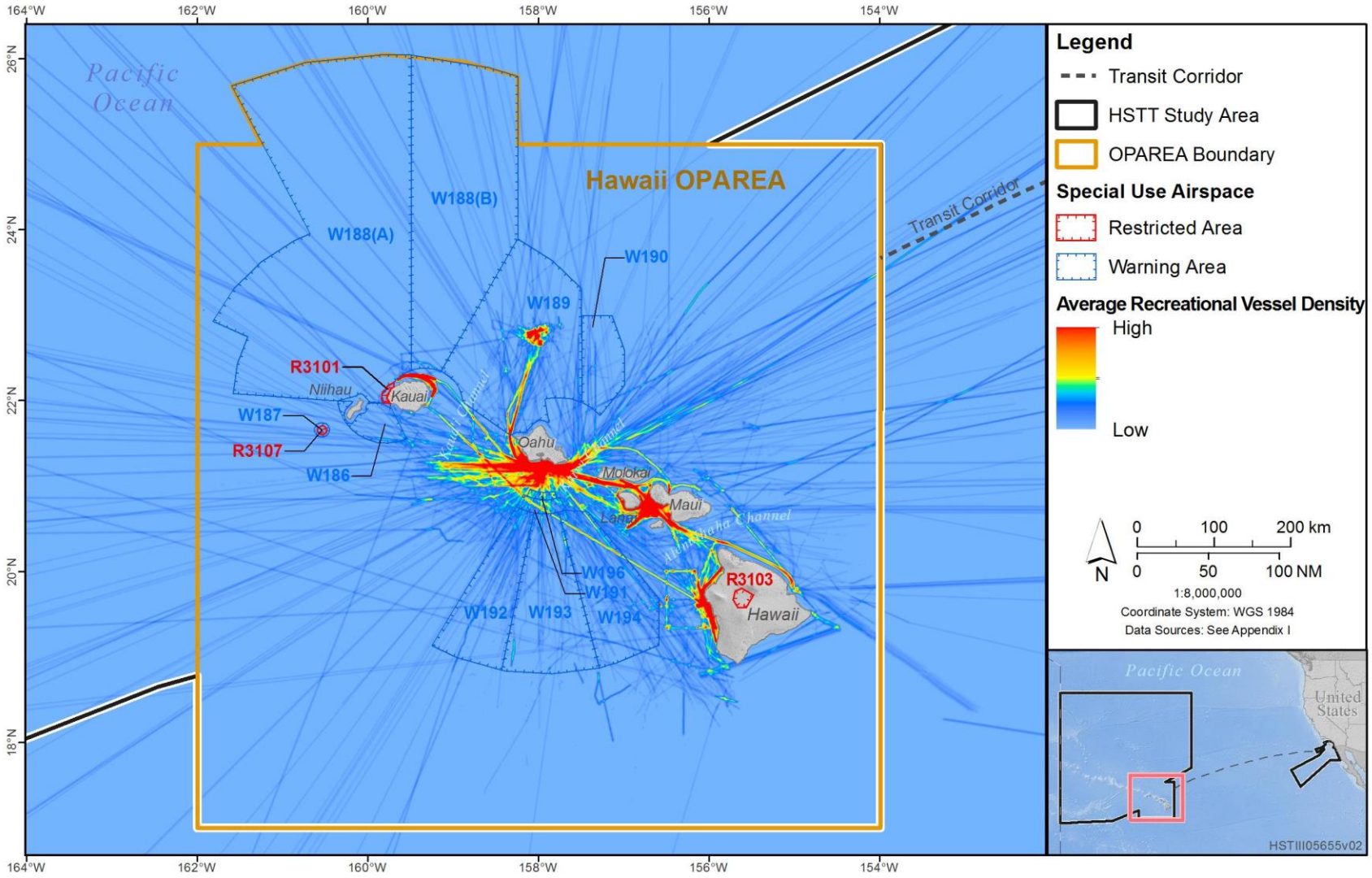


Figure 3.11-16: Relative Density of Recreational Vessels in the Hawaii Range Complex

In addition, there are numerous beaches and parks throughout the islands (Figure 3.11-17, Figure 3.11-18, and Figure 3.11-19).

Many tourism activities use Hawaii's coastal and offshore waters. Navy vessels present in the waters of the Hawaii Range Complex represent a small fraction of the overall boat traffic, and, correspondingly, account for only a small fraction of the circumstances that have the potential to limit public access in the open-ocean area around Hawaii (Mintz & Filadelfo, 2011; Mintz, 2012).

Recreational fishing in Hawaii is very important economically with resident and non-resident anglers spending over $750 million on trips and equipment in 2006. The economic impact of these expenditures added $380.6 million to the economy, generated $253.6 million in income, supported 7,000 jobs, and generated $105.0 million in government revenue in 2006 (Gentner & Steinback, 2008). More recently, Hutt et al. (2015) reported on the economic contributions of bait and tackle retailers in Hawaii. Over $22.6 million in expenditures added $38 million into the economy, generated $19 million in income, and supported 285 jobs.

Tourism, and by extension recreational fishing by tourists, varies seasonally. Additionally, the country or region of origin (e.g., U.S. Pacific coast, U.S. Atlantic coast, Japan) of tourists varies seasonally, influencing the types of activities in which tourists participate during the year (Hawaii Tourism Authority, 2015a). Surfing is a popular activity with residents and tourists in nearshore waters off all of the Main Hawaiian Islands. The popularity of a surfing beach varies seasonally with the swell, which typically approaches from the north in winter months and from the south in summer.

The whale watching industry has grown worldwide since its inception in the 1950s (O'Connor et al., 2009). In Hawaii, approximately 30 percent of first time visitors and 20 percent of returning visitors take some type of a boat tour, which includes whale watching tours (Hawaii Tourism Authority, 2015a). Humpback whale watching around the Main Hawaiian Islands peaks from January through March. Whale watching contributes approximately $20 million annually to the State's economy (National Oceanic and Atmospheric Administration, 2013). Dolphin cruises are also popular with tourists and occur year round.

Marine mammal sightings are expected to occur from the coast to 50 NM offshore, including the areas off the Pacific Missile Range Facility, close to shore at Pyramid Rock Beach on Oahu, or areas within the 100-fathom contours such as the Molokai–Lanai–Maui–Kahoolawe channels and Penguin Bank. Although tourist day trips typically stay closer to shore or from beach vantage points, these activities can occur throughout the Hawaii Range Complex. Additional information on humpback whales, including description, habitat, abundance, and distribution, is provided in Section 3.7 (Marine Mammals).

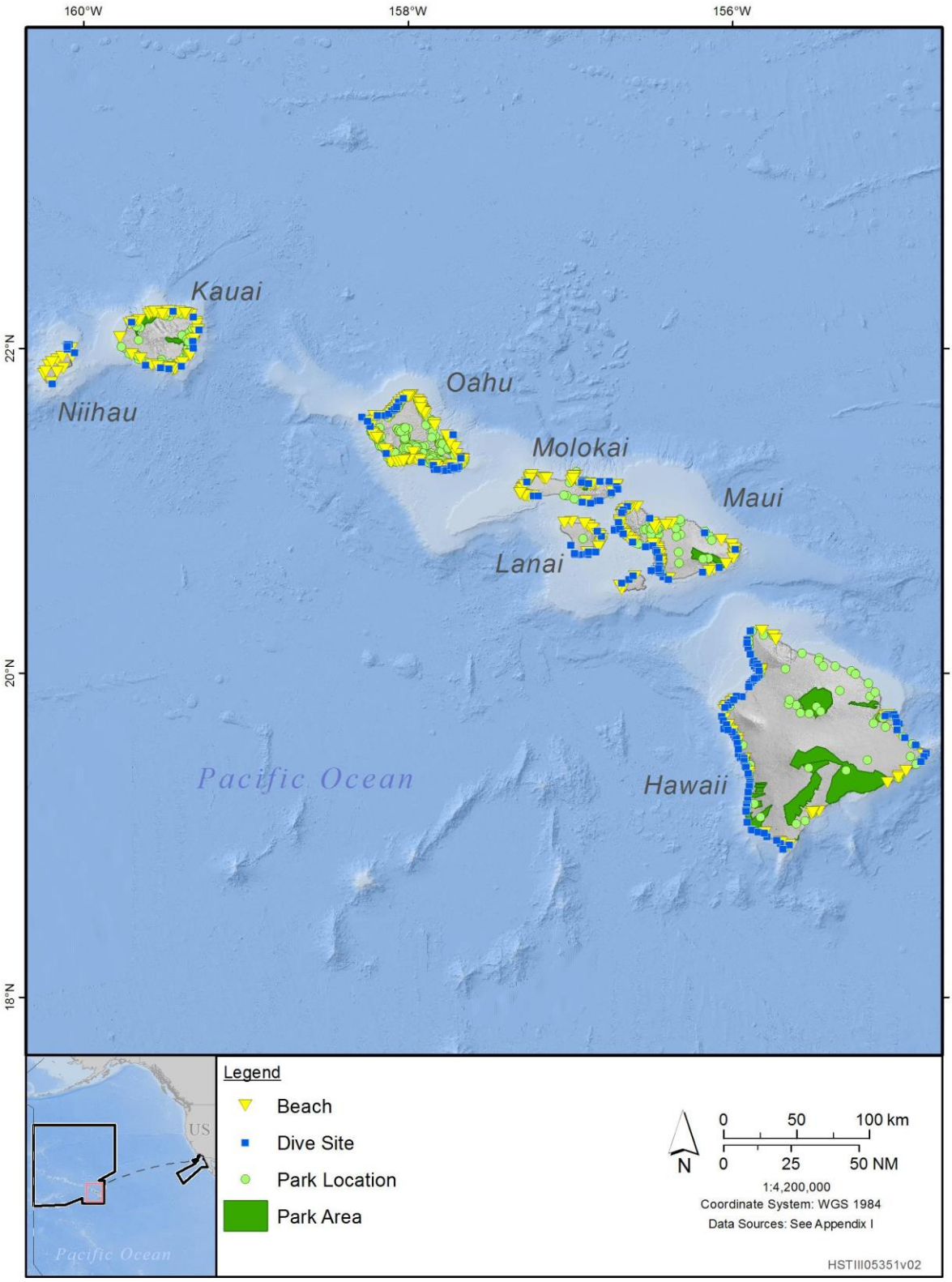


Figure 3.11-17: Main Hawaiian Islands Recreation Areas

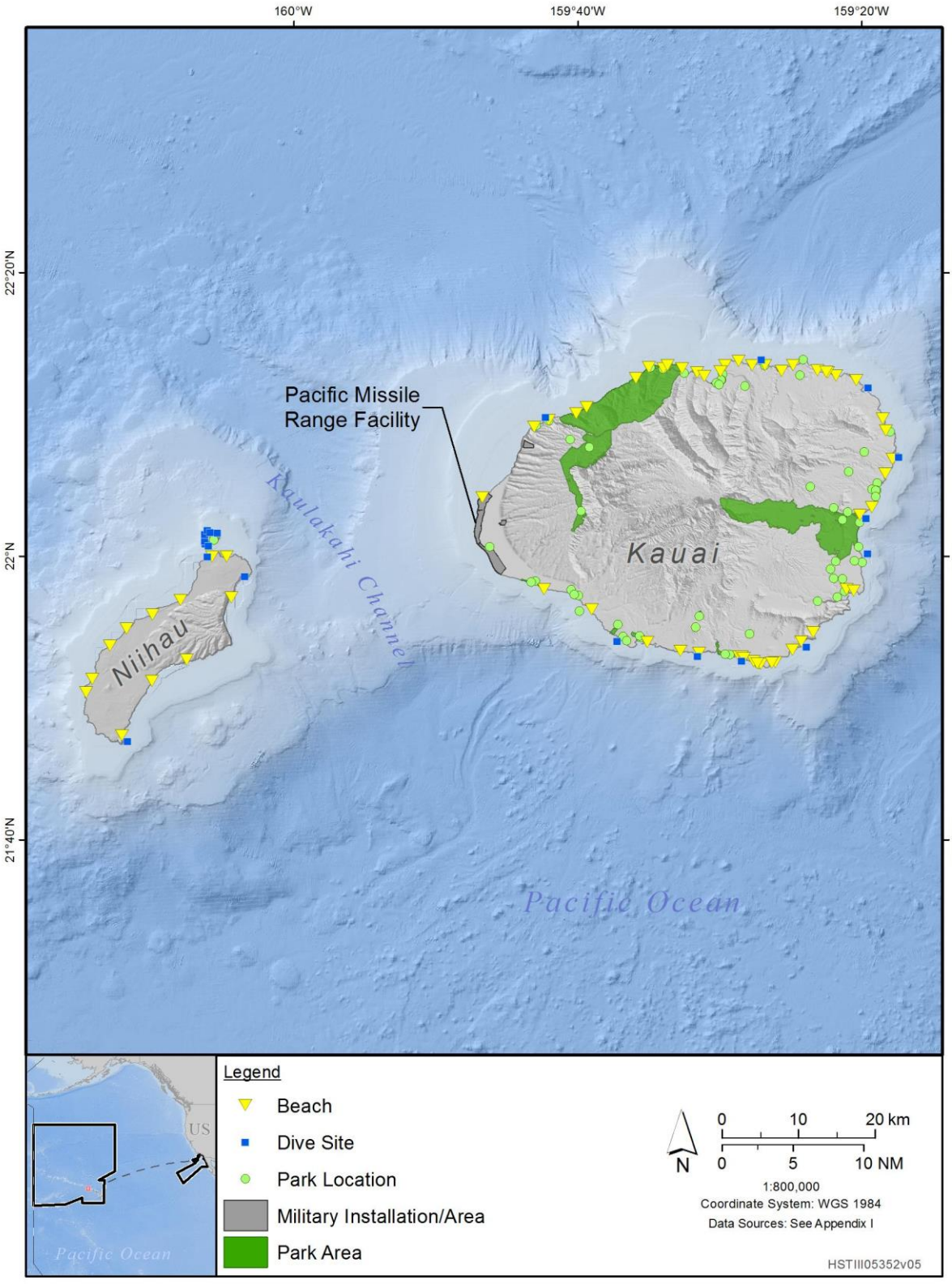


Figure 3.11-18: Kauai-Niihau Island Recreation Areas

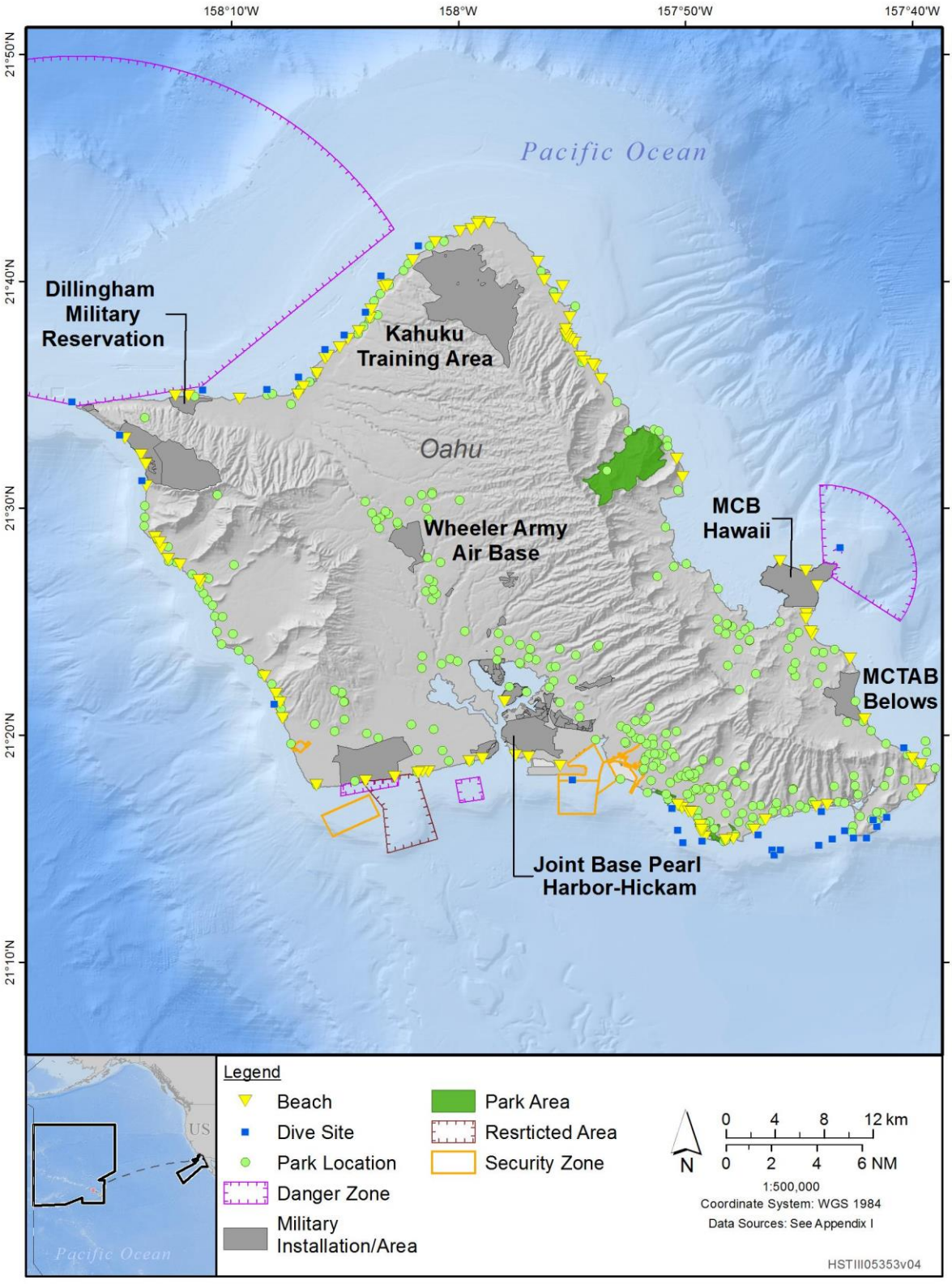


Figure 3.11-19: Oahu Island Recreation Areas

Notes: MCB = Marine Corps Base, MCTAB = Marine Corps Training Area Bellows

3.11.2.4.2 Southern California Range Complex

Travel and tourism are important to the Southern California economy. In 2014, travel-related spending, earnings (after tax profit or net income), and room sales and occupancy taxes added over $85 billion to the Southern California economy (Visit California, 2015) (Figure 3.11-20). In addition, over 413,000 jobs in Southern California were supported by travel and tourism (Figure 3.11-21).

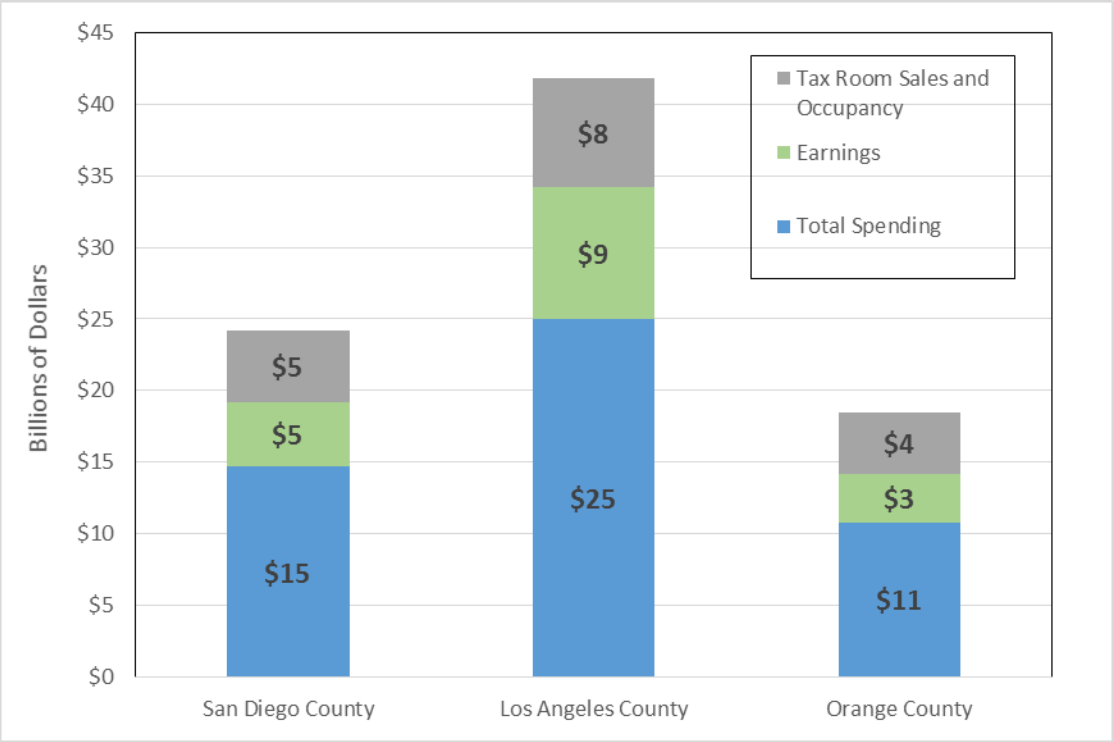


Figure 3.11-20: Economic Impact of Visitors to Southern California in 2014



Figure 3.11-21: Jobs Supported by the Travel Industry in Southern California in 2014

Marine environments in the Southern California portion of the HSTT Study Area are popular locations for recreational activities including sightseeing, whale watching, sport fishing, boating, diving, and surfing. Most recreation and tourism activities occur close to the mainland coast of Southern California or between the mainland and the Channel Islands, and depicted by the average relative density of recreational vessels (Figure 3.11-22). The proportion of recreational vessels reporting their location using the Automatic Identification System is lower than the proportion of commercial vessels and is likely lower than the proportion of military vessels; however, the data are illustrative of the areas used by different types of vessels. The average relative density of recreational vessels in the Southern California portion of the HSTT Study Area was calculated as 0.0470 vessels per km^2, approximately 14 times greater than the average relative density of military vessels.

The shallower waters near the Channel Islands and some offshore banks, such as Tanner and Cortes Banks, are especially popular areas for Self-Contained Underwater Breathing Apparatus (SCUBA) diving, fishing, and occasionally surfing. Very little recreational activity takes place in the southwestern portion of the Southern California Range Complex because of the great distance from land and deep waters.

Santa Catalina and Santa Barbara Islands are within the Study Area and visited by tourists. While Navy activities are conducted offshore of these islands, there is little interaction between the public and Navy activities.

Whale watching in Southern California waters focuses on the annual gray whale southward and northward migrations. The southward migration from Arctic feeding grounds to Baja California, Mexico where mating and calving take place, is primarily from December through February. The return migration northward peaks in April and May (O'Connor et al., 2009). Other marine mammal species like humpback whales, blue whales, and orcas are also seen during other times of the year. Though tourist day trips typically stay closer to the mainland, these activities can occur throughout the Southern California portion of the HSTT Study Area. The Channel Islands National Marine Sanctuary is a popular destination for extended whale watching trips (O'Connor et al., 2009).

During fall and winter, charter boats and privately operated boats enter the Southern California OPAREA and San Clemente Island waters for salt-water sport fishing, recreational diving, surfing, and other boating activities (Figure 3.11-23). Salt-water sport fishing and recreational diving take place primarily around San Clemente Island, and to a lesser extent in the shallower waters over Tanner and Cortes banks. In winter, when large swells form in the North Pacific, some charter and private vessels travel to Cortes Bank and Tanner Bank to surf extremely large waves created at the shallow banks, which rise from the seafloor to within 6 ft. from the surface at one location. The right oceanographic conditions can generate surfable waves that exceed 70 ft., attracting "big wave" surfers from all over the world (Casey, 2010). Distance from shore—the banks are approximately 34 and 40 NM from San Clemente Island—and the open ocean conditions make any recreational activities at Tanner Bank and Cortes Bank inherently more hazardous. Dive sites occur throughout the nearshore areas at various shipwrecks and reefs and, surfing off of Point Loma and at several sites off Santa Catalina Island are popular.

The nearshore waters off San Clemente Island are a more popular destination than the more remote banks. Surfers can venture year round to the breaks off of San Clemente Island to surf the island's south points (China and Pyramid Points) and up the west shore of the island depending on the swell direction of the season (Figure 3.11-23). Although both areas are within the Southern California Range Complex and are used throughout the year, they are not used often because of the time and effort it takes to reach the sites and the infrequent confluence of oceanographic conditions necessary for good surfing.

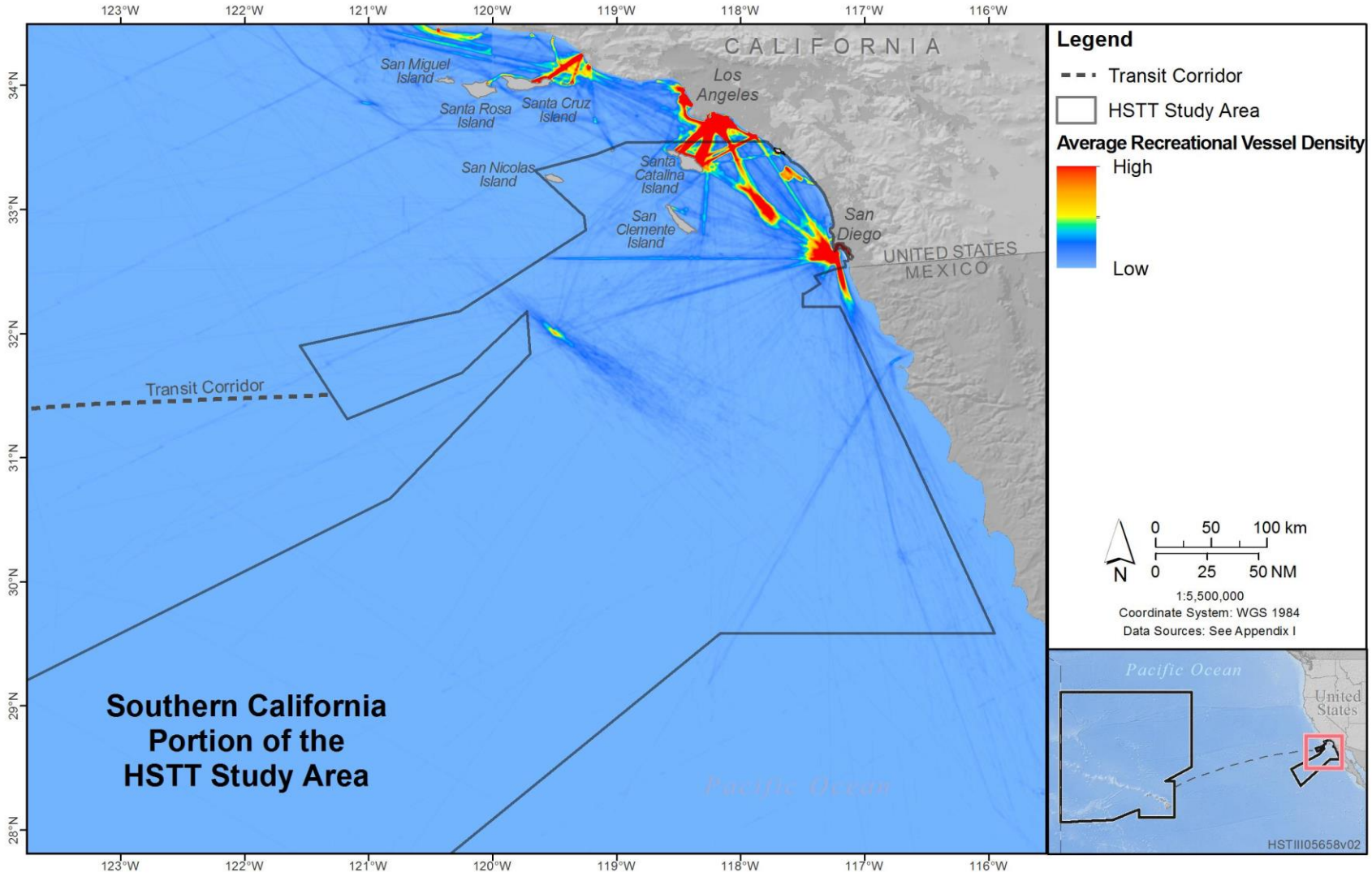


Figure 3.11-22: Relative Density of Recreational Vessels in the Southern California Portion of the HSTT Study Area

Note: HSTT = Hawaii–Southern California Training and Testing

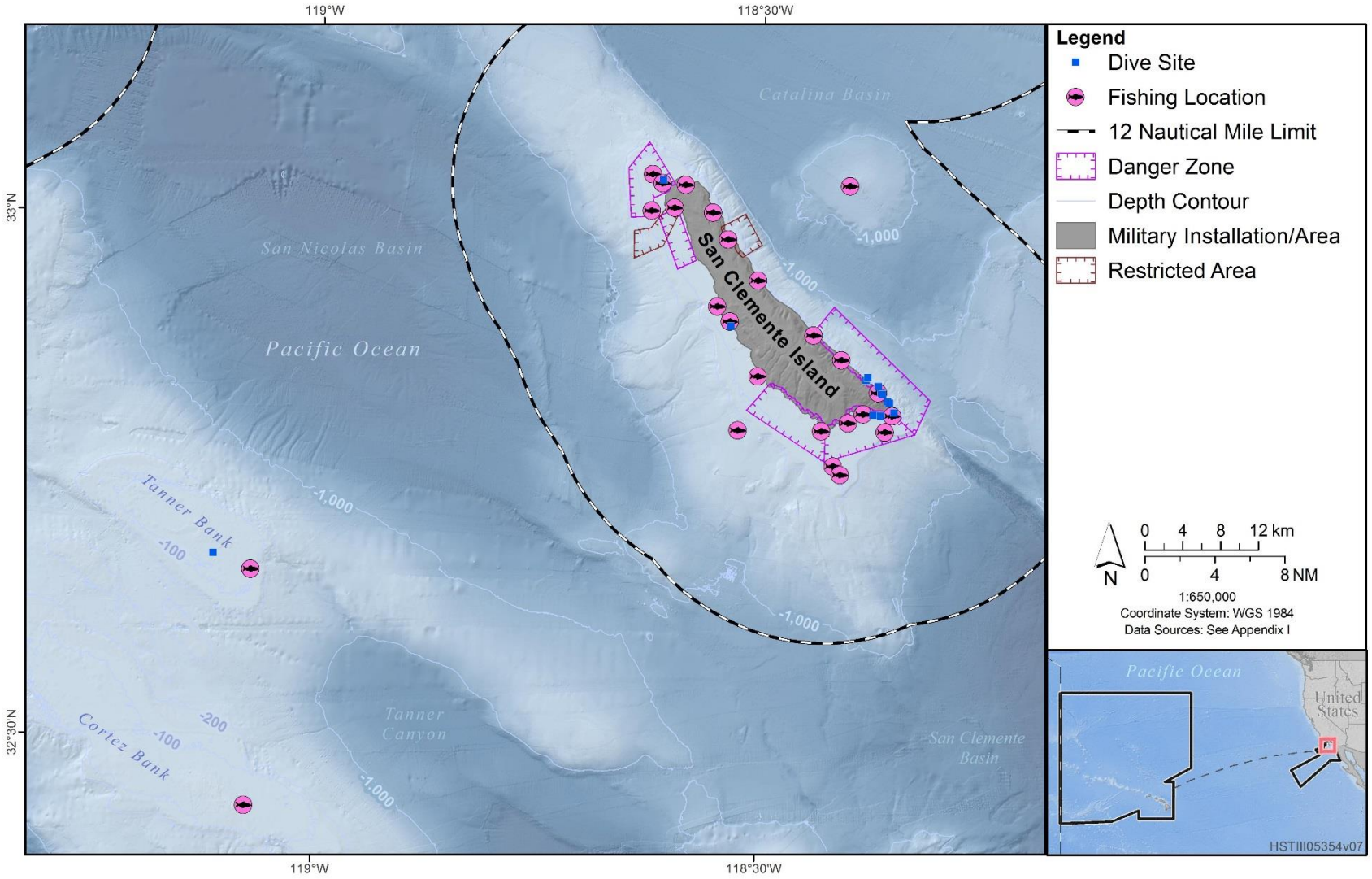


Figure 3.11-23: Recreation Areas Around San Clemente Island

San Clemente Island's relatively warm waters, good underwater visibility, and largely pristine diving conditions make it a popular diving destination (Channel Islands Dive Adventures, 2015). Charter dive trips to specific sites are often published and booked as many as 6 months in advance. Diving occurs year round, though the number of trips to San Clemente Island and the banks appear to peak during lobster season (October–March).

San Diego Bay is a natural harbor adjacent to downtown San Diego, and is frequently used by recreational boaters who access the Bay from surrounding marinas and mooring areas. The City of San Diego, City of Coronado, City of Imperial Beach, City of Chula Vista, and National City surround and have an interest in activities within San Diego Bay. The Sweetwater Canal, located in south San Diego Bay, is the site of the National City Marina and Pepper Park. The Chula Vista Marina is located farther south. Both marinas are popular access points used by recreational boaters who spend time in the Bay and traveling through the Bay to access the Pacific Ocean (Figure 3.11-24).

Fiddler's Cove Marina, operated by the Navy, is located on the bayside south of the Silver Strand Training Complex-North (Figure 3.11-24). The marina has approximately 150 moorings and approximately 130 dock slips; the recreational vehicle park offers year round camping. Both facilities are open to active duty, retirees, Department of Defense civilians, and sponsored civilian guests.

Glorietta Bay is located on the bayside north of the Silver Strand Training Complex-North and is used by the public for recreation and pleasure boating. Navy piers at the Naval Amphibious Base Coronado extend into Glorietta Bay from its northern shore and support small boat training activities at the Silver Strand Training Complex (Figure 3.11-24).

In San Diego Bay, there is a designated security zone extending from the northern and eastern boundary of Naval Amphibious Base Coronado prohibiting all public access (33 CFR 334.860) (Figure 3.11-24). A separate restricted area lies on the south side of Naval Air Base Coronado on the bay side and extends south to Fiddler's Cove. Activities including swimming, fishing, waterskiing, and mooring are all prohibited; however, vessels are permitted to transit through the area. All vessels entering the restricted area must proceed across the area by the most direct route and without unnecessary delay. For vessels under sail, necessary tacking constitutes a direct route. A portion of the restricted area extending 120 ft. from pier heads and from the low water mark on shore where piers do not exist is closed to all persons and vessels except those owned by, under hire to, or performing work for, the Naval Amphibious Base.

Recreational activities offshore of the Silver Strand Training Complex and the Naval Amphibious Base Coronado are permitted outside of the security zone and restricted area and include sport fishing, bait fishing for the sport fishers, lobster fishing, and sailboat regattas. Organized activities (such as sail races and regattas) within the restricted area may be allowed if a request has been made to the Commanding Officer, Naval Base, Coronado. Silver Strand State Beach offers ocean side camping, kite surfing, and surfing. The City of Coronado beach, which lies between Naval Air Station North Island and Naval Amphibious Base Coronado, is a major public beach. The Young Men's Christian Association Camp Surf at the Silver Strand Training Complex – South is a major recreational facility for military and civilian families and offers surfing and beach activities.

3.11.2.4.3 Transit Corridor

It is assumed that there is no tourism activity within the transit corridor. It is highly unlikely that tourism activities would occur in the transit corridor because of the great distance from shore.

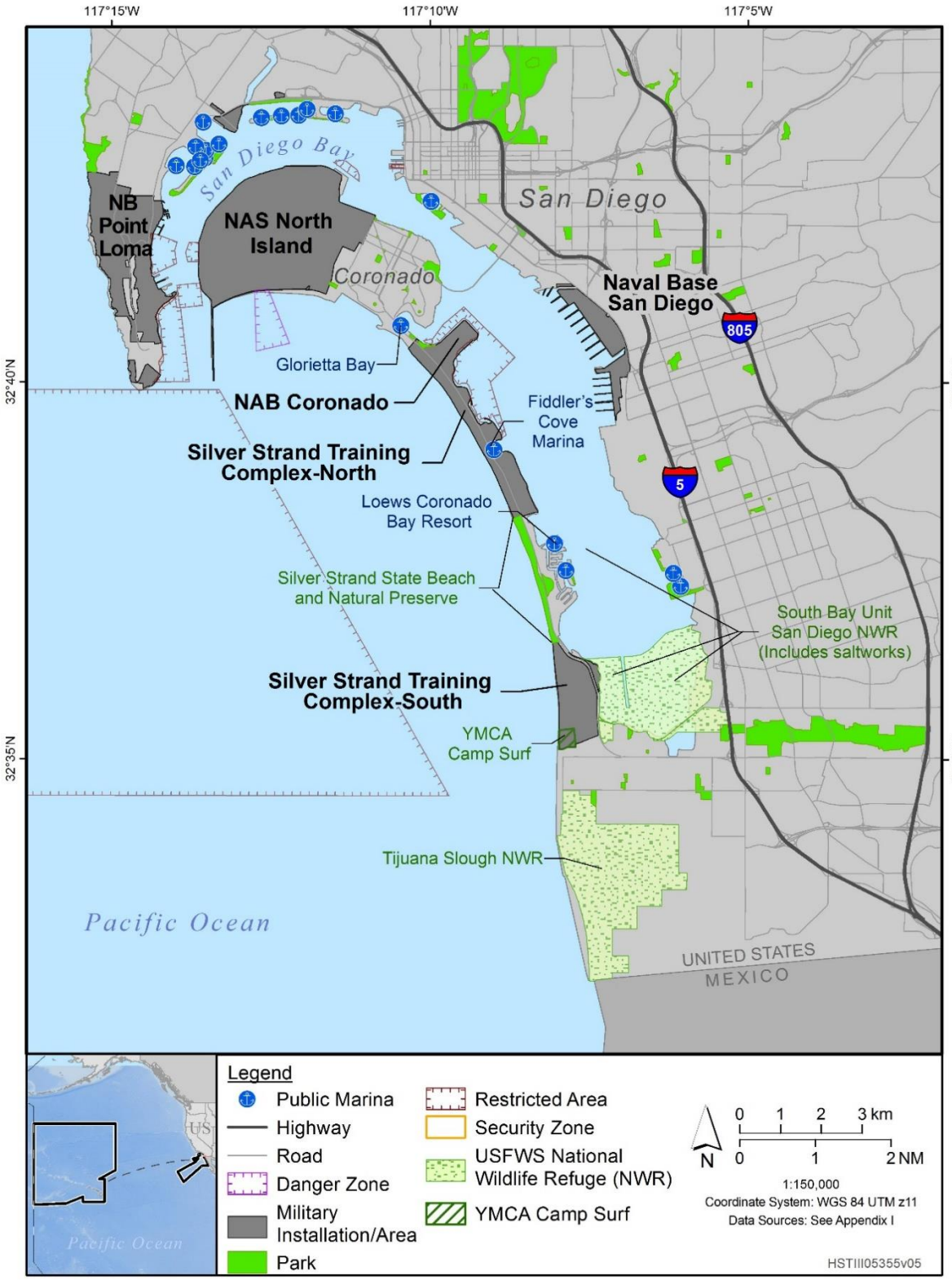


Figure 3.11-24: Recreation Areas near Navy Facilities on San Diego Bay

Notes: YMCA = Young Men's Christian Association, NAB = Naval Amphibious Base, USFWS = United States Fish and Wildlife Service, NAS = Naval Air Station

3.11.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact socioeconomic resources of the Study Area. Tables 2.6-1 through 2.6-5 present the baseline and proposed training and testing activity locations for each alternative, including the number of events occurring annually and over a five-year period. Each socioeconomic resource stressor is introduced, analyzed by alternative, and analyzed for training and testing activities. Appendix B (Activity Stressor Matrices) shows the stressors that were considered for analysis of socioeconomic resources. The stressors vary in intensity, frequency, duration, and location within the Study Area. The primary stressors applicable to socioeconomic resources in the Study Area and that are analyzed include the following:

- **Accessibility** (availability of access on the ocean and in the air)
- **Airborne acoustics** (weapons firing, aircraft, and vessel noise)
- **Physical disturbance and strikes** (aircraft, vessels and in-water devices, military expended materials)

Secondary stressors resulting in indirect impacts on socioeconomic resources are discussed in Section 3.11.4 (Secondary Stressors). This section evaluates the impacts of the alternatives on the economy of the region of influence as well as social impacts. The evaluation addresses how the action alters the way individuals live, work, play, relate to one another, and function as members of society. Because proposed HSTT activities are predominantly offshore, socioeconomic impacts would be associated with economic activity, employment, income, and social conditions (e.g., livelihoods) of industries or operations that use the ocean resources within the Study Area. Although the typical socioeconomic considerations such as population, housing, and employment are not applicable, this section will analyze the potential for economic impacts on marine-based activities and coastal communities. When considering impacts on recreational activities such as fishing, boating, and tourism, both the economic impact associated with revenue from recreational tourism and public enjoyment of recreational activities are considered.

The proposed HSTT training and testing activities were evaluated to identify specific components that could act as stressors by directly or indirectly affecting sources of commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism. For each stressor, a discussion of impacts on these sources is included for each alternative. The analysis includes consideration of the mitigation that the Navy will implement to avoid potential impacts on seafloor resources, some of which are important socioeconomic resources.

The analysis indicated that the relative potential for socioeconomic impacts would be similar across various areas and marine ecosystems in the Study Area. Therefore, the analysis of environmental consequences was not broken down by large marine ecosystem. Based on an initial screening of potential impacts of sonar maintenance and testing, pierside locations have been eliminated from detailed consideration in the analysis of impacts on energy, mineral extraction, and transportation and shipping. Elimination of these resources was based on the extremely limited potential for active sonar to damage infrastructure or interfere with transportation operations.

3.11.3.1 Impacts on Accessibility

Navy training and testing activities have the potential to temporarily limit access to areas of the ocean for a variety of human activities associated with commercial transportation and shipping, commercial

recreation and fishing, subsistence fishing, and tourism in the Study Area. This section details the range of possible impacts, including a description of existing activities and associated impacts. Potential impacts from each alternative are analyzed below. In 2015, the Navy completed the Southern California and Northern California Range Complexes Encroachment Action Plan to evaluate the use of offshore and nearshore waters by military and civilian stakeholders (U.S. Department of the Navy, 2015). The Navy does not possess exclusive rights to these waters. Based on freedom of the seas and open access rights to citizens and commercial organizations alike, these same waters are used by civilians for commercial and recreational activities. For safety reasons, Navy training and testing activities can occasionally limit public access to airspace and nearshore and offshore waters in the Study Area. Similarly, the public's use of the airspace and sea space can conflict with Navy training and testing activities.

When training or testing activities are scheduled that require specific areas to be free of non-participating vessels and aircraft due to public safety concerns, the Navy requests that the U.S. Coast Guard and Federal Aviation Administration issue Notices to Mariners and Notices to Airmen, respectively, to warn the public of upcoming Navy activities. Many training and testing activities occur in established restricted areas and danger zones as published on navigational and aeronautical charts. Some frequently used areas have standing Notices to Mariners and Notices to Airmen to allow real-time, immediate use.

Limits on accessibility to certain areas of the Study Area due to Navy training and testing would essentially remain unchanged from the current conditions. If access by the public to an area is hindered to the extent that equipment (e.g., fishing gear) cannot be monitored or used, then there would be an impact if this condition would directly contribute to loss of income, revenue, or employment. Disturbance to human activities associated with payrolls, revenue, or employment is quantified by the amount of time the activity may be halted or rerouted and the ability to perform the task in another location. The Navy is not proposing to add any new restricted areas and proposes to continue the same type of temporary area closures that have occurred for decades.

Accessibility, or restrictions to the availability of air and ocean space, would be a temporary condition. While mariners and pilots have a responsibility to be aware of conditions on the ocean and in the air, it is not expected that direct conflicts in accessibility would occur. The locations of restricted areas are published and available to mariners and pilots, who typically review such information before boating or flying in any area. Restricted areas are typically avoided by experienced mariners and pilots. Prior to initiating a training activity, the Navy would follow standard operating procedures to visually scan an area to ensure that nonparticipants are not present. If nonparticipants are present, the Navy delays, moves, or cancels its activity. Accessibility is no longer restricted once the activity concludes. Additional information on existing Navy procedures for mitigating potential impacts on accessibility are described in the Southern California and Northern California Range Complexes Navy Encroachment Action Plan (U.S. Department of the Navy, 2015).

3.11.3.1.1 Impacts on Socioeconomic Activities from Limiting Accessibility

3.11.3.1.1.1 Commercial Transportation and Shipping

The offshore and nearshore areas of the Study Areas include established Navy OPAREAs used for military training and testing activities. Commercial vessels entering OPAREAs, including established restricted areas and danger zones, within the Study Area operate under maritime regulations and are not limited by Navy activities. Potential disruptions to commercial shipping are limited or avoided by the U.S. Coast Guard issuing Notices to Mariners. Notices to Mariners advise commercial ship operators,

commercial fishers, recreational boaters, and other users of the area that the military will be operating in a specific area, allowing them to plan their activities accordingly. These temporary clearance procedures are established and implemented for the safety of the public and have been employed regularly over time without substantial socioeconomic impacts on commercial shipping activities.

3.11.3.1.1.2 Commercial and Recreational Fishing

Commercial and recreational fishing activities make an appreciable contribution of 10s of millions of dollars to the overall economy within the Study Area (Table 3.11-5, Table 3.11-7). The Navy has performed military activities within this region in the past with limited interruption to fishing or recreational activities. Commercial and recreational interests such as fishing, boating, and beach use are only restricted temporarily. Temporary closing of areas within the Study Area (typically offshore areas of the Pacific Missile Range Facility and areas in the vicinity of San Clemente Island) for security and safety does not limit public access to surrounding areas. Areas that are temporarily closed are only closed for the duration of the activity and are re-opened at the completion of the activity.

These temporary range clearance procedures for safety purposes do not adversely affect commercial and recreational fishing activities because displacement is of short duration (less than 24 hours). When range clearance is required, the public is notified via Notices to Mariners issued by the U.S. Coast Guard. These measures provide mariners with advance notice of areas being used by the Navy for training and testing activities. This allows the public to select an alternate destination without appreciable effect to their activities.

Scheduled closures to Navy training and testing areas are also posted on several publicly accessible Navy websites. Closures affecting waters around San Clemente Island are posted at http://www.scisland.org/schedules/safetyZoneUse/days/1.html. The public website for the Naval Base Coronado (http://www.cnic.navy.mil/Coronado) provides advance notice of training activities originating from the base.

The Notices to Mariners and postings on Navy websites are intended to prevent fishers and other boaters from expending time and fuel resources transiting to a closed location. In 2009, the Navy completed a study to assess the effects of Navy activities on commercial and recreational fishing near San Clemente Island in the Southern California Range Complex (Naval Undersea Warfare Center, 2009). The 2009 Southern California Fisheries Study resulted in several recommendations to improve communications between the Navy and commercial and recreational fishers. Since the completion of the study, the Navy has developed several methods for avoiding conflicts between civilian and military activities during potentially hazardous training and testing events off of San Clemente Island.

- Establishment of publicly accessible websites allows the public to view the schedule of past, current, and upcoming closures. Temporary closure of a portion of the safety zone to accommodate a potentially hazardous activity is posted on the website. Most areas within the safety zone are accessible to the public when activities are not taking place; however, section "G" of the safety zone and Wilson Cove (Figure 3.11-23) are permanently restricted due to high use (in the case of section G) and the presence of mission critical infrastructure (in the case of Wilson Cove).
- The Navy issues regular and up-to-date broadcasts of scheduled closures by radio for fishers and other boaters that do not have access to the website.

- The Navy specifies if a scheduled activity requires a complete closure or if fishing or boating can occur simultaneously with the Navy activity.
- The Navy maintains a 24-hour watch on the safety zone. Vessels in the area can contact the Navy on marine-band radio, "MARBAND 82A," to request authorization to transit (only) through section G or to check the status of other portions of the safety zone that may be closed temporarily.
- The Navy has and will continue to participate in public outreach events to discuss the importance of safety zones in sustaining public safety and the military's critical need to conduct training and testing in the waters around San Clemente Island. Recently, the U.S. Coast Guard invited the Navy to participate in a televised press conference at the beginning of the 2015–2016 lobster season to present information on the San Clemente Island safety zone website.

Upon completion of the training or testing activity, the safety zone would be reopened and fishers and boaters would be able to return to the previously closed area. To help manage competing demands and maintain public access in the Study Area, the Navy conducts its offshore operations in a manner that minimizes restrictions to commercial fishers. Navy ships, commercial fishers, and recreational users can operate within the area together while maintaining a safe separation distance. If necessary, Navy participants would relocate to avoid conflicts with non-Navy participants and maintain the safety of non-participants.

Only specific areas within the Hawaii Range Complex and Southern California Range Complex are designated as danger zones or restricted areas. In addition to these areas, the Navy may temporarily establish an exclusion zone for the duration of a specific activity (e.g., an activity involving the detonation of explosives) to prevent non-participating vessels and aircraft from entering an unsafe area. Exclusion zones typically have a radius of only a couple of miles (this varies depending on the activity); are surveyed before, during, and after the activity takes place; and end after the activity is completed. Establishment of an exclusion zone would temporarily limit commercial and recreational fishing in that specific area; however, other areas in the Study Area would remain open to commercial and recreational fishing (U.S. Department of the Navy, 2015). See Section 3.12 (Public Health and Safety) for more information on safety measures employed by the Navy to protect the public.

The Navy does not exclude fishing activities from occurring in areas of the Hawaii Range Complex and Southern California Range Complex that are not being used by the Navy during training and testing activities. Off the Main Hawaiian Islands, the largest catch, by weight, are of tuna species (Table 3.11-5), which are fished for using long-line fishing gear. Regulations require that the long-line fishery occurs beyond 50 to 75 NM during most of the year, with the exception of October through January, where the limit moves landward to between 25 and 50 NM from shore. The market squid fishery is California's largest fishery by weight and value for commercial fishers (Table 3.11-7). The squid are considered a nearshore species, and are known to occur in bays (e.g., Monterey Bay).

The Navy has been conducting training and testing activities within the Study Area for decades, and has taken and will continue to take measures to prevent interruption of commercial and recreational fishing activities. To minimize potential military/civilian interactions, the Navy will continue to publish scheduled operation times and locations on publicly accessible Navy websites and through U.S. Coast Guard issued Notices to Mariners up to 6 months in advance. These efforts are intended to ensure that commercial and recreational users are aware of the Navy's plans and allow users to plan their activities to avoid scheduled Navy activities. Therefore, decreases in the frequency of fishing trips or in the

availability of desirable fishing locations due to Navy activities is not expected. Commercial and recreational fishing activities could occur in the area before and after the temporary restriction. Should the Navy find nonparticipants present in an exclusion zone, the Navy would halt or delay (and reschedule, if necessary) all potentially hazardous activity until the nonparticipants have exited the exclusion zone.

3.11.3.1.1.3 Subsistence Fishing

Subsistence fishing typically occurs from the shore or from small vessels within state waters (3 NM or closer to shore). Navy training and testing activities occur farther from shore in offshore waters where subsistence fishing typically does not occur. Therefore, there would be no foreseeable impact on subsistence fishing from the proposed training and testing activities in the Study Area.

3.11.3.1.1.4 Tourism

Tourism activities make an appreciable contribution to the overall economy within the Study Area. Temporary range clearance procedures in the area, mainly around the Pacific Missile Range Facility and San Clemente Island, for safety purposes, do not adversely affect tourism activities because displacement is of short duration (typically less than 24 hours) and are in areas where tourism activities are not as prevalent. The Navy temporarily limits public access only to areas where there is a risk of injury or property damage and publishes scheduled activities through the use of Notices to Mariners issued by the U.S. Coast Guard and publically accessible websites. The Navy strives to conduct its operations in a manner that is compatible with recreational ocean users by minimizing temporary access restrictions. Published notices allow recreational users to adjust their routes to avoid temporary restricted areas. If civilian vessels are within a testing or training area at the time of a scheduled operation, Navy personnel would continue operations only where and when it is safe and possible to avoid the civilian vessels. If avoidance is not safe or possible, the operation would be halted and may relocate or be delayed. In some instances where safety requires exclusive use of a specific area, nonparticipants in the area are asked to relocate to a safer area for the duration of the operation. Therefore, there would be no foreseeable impact on tourism from conducting proposed training and testing activities in the Study Area.

The Navy has received comments on previous EISs expressing concern that marine mammals could be extirpated from areas where they have been observed or otherwise available for whale watching and similar recreational or tourist activities. As described in detail in Section 3.7 (Marine Mammals), Navy training and testing has been occurring in the same areas for decades and there are no data or other information to indicate that populations of any marine mammals, including those popular with whale watchers, have been or would be affected. This assessment is based on four indicators from areas in the Pacific where Navy training and testing has continued for decades: (1) evidence suggesting or documenting increases in the numbers of marine mammals present in areas where Navy operates, (2) examples of documented presence and site fidelity of species and long-term residence by individual animals of some species, (3) use of training and testing areas for breeding and nursing activities, and (4) eight years of comprehensive monitoring data indicating a lack of any observable effects to marine mammal populations as a result of Navy training and testing activities. Therefore, no effects on wildlife viewing and other wildlife-dependent recreational activities and no economic effects on tourism (such as whale watching) and related businesses dependent on observing wildlife in their natural habitats are anticipated.

3.11.3.1.1.5 Impacts on Accessibility Under Alternative 1

Impacts on Accessibility Under Alternative 1 for Training Activities

Under Alternative 1, potential accessibility impacts would be associated primarily with air warfare, surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities would continue at current levels and within established ranges and training locations. There would be no anticipated impacts on commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism because inaccessibility to areas of co-use would be temporary and of short duration (hours). In addition, the Navy has implemented recommendations from the 2009 Southern California Fisheries Study, which should improve communications between the Navy and fishers, both recreational and commercial, and reduce the number of instances when fishers must leave a temporarily closed area (Naval Undersea Warfare Center, 2009). Based on the Navy's standard operating procedures and the large expanse of the Study Area that would be available to the public, accessibility impacts would be negligible.

Impacts on Accessibility Under Alternative 1 for Testing Activities

Under Alternative 1, potential accessibility issues would be associated primarily with air warfare, surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, vessel evaluations, and other weapons platform testing. Testing activities would continue at current levels and within established training and testing ranges. There would be no anticipated impacts on commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism because inaccessibility to areas of co-use would be temporary and of short duration (hours). In addition, the Navy has implemented recommendations from the 2009 Southern California Fisheries Study, which should improve communications between the Navy and fishers, both recreational and commercial, and reduce the number of instances when fishers must leave a temporarily closed area (Naval Undersea Warfare Center, 2009). Based on the Navy's standard operating procedures and the large expanse of the Study Area that would be available to the public, accessibility impacts would be negligible.

3.11.3.1.1.6 Impacts on Accessibility Under Alternative 2

Alternative 2 consists of the activities described under Alternative 1 but with a nominal increase in the use of some sonar systems, explosives, and associated vessel and aircraft activity. The locations of these activities would remain the same as described under Alternative 1. Alternative 2 also includes the training and testing of personnel required for proficiency with these systems.

Impacts on Accessibility Under Alternative 2 for Training Activities

Under Alternative 2, potential accessibility issues would be the same as those associated with Alternative 1. There would be no changes to the Navy's standard operating procedures defining safety precautions and actions taken by the Navy to protect the public during hazardous training activities on the ocean. There would be no anticipated impacts from Alternative 2 training activities on commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism, because training activities would place only temporary and short duration (hours) restrictions on public use of scheduled training areas. In addition, the Navy is implementing recommendations from the 2009 Southern California Fisheries Study which should improve communications between the Navy and recreational fishermen and reduce the number of instances when fishers must leave a temporarily closed area (Naval Undersea Warfare Center, 2009). Based on the Navy's standard operating procedures and the large expanse of the Study Area that would be available to the public, accessibility impacts would be negligible.

Impacts on Accessibility Under Alternative 2 for Testing Activities

Under Alternative 2, potential accessibility issues would be the same as those associated with Alternative 1. Testing of some sonar systems and explosives would increase nominally within the Study Area. There would be no changes to the Navy's standard operating procedures defining safety precautions and actions taken by the Navy to protect the public during hazardous testing activities on the ocean. There would be no anticipated impacts from Alternative 2 testing activities on commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism, because testing activities would place only temporary and short duration (hours) restrictions on public use of scheduled testing areas. In addition, the Navy is implementing recommendations from the 2009 Southern California Fisheries Study, which should improve communications between the Navy and recreational fishermen and reduce the number of instances when fishers must leave a temporarily closed area (Naval Undersea Warfare Center, 2009). Based on the Navy's standard operating procedures and the large expanse of the Study Area that would be available to the public, accessibility impacts would be negligible.

3.11.3.1.1.7 Impacts on Accessibility Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various accessibility stressors (e.g., limits on access to desirable fishing locations) would not be introduced into the marine environment. Training and testing activities have occurred throughout the Study Area for decades, resulting in and sustaining increases in jobs, military and civilian infrastructure, and population growth in numerous towns, cities, and regions located along the Southern California coast and on the Main Hawaiian Islands.

While it is reasonable to assume that ceasing all training and testing activities associated with the Proposed Action would make certain areas where the Navy has conducted training and testing more accessible (i.e., available to the public more often), the effect would be minimal, because Navy operating areas are used for other purposes by the Navy and would likely remain in place for the foreseeable future. Military activities would continue to occur in some of the same areas (e.g., the range at San Clemente Island). Furthermore, the Navy has implemented a number of methods to communicate upcoming activities that would result in temporary restrictions on access to training and testing areas. These methods, which include Notices to Mariners, Notices to Airmen, broadcasts on marine band radio, website postings, and direct communication with the public through media and local organizations, all serve to reduce impacts on accessibility.

Ceasing training and testing activities may reduce the number and types of jobs available in locations where the Navy is a vital or even the primary economic driver sustaining local communities. For example, the use of munitions and other equipment for training and testing activities under the Proposed Action would no longer be needed, and, consequently, the number of jobs supporting those industries may be reduced or, alternatively, some jobs may be relocated. The secondary effects from reducing personnel who support Navy training and testing activities could include a decline in local business and a decrease in the need for infrastructure, such as schools. If jobs are relocated, a smaller population may no longer be able to sustain the local economy that developed to support the larger population. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is highly likely that many, if not all, coastal communities would be impacted to varying degrees.

3.11.3.1.2 Summary of Potential Impacts on Accessibility

Access restrictions in the Navy training and testing areas would be temporary, and these conditions would return to normal upon completion of training and testing activities. The Navy limits access to areas where, due to the nature of the training or testing activity, there is a risk of injury or property damage. Through the use of Notices to Mariners, marine band radio, and postings on publicly accessible websites, the Navy provides information on scheduled closures that may limit access to areas also used by the public. See Section 3.11.3.1.1.2 (Commercial and Recreational Fishing) for additional methods the Navy uses to communicate with the public about activities occurring at San Clemente Island. Similar procedures are implemented for other areas in the Study Area. Notification of upcoming training and testing activities allows the public to adjust their routes to avoid temporary restricted areas. If civilian vessels are within a testing or training area at the time of a scheduled activity, Navy personnel may continue operations if it is safe and possible to do so. If avoidance of a non-participating vessel (e.g., fishing boat) is not safe or possible, the activity may relocate or be delayed until it can be conducted safely. For these reasons, limiting accessibility is unlikely to result in a direct loss of income, revenue, employment, resource availability, or quality of experience.

3.11.3.2 Impacts from Airborne Acoustics

As an environmental stressor, loud noises, sonic booms, and vibrations generated from Navy training and testing activities such as weapons firing, in-air explosions, and aircraft transiting have the potential to disrupt wildlife and humans in the Study Area. The public might intermittently hear noise from ships or aircraft overflights if they are in the general vicinity of a training or testing event, but there would be no impact on public health and safety because of the infrequency and duration of events (Section 3.12, Public Health and Safety).

3.11.3.2.1 Impacts on Socioeconomic Activities from Airborne Acoustics

Airborne noise would not impact commercial transportation and shipping. Based on the analysis of impacts from the Proposed Action, fish would not experience substantial impacts from airborne acoustics (Section 3.6, Fishes). Invertebrates (Section 3.4), also important commercial fishery resources, would not be affected by airborne acoustics, because most marine species are limited in their ability to sense sound. Therefore, airborne noise from Navy activities would not impact the availability of target species for commercial or recreational fishing or subsistence fishing.

Noise interference could decrease public enjoyment of recreational activities. These effects would occur on a temporary basis, only when weapons firing, in-air explosions, and aircraft transiting occur. Of these activities, Navy activities involving weapons firing and in-air explosions would only occur when the Navy can confirm the area is clear of nonparticipants, reducing the likelihood these activities would be a disturbance. The possibility of encountering some type of noise related to a training or testing activity is unlikely to deter a resident or tourist from participating in a recreational activity (e.g., a fishing trip) in nearshore or offshore areas. Most naval training would occur well out to sea, while civilian recreational activities are concentrated within a few miles of shore, resulting in minimal overlap and negligible impacts. Tourism and recreational activity revenue is not expected to be impacted by airborne noise.

3.11.3.2.1.1 Impacts from Airborne Acoustics Under Alternative 1

Impacts from Airborne Acoustics Under Alternative 1 for Training Activities

Under Alternative 1, potential airborne noise impacts would be associated primarily with air warfare, surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities would continue at current levels and within established ranges and training locations. There would be

no anticipated impacts on commercial transportation and shipping, commercial and recreational fishing, and subsistence fishing, because (1) most Navy training occurs well out to sea, while most civilian activities, including tourism, fishing, and recreational activities, occur closer to shore; (2) Navy training activities producing airborne noise are normally short term and temporary; and (3) Navy standard operating procedures are already in place to avoid impacts on civilian activities in training areas and would require that the area is clear of nonparticipants before initiating a training activity. Therefore, airborne noise impacts on tourism and recreational activity would be negligible.

Impacts from Airborne Acoustics Under Alternative 1 for Testing Activities

Under Alternative 1, potential airborne noise impacts would be associated primarily with air warfare, surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, sea trials, and other weapons platform testing. Testing activities would continue at current levels and within established ranges and training locations. There would be no anticipated impacts on commercial transportation and shipping, commercial and recreational fishing, and subsistence fishing, because (1) most Navy training occurs well out to sea, while most civilian activities, including tourism, fishing, and recreational activities, occur closer to shore; (2) Navy training activities producing airborne noise are normally short term and temporary; and (3) Navy standard operating procedures are already in place to avoid impacts on civilian activities in training areas and would require that the area is clear of nonparticipants before initiating a training activity. Therefore, airborne noise impacts on tourism and recreational activity would be negligible.

3.11.3.2.1.2 Impacts from Airborne Acoustics Under Alternative 2

Alternative 2 consists of the activities described under Alternative 1 but with a nominal increase in the use of some sonar systems, explosives, and associated vessel and aircraft activity. The locations of these activities would remain the same as described under Alternative 1. Alternative 2 also includes the training and testing of personnel required for proficiency with these systems.

Impacts from Airborne Acoustics Under Alternative 2 for Training Activities

Under Alternative 2, airborne noise issues would be the same as those associated with Alternative 1, with the exception of a nominal increase in vessel and aircraft activity associated with an increase in the use of some sonar systems. However, the increase in airborne noise would be negligible. There would be no anticipated impacts from Alternative 2 training activities on commercial transportation and shipping, commercial and recreational fishing, and subsistence fishing, because (1) most Navy training occurs well out to sea, while most civilian activities, including tourism, fishing, and recreational activities, occur closer to shore; (2) Navy training activities producing airborne noise are normally short term and temporary; and (3) Navy standard operating procedures are already in place to avoid impacts on civilian activities in training areas and would require that the area is clear of nonparticipants before initiating a training activity. Therefore, airborne noise impacts on tourism and recreational activity would be negligible.

Impacts from Airborne Acoustics Under Alternative 2 for Testing Activities

Under Alternative 2, airborne noise issues would be the same as those associated with Alternative 1, with the exception of a nominal increase in vessel and aircraft activity associated with an increase in the use of some sonar systems and explosives. However, the increase in airborne noise would be negligible. There would be no anticipated impacts from Alternative 2 testing activities on commercial transportation and shipping, commercial and recreational fishing, and subsistence fishing, because (1) most Navy training occurs well out to sea, while most civilian activities, including tourism, fishing,

and recreational activities, occur closer to shore; (2) Navy training activities producing airborne noise are normally short term and temporary; and (3) Navy standard operating procedures are already in place to avoid impacts on civilian activities in training areas and would require that the area is clear of non-participants before initiating a training activity. Therefore, airborne noise impacts on tourism and recreational activity would be negligible.

3.11.3.2.1.3 Impacts from Airborne Acoustics Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Training and testing activities have occurred throughout the Study Area for decades, resulting in and sustaining increases in jobs, military and civilian infrastructure, and population growth in numerous towns, cities, and regions located along the Southern California coast and on the Main Hawaiian Islands. While it is reasonable to assume that ceasing all training and testing activities associated with the Proposed Action would reduce airborne noise, the effect would be negligible, because other commercial and non-military activities (e.g., shipping and recreational boating) that produce airborne noise occur at a higher tempo and closer to shore than Navy training and testing activities.

Ceasing training and testing activities may reduce the number and types of jobs available in locations where the Navy is a vital or even the primary economic driver sustaining local communities. For example, the use of munitions and other equipment used for training and testing activities would no longer be needed and, consequently, the number of jobs supporting those industries may be reduced or alternatively, some jobs may be relocated. The secondary effects from reducing personnel who conduct and support Navy training and testing activities could include a decline in local business and a decrease in the need for infrastructure, such as schools. If jobs are relocated, a smaller population may no longer be able to sustain the local economy that developed to support the larger population. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is highly likely that many coastal communities would be impacted to varying degrees.

3.11.3.2.2 Summary of Potential Impacts from Airborne Acoustics

Because the majority of Navy training and testing activities are conducted far from where tourism and recreational activities are concentrated, the impact of airborne noise would be negligible. The public might intermittently hear noise from transiting ships or aircraft overflights if they are in the general vicinity of a training or testing activity, but these occurrences would be infrequent. The infrequent exposure to airborne noise would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience.

3.11.3.3 Impacts from Physical Disturbance and Strike Stressors

The evaluation of impacts on socioeconomic resources from physical stressors focuses on direct physical encounters or collisions with objects moving through the water or air (e.g., vessels, aircraft, unmanned devices, and towed devices), dropped or fired into the water (non-explosive practice munitions, other military expended materials, and seafloor devices), or resting on the ocean floor (anchors, mines, and targets) that may damage or encounter civilian equipment. Physical disturbances that damage equipment and infrastructure could disrupt the collection and transport of products, which may impact industry revenue or operating costs.

Navy training and testing equipment and vessels moving through the water could collide with non-Navy vessels and equipment. Most of the training and testing activities involve vessel movement and use of

towed devices. However, the likelihood that a Navy vessel would collide with a non-Navy vessel is remote, because of the use of navigational aids or buoys separating vessel traffic, shipboard lookouts, radar, and marine band radio communications by both Navy and civilians. Therefore, the potential to impact commercial transportation and shipping by physical disturbance or strike is negligible and requires no further analysis.

Aircraft conducting training or testing activities in the Study Area operate in designated military special use airspace (e.g., warning areas and restricted areas). All aircraft, military and civilian, are subject to Federal Aviation Administration regulations, which define permissible uses of designated airspace, and are implemented to control those uses. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation. By adhering to these regulations, the likelihood of civilian aircraft coming into contact with military aircraft or munitions is remote. In addition, Navy aircraft follow procedures outlined in Navy air operations manuals, which are specific to a warning area or other special use airspace, and which describe procedures for operating safely when civilian aircraft are in the vicinity.

Military expended materials can physically interact with civilian equipment and infrastructure. Many of the training and testing activities use military expended materials including chaff, flares, projectiles, casings, target fragments, missile fragments, rocket fragments, ballast weights, and mine shapes.

3.11.3.3.1 Impacts on Socioeconomic Activities from Physical Disturbance and Strike Stressors

3.11.3.3.1.1 Commercial Transportation and Shipping

There would be no anticipated impacts on commercial transportation activities in the Study Area, because naval vessels and aircraft conducting training and testing generally conduct these activities far from commercially used waterways and airways. While physical disturbances or strikes could damage commercial marine vessels or aircraft, the Navy implements standard operating procedures for clearing training and testing areas of all nonparticipants before initiating hazardous activities. Therefore, the potential for Navy activities to disrupt or disturb commercial vessels or aircraft by physical disturbances or strikes would be negligible.

3.11.3.3.1.2 Commercial and Recreational Fishing

The majority of commercial fishing in the California takes place in state waters, less than 3 NM from shore, where the Navy conducts very limited training and testing activities. Nearly 80 percent (by weight) of commercial landings caught off California were from state waters. Offshore of the Hawaiian Islands, only 5 percent of commercial landings is from state waters; however, over 50 percent is caught on the high seas, beyond 200 NM from the coast and outside of the U.S. Exclusive Economic Zone. The majority of Navy training and testing activities takes place within 200 NM from shore (National Marine Fisheries Service, 2012a, 2012b).

Approximately 10 percent of fish caught during recreational fishing trips are caught in federal waters (beyond 3 NM from shore) (National Marine Fisheries Service, 2015b). Therefore, most recreational fishing would occur far from potential physical disturbances and strikes associated with training and testing activities. Some commercial fishing may occur beyond state waters in Navy training and testing areas and could be affected by the proposed activities if those activities were to alter fish population levels in those areas to such an extent that commercial fishers would no longer be able to find their target species. As described in Section 3.6.3 (Fishes, Environmental Consequences), the behavioral responses that could occur from various types of physical stressors associated with training and testing activities would not compromise the general health or condition of fishes or populations of fishes.

Section 3.6.3 (Fishes, Environmental Consequences) also evaluated potential impacts on fish habitat from physical disturbances, strikes (by small-, medium-, and large-projectiles), and the use of electromagnetic and towed devices. Physical disturbances and strikes would be concentrated within designated gunnery box areas, resulting in localized disturbances of hard bottom areas, but could occur anywhere in the Study Area. Direct and indirect impacts on the fishes using hard bottom habitat in the Study Area could occur. The use of electromagnetic devices would not harm fishes, result in behavioral responses, or affect habitat. The use of towed devices may result in short-term and localized movement of fishes to avoid the device; however, long term avoidance of an area is not anticipated. Impacts on populations of fishes in the Study Area would not be expected, and, therefore, loss of revenue or employment by commercial fishers would not occur. No impacts on recreational fishing in the Study Area would be anticipated.

Commercial fishing activities have the potential to be impacted by military equipment placed in the water column or on the seafloor for use during Navy training and testing activities. This equipment could include ship anchors; moored or bottom-mounted targets, mines, and mine shapes; bottom-mounted tripods; and the use of towed system and attachment cables. Many different types of commercial fishing gear are used in the Study Area, including gillnets, longline gear, troll gear, trawls, seines, and traps or pots. Commercial bottom-fishing activities, such as dredging, bottom trawling, long lines, and pots and traps have the greatest potential to be impacted by materials expended during training and testing activities and that ultimately reside on the seafloor. For example, military expended materials, such as decelerators/parachutes, cables, and guidance wires, would ultimately sink to the seafloor and could inadvertently snag, entangle, and damage fishing equipment. Interaction with bottom-fishing gear could result in the loss of or damage to commercial fishing gear and Navy equipment. When these rare events occur, they could result in loss of income, revenue, and employment. Entanglement by fiber optic cables and guidance wires expended during training and testing activities would not affect fish habitat and is unlikely to be encountered by commercial fishers. Even if encountered, fiber optic cables are brittle and are likely to break easily if entangled with fishing gear. Commercial fishers anticipate that fishing gear will be lost or damaged throughout the year and incorporate the economic loss into their business model.

The Navy recovers many of the targets (e.g., mines and mine shapes) and target fragments used in training and testing activities, and would continue to do so to minimize the potential for interaction with fishing gear and fishing vessels. Unrecoverable items are typically small, constructed of soft materials (e.g., cardboard boxes or tethered target balloons), or are intentionally designed to sink to the bottom after serving their purpose (such as expended 55-gallon steel drums), so that they would not represent a collision risk to vessels, including commercial fishing vessels. Although larger expended items, such as 55-gallon drums, may pose a risk to certain types of fishing gear used for bottom fishing, the probability of encountering such an item is remote given the large area over which expended materials would be distributed; the depth of the water where most activities using expended materials would occur; and the tendency for larger, heavier materials to become embedded in soft sediments, making them less likely to be snagged by fishing gear.

Based on the large size of the Study Area, the limited areas of concentrated military activity, and the advance release of Notices to Mariners prior to conducting activities, impacts on commercial or recreational fishing from physical disturbances and strikes in the Study Area would be rare and were it to occur would have a negligible economic impact on the commercial or recreational fishing industries.

3.11.3.3.1.3 Subsistence Fishing

Subsistence fishing typically occurs from the shore or from small vessels within state waters (3 NM or closer to shore). Navy training and testing activities using expended materials occur farther from shore in deep waters where subsistence fishing typically does not occur. Therefore, there would be no foreseeable physical disturbance or strike impacts on subsistence fishing from training and testing activities in the Study Area.

3.11.3.3.1.4 Tourism

While Navy training and testing activities can occur throughout the Study Area, most (especially hazardous) activities occur well out to sea. Most civilian recreational activities engaged in by both tourists and residents take place within a few miles of land or in many cases along the shoreline.

Snorkeling and diving take place primarily at known recreational sites, including shipwrecks and reefs. The locations of these popular sites are well documented, boats are typically well marked, and diver-down flags would be visible from, and avoided by, Navy ships conducting training and testing activities. As a result, conflicts between training and testing activities within the offshore areas and recreational diving and snorkeling would not occur.

Other tourism activities such as whale watching, boating, or use of other watercraft or aircraft may occur farther offshore. Activities occurring farther from shore would usually be conducted from larger boats that are typically well marked and visible to Navy ships conducting training and testing activities. Individual boaters engaged in tourism activities, such as whale watching, monitor navigational information to avoid Navy training and testing areas. Vessel operators are responsible for being aware of designated danger zones in surface waters and any Notices to Mariners that are in effect. Operators of recreational or commercial vessels are responsible for abiding by U.S Coast Guard maritime regulations. In conjunction with these responsibilities, Navy standard operating procedures require Navy vessels to ensure that an area is clear of nonparticipants before initiating training and testing activities. Conflicts between Navy training and testing in offshore areas and whale watching or other offshore recreational activities are not expected to occur. The Navy would continue to recover larger pieces of targets used in certain training and testing activities so that target debris would not pose a collision risk to civilian vessels. Unrecoverable pieces of targets are typically small, constructed of soft materials such as cardboard, are pieces of tethered target balloons, or are designed to sink to the seafloor after use and would not damage civilian vessels if encountered.

Temporary range clearance procedures in the areas, mainly around the Pacific Missile Range Facility and San Clemente Island, for safety purposes, do not adversely affect tourism activities, because displacement is of short duration (typically less than 24 hours) and are in areas where tourism activities are not as prevalent. The Navy temporarily limits public access to areas where there is a risk of injury or property damage through the use of Notices to Mariners issued by the U.S. Coast Guard. The Navy also maintains a website which provides information on scheduled closures around San Clemente Island (see Section 3.11.3.1.1.2, Commercial and Recreational Fishing, for additional details). Published notices allow recreational users to adjust their routes to avoid temporary restricted areas. If civilian vessels are within a testing or training area at the time of a scheduled operation, Navy personnel continue operations and avoid them if it is safe and possible to do so. If avoidance is not safe or possible, the operation may relocate or be delayed. In some instances where safety requires exclusive use of a specific area, nonparticipants in the area are asked to relocate to a safer area for the duration of the operation. Because Navy training and testing activities vary in location and are primarily short-term in

duration, impacts on tourism activities from rerouting or postponing activities would be negligible. Changes to offshore tourism activities in the Study Area would not be expected, and, therefore, loss of revenue or employment associated with tourism would not be expected as a result of training and testing activities.

3.11.3.3.1.5 Impacts from Physical Disturbance and Strike Stressors Under Alternative 1

Impacts from Physical Disturbance and Strike Stressors Under Alternative 1 from Training Activities

Under Alternative 1, potential physical disturbance and strike impacts would be associated primarily with air warfare, surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities in these warfare areas would continue at current levels and within established ranges and training locations.

There would be no anticipated impacts on commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism, because of the large size of the Study Area, the limited areas of operations, and implementation of the Navy's standard operating procedures, which includes ensuring that an area is clear of all non-participating vessels before training activities take place. In addition, the Navy provides advance notification of training activities to the public through Notices to Mariners issued by the U.S. Coast Guard and postings on Navy websites (e.g., the San Clemente Island website). Damage to or loss of commercial fishing gear from interaction with Navy vessels, equipment, or other expended materials is unlikely. The Navy recovers many practice munitions (e.g., mines and mine shapes) for reuse following the activity. The Navy also recovers larger floating objects or materials, such as targets or target fragments, to avoid having them become hazards to navigation. Smaller objects that remain in the water column would be unlikely to pose a risk to fishing gear. Furthermore, the Navy will implement mitigation to avoid impacts from explosives and physical disturbance and strike stressors on seafloor resources in mitigation areas throughout the Study Area (see Section 5.4.1, Mitigation Areas for Seafloor Resources). The mitigation areas will help avoid potential impacts on shallow-water coral reefs, live hard bottom, artificial reefs, and shipwrecks, which are valuable components of the snorkeling, diving, and fishing industries. Considering the expansive size of the Navy's OPAREAs, the wide distribution of military expended materials over these large areas, and implementation of standard operating procedures and mitigation, impacts from physical disturbances and strikes on commercial and recreational fishing, subsistence fishing, and tourism would be negligible.

Impacts from Physical Disturbance and Strike Stressors Under Alternative 1 from Testing Activities

Under Alternative 1, potential physical disturbance and strike would be associated primarily with air warfare, surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, sea trials, and other weapons platform testing. Testing activities would continue at current levels and within established training and testing ranges.

There would be no anticipated impacts on commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism, because of the large size of the Study Area, the limited areas of operations, and implementation of the Navy's standard operating procedures, which includes ensuring that an area is clear of all non-participating vessels before testing activities take place. In addition, the Navy provides advance notification of testing activities to the public through Notices to Mariners issued by the U.S. Coast Guard and postings on Navy websites (e.g., the San Clemente Island website). Damage to or loss of commercial fishing gear from interaction with Navy equipment or other expended materials is unlikely. The Navy recovers many practice munitions (e.g., mines and mine

shapes) for reuse following the activity. The Navy also recovers larger floating objects or materials, such as targets or target fragments, to avoid having them become hazards to navigation. Smaller objects that remain in the water column would be unlikely to pose a risk to fishing gear. Furthermore, the Navy will implement mitigation to avoid impacts from explosives and physical disturbance and strike stressors on seafloor resources in mitigation areas throughout the Study Area (see Section 5.4.1, Mitigation Areas for Seafloor Resources). The mitigation areas will help avoid potential impacts on shallow-water coral reefs, live hard bottom, artificial reefs, and shipwrecks, which are valuable components of the snorkeling, diving, and fishing industries. Considering the expansive size of the Navy's OPAREAs, the wide distribution of military expended materials over these large areas, and implementation of standard operating procedures and mitigation, impacts from physical disturbances and strikes on commercial and recreational fishing, subsistence fishing, and tourism would be negligible.

3.11.3.3.1.6 Impacts from Physical Disturbance and Strike Stressors Under Alternative 2

Alternative 2 consists of the activities described under Alternative 1 but with a nominal increase in the use of some sonar systems and explosives associated vessel and aircraft activity. The locations of these activities would remain the same as described under Alternative 1. Alternative 2 also includes the training and testing of personnel required for proficiency with these systems.

Impacts from Physical Disturbance and Strike Stressors Under Alternative 2 from Training Activities

Under Alternative 2, potential physical disturbance and strike impacts would be the same as described under Alternative 1. A nominal increase in vessel and aircraft activity associated with an increase in the use of some sonar systems would occur under Alternative 2; however, the increase in the probability of a physical disturbance or strike would be negligible. There would be no changes to the Navy's mitigation measures or standard operating procedures for hazardous training activities performed in the Study Area, which includes ensuring that an area is clear of all non-participating vessels before training activities take place. The expansive size of the Navy's OPAREAs, the wide distribution of military expended materials over these large areas, and implementation of standard operating procedures and mitigation ensure that impacts from physical disturbances and strikes would be negligible. The advance public release of Notices to Mariners issued by the U.S. Coast Guard and postings of upcoming activities on Navy websites (e.g., the San Clemente Island website) would inform the public of upcoming activities and enable them to plan to avoid the area. Therefore, impacts from physical disturbance and strike on commercial and recreational fishing, subsistence fishing, and tourism would be negligible.

Impacts from Physical Disturbance and Strike Stressors Under Alternative 2 from Testing Activities

Under Alternative 2, potential physical disturbance and strike impacts would be the same as those associated with Alternative 1. A nominal increase in vessel and aircraft activity associated with an increase in the use of some sonar systems and explosives would occur under Alternative 2; however, the increase in the probability of a physical disturbance or strike would be negligible. There would be no changes to the Navy's mitigation measures or standard operating procedures for hazardous testing activities performed in the Study Area. The expansive size of the Navy's OPAREAs, the wide distribution of military expended materials over these large areas, and implementation of standard operating procedures and mitigation ensure that impacts from physical disturbances and strikes would be negligible. The advance public release of Notices to Mariners issued by the U.S. Coast Guard and postings of upcoming activities on Navy websites (e.g., the San Clemente Island website) would inform the public of upcoming activities, and enable them to plan to avoid the area. Therefore, impacts from

physical disturbance and strike on commercial and recreational fishing, subsistence fishing, and tourism would be negligible.

3.11.3.3.1.7 Impacts from Physical Disturbance and Strike Stressors Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various physical disturbance and strike stressors (e.g., disruption to fishing) would not be introduced into the marine environment. Training and testing activities have occurred throughout the Study Area for decades, resulting in and sustaining increases in jobs, military and civilian infrastructure, and population growth in numerous towns, cities, and regions located along the Southern California coast and Main Hawaiian Islands. While it is reasonable to assume that ceasing training and testing activities associated with the Proposed Action would reduce the potential for disruption of civilian activities by physical disturbances or strikes, the effect would be negligible, because the likelihood of a disturbance, as described under Alternative 1, is already negligible.

Ceasing training and testing activities may reduce the number and types of jobs available in locations where the Navy is a vital or even the primary economic driver sustaining local communities. For example, the use of munitions and other equipment used for training and testing activities would no longer be needed, and, consequently, the number of jobs supporting those industries may be reduced or, alternatively, some jobs may be relocated. The secondary effects from reducing personnel who support Navy training and testing activities could include a decline in local business and a decrease in the need for infrastructure, such as schools. If jobs are relocated, a smaller population may no longer be able to sustain the local economy that developed to support the larger population. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is highly likely that many coastal communities would be impacted to varying degrees.

3.11.3.3.2 Summary of Potential Impacts from Physical Disturbance and Strike Stressors

Because the majority of Navy training and testing activities are conducted far from where commercial and recreational activities are concentrated, the potential for a physical disturbance or strike would be negligible. The public might intermittently observe a transiting ship or aircraft flying overhead if they are in the general vicinity of a training or testing activity, but these occurrences would be infrequent and of short duration. The Navy does not typically train or test in areas close to civilian infrastructure and activities and, based on the Navy's standard operating procedures and the large expanse of the testing and training ranges, the likelihood of a physical disturbance or strike disrupting commercial or recreational activities in the Study Area would be negligible. Therefore, loss of revenue or employment changes to socioeconomic activities and resources in the Study Area would not be expected.

3.11.4 Secondary Stressors

Socioeconomic Resources could be indirectly impacted by training and testing activities if changes to physical and biological resources were to alter the way commercial transportation, commercial or recreational fishing, subsistence fishing, and tourism were conducted.

Impacts on sediment and water quality, fishes, invertebrates, and marine mammals were considered to be potential secondary stressors to socioeconomic resources. Impacts on sediment and water quality have the potential to affect habitat for fishes and invertebrates that are of vital importance to the commercial fishing industry as well as recreational and subsistence fishers and the local industries that support those activities. A portion of the tourism industry is also dependent on coastal and

marine-based activities in both Southern California and Hawaii and could be affected by impacts on fisheries. No indirect or secondary impacts on commercial transportation and shipping are anticipated.

Commercial, recreational, and subsistence fishing and tourism could be impacted if the proposed activities altered fish or invertebrate populations to such an extent that species abundance was no longer sufficient to support these socioeconomic activities. Disturbances to marine mammal populations that result in abandonment of areas where whales are known to occur could impact the whale watching industry. However, no secondary impacts on socioeconomic resources would occur based on the results of analyses presented in Sections 3.4 (Invertebrates), 3.6 (Fishes), and 3.7 (Marine Mammals). These sections concluded that there would be no population-level impacts on marine species from training and testing activities, including from the use of explosives and sonar and other transducers.

3.11.5 Summary of Potential Impacts on Socioeconomic Resources

This section evaluates the potential impacts on socioeconomic resources from all stressors combined. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the sections above. Stressors associated with Navy training and testing activities do not typically occur in isolation but rather occur in some combination. For example, anti-submarine warfare activities can include elements of airborne acoustics, physical disturbance and strike, and accessibility restrictions that are all coincident in space and time. An analysis of the combined impacts of all stressors considers the potential consequences of aggregate exposure to all stressors and the repetitive or additive consequences of exposure over multiple years. The stressors from the proposed training and testing activities that have the potential to impact socioeconomic resources include limits on accessibility to air and sea space within the Study Area, airborne acoustics, physical disturbances and strikes, and indirect impacts resulting from availability of resources (e.g., target fish species).

3.11.5.1 Combined Impacts of All Stressors Under Alternative 1

Under Alternative 1, training and testing activities would be widely dispersed throughout the Study Area, limiting the potential for co-occurrence of stressors from multiple training or testing activities being conducted at the same time but in a different location. Certain training and testing activities may return to a specific geographic location to use its unique physical characteristics. Repeatedly using the same area may limit accessibility to that area for commercial or recreational activities relative to a less frequently used area. The Navy typically uses established ranges, warning areas, and danger zones for training and testing activities that are conducted repeatedly over time. Many commercial and recreational users in the region are familiar with the locations of Navy activities, which allows for better planning and fewer instances of conflict. When an area needs to be temporarily closed to the public, the Navy notifies the public through Notices to Mariners and Notices to Airmen, issued by the U.S. Coast Guard and the Federal Aviation Administration, respectively, ahead of time to avoid potential conflicts with the public. If multiple, incompatible training or testing activities need to use a specific location, the activities would not be scheduled at the same time, and stressors associated with each activity would not occur at the same time. Therefore, an increase in impacts resulting from a combination of stressors occurring simultaneously is not expected.

3.11.5.2 Combined Impacts of All Stressors Under Alternative 2

The number and types of training and testing activities that would be conducted under Alternative 2 is similar to those described under Alternative 1 (see Chapter 2, Description of Proposed Action and Alternatives). Therefore, the combined impacts of all stressors under Alternative 2 would be the same as described under Alternative 1.

3.11.5.3 Combined Impacts of All Stressors Under the No Action Alternative

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Therefore, training and testing activities would not limit accessibility to air and sea space (although other Navy activities would still use established ranges, warning areas, and danger zones), generate airborne noise, or cause physical disturbances and strikes. No impacts on socioeconomic resources from these stressors would occur.

Ceasing the proposed training and testing activities may reduce the number and types of jobs available in locations where the Navy is a vital or even the primary economic driver sustaining local communities. For example, the use of munitions and other equipment used for training and testing activities would no longer be needed and, consequently, the number of jobs supporting those industries may be reduced or, alternatively, some jobs may be relocated. The secondary effects from reducing personnel who support Navy training and testing activities could include a decline in local business and a decrease in the need for infrastructure, such as schools. If jobs are relocated, a smaller population may no longer be able to sustain the local economy that developed to support the larger population. While more complex studies at the local level would need to be conducted to quantify potential socioeconomic impacts from ceasing training and testing activities, it is highly likely that many coastal communities would be impacted to varying degrees.

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3.12 Public Health and Safety

Final
Environmental Impact Statement/Overseas Environmental Impact Statement
Hawaii-Southern California Training and Testing

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3.12 PUBLIC HEALTH AND SAFETY

PREFERRED ALTERNATIVE SYNOPSIS

The United States Department of the Navy considered all potential stressors that public health and safety could be exposed to from the Proposed Action. The following conclusions have been reached for the Preferred Alternative (Alternative 1):

- In-Water Energy: Because of the Navy's standard operating procedures, impacts on public health and safety would be unlikely.
- In-Air Energy: Because of the Navy's standard operating procedures, impacts on public health and safety would be unlikely.
- Physical Interactions: Because of the Navy's standard operating procedures, impacts on public health and safety would be unlikely.
- Secondary Stressors (sediments and water quality): Because water and sediment quality impacts would be minimal and temporary and the Navy would not exceed state or federal water quality standards, impacts on public health and safety would be unlikely.

3.12.1 INTRODUCTION

This section provides the analysis of potential impacts on public health and safety within the Hawaii-Southern California Training and Testing (HSTT) Study Area.

The affected environment provides the context for evaluating the effects of the Navy training and testing on public health and safety. Generally, the greatest potential for a proposed activity to impact the public is in nearshore areas because that is where public activities are most concentrated. Proposed training and testing in nearshore areas could be close to dive sites and other recreational areas where the collective health and safety of groups of individuals would be of concern. Most commercial and recreational marine activities (with the exception of commercial shipping) occur close to the shore, usually limited by the capabilities of the vessel or equipment used.

The Navy employs standard operating procedures to provide for the safety of personnel and equipment as well as the success of the training and testing activities. Standard operating procedures designed to prevent public health and safety impacts are discussed in detail in Section 2.3.3 (Standard Operating Procedures). The following subsections generally discuss established safety protocols and standard operating procedures associated with the sea space and airspace environment, as well as specific procedures associated with aviation safety, submarine navigation safety, surface vessel navigation safety, sonar safety, electromagnetic energy safety, and munitions safety.

Methods

The requirements for public health and safety were derived from federal regulations, Department of Defense (DoD) directives, and Navy instructions for training and testing. The directives and instructions provide specifications for mission planning and execution, including criteria for public health and safety considerations.

The alternatives were evaluated based on two factors: the potential for specific training or testing activities to impact public health and safety, and the degree to which those activities could have an impact. The likelihood that members of the public would be near a training or testing activity determined the potential for exposure to the activity. If the potential for exposure existed, the degree of the potential impacts on public health and safety, including increased risk for injury or loss of life, was determined. If the potential for exposure did not exist, it was determined that there would be no impacts on public health and safety.

The Study Area is shared by military, commercial, institutional, and recreational users. The Navy is committed to ensuring public safety during training and testing activities. To protect public safety, access to certain ocean areas must be temporarily limited during certain training and testing activities.

3.12.2 Affected Environment

3.12.2.1 General Background

The area of interest for assessing potential impacts on public health and safety is the U.S. territorial waters of southern California and Hawaii (seaward of the mean high water line to 12 nautical miles [NM]). Military, commercial, institutional, and recreational activities take place simultaneously in the Study Area and have coexisted safely for decades. These activities coexist safely because established rules and practices lead to safe use of the waterway and airspace. The following paragraphs briefly discuss the rules and practices for recreational, commercial, and military use in sea surface areas and airspace.

3.12.2.1.1 Sea Space

Most of the sea space in the Study Area is accessible for recreational and commercial activities; however, some activities are prohibited or restricted in certain areas (e.g., danger zones and restricted areas).

In accordance with Title 33 Code of Federal Regulations (CFR) part 165 (Regulated Navigation Areas and Limited Access Areas), these restrictions can be permanent or temporary. Nautical charts issued by the National Oceanic and Atmospheric Administration include these federally designated zones and areas. Operators of recreational and commercial vessels have a duty to abide by maritime regulations administered by the U.S. Coast Guard.

In accordance with Title 33 CFR part 72 (Aids to Navigation), the U.S. Coast Guard informs private and commercial vessels about temporary closures via Notices to Mariners. These notices provide information about durations and locations of closures because of activities that are potentially hazardous to surface vessels. Broadcast notices on maritime frequency radio, weekly publications by the appropriate U.S. Coast Guard Navigation Center, and global positioning system navigation charts disseminate these navigational warnings.

3.12.2.1.2 Airspace

Most of the airspace in the Study Area is accessible to general aviation (recreational, private, corporate) and commercial aircraft; however, some areas, like waterways, are temporarily off-limits to civilian and commercial use. The Federal Aviation Administration has established special use airspace, which is airspace of defined dimensions wherein activities must be confined because of their nature or wherein limitations may be imposed upon aircraft operations that are not part of those activities (Federal Aviation Administration Order 7400.2L *Procedures for Handling Airspace Matters*, *Special Use Airspace* -

Part 5, Chapters 21 to 28, effective April 27, 2017). Special use airspace in the Study Area includes the following:

- Restricted airspace: Areas where aircraft are subject to restriction due to the existence of unusual (often invisible) hazards to aircraft (e.g., release of munitions). Some areas are under strict control of the DoD, and some are shared with nonmilitary agencies (Federal Aviation Administration Order 7400.2L, Chapter 23).
- Military Operations Areas: Airspace designated outside of Class A airspace to separate or segregate certain nonhazardous military activities from Instrument Flight Rules traffic and identify for Visual Flight Rules traffic where these activities are conducted (Federal Aviation Administration Order 7400.2L, Chapter 25).
- Warning areas: Areas of defined dimensions, extending from 3 NM outward from the coast of the United States, that serve to warn non-participating aircraft of potential danger (Federal Aviation Administration Order 7400.2L, Chapter 24).

Additionally, Air Traffic Control Assigned Airspace is airspace of defined vertical/lateral limits, implemented by Letter of Agreement between the user and the concerned Air Route Traffic Control Center, and assigned by Air Traffic Control for the purpose of providing air traffic segregation between the specified activity being conducted within the assigned airspace and other instrument flight rules traffic. Air Traffic Control Assigned Airspace should not be established to contain activities for which a specific type of special use airspace should be designated (i.e., should not be used as a substitute for a more appropriate special use airspace designation).

Notices to Airmen are created and transmitted by government agencies and airport operators to alert aircraft pilots of any hazards en route to or at a specific location. Notices to Airmen contain information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, procedure, or hazard in the National Airspace System), the timely knowledge of which is essential to personnel concerned with flight operations. The Federal Aviation Administration issues Notices to Airmen to disseminate information on upcoming or ongoing military exercises with resulting airspace restrictions. Civilian aircraft operators are responsible for being aware of restricted areas in airspace and any Notices to Airmen in effect. Pilots have a duty to abide by aviation rules as administered by the Federal Aviation Administration.

Weather conditions dictate whether an aircraft (general aviation, commercial, or military) can fly under Visual Flight Rules or Instrument Flight Rules. Under Visual Flight Rules, the weather is favorable and the pilot is required to remain clear of clouds by specified distances to ensure separation from other aircraft under the concept of “see and avoid.” Pilots flying under Visual Flight Rules must be able to see outside of the cockpit, control the aircraft’s attitude, navigate, and avoid obstacles and other aircraft based on visual cues. Pilots flying under Visual Flight Rules assume responsibility for their separation from all other aircraft and are generally not assigned routes or altitudes by air traffic control.

During unfavorable weather, pilots must follow Instrument Flight Rules. Factors such as visibility, cloud distance, cloud ceilings, and weather phenomena cause visual conditions to drop below the minimum required to operate by visual flight referencing. Instrument Flight Rules are the regulations and restrictions a pilot must comply with when flying in weather conditions that restrict visibility. Pilots can fly under Instrument Flight Rules in Visual Flight Rules weather conditions; however, pilots cannot fly under Visual Flight Rules in Instrument Flight Rules weather conditions.

3.12.2.2 Safety and Inspection Procedures

In accordance with Navy instructions presented in this chapter, safety and inspection procedures discussed in this section are designed to ensure public health and safety. Through the Naval Safety Center and Fleet Safety Center, the Navy promotes a proactive and comprehensive safety program designed to reduce to the greatest extent possible any potential adverse impacts on public health and safety from training and testing activities.

As previously stated, the greatest potential for training or testing activities to impact the public is in nearshore areas, because public activities are concentrated in those areas. When planning a training or testing activity, the Navy considers proximity of the activity to public areas in choosing a location. Important factors considered include the ability to control access to an area; schedule (time of day, day of week); frequency, duration, and intensity of activities; range safety procedures; operational control of activities or events; and safety history.

The Navy's Fleet Area Control and Surveillance Facilities provide support and training resources for DoD, Department of Homeland Security, and foreign military units by coordinating, scheduling, and monitoring activities in the U.S. Pacific Fleet operating areas and special use airspace. At Navy Ranges, such as the Pacific Missile Range Facility, Range Control is responsible for hazard area surveillance and clearance and the control of all range operational areas. Although operations in special use airspace are scheduled through the Navy Fleet and Area Control and Surveillance Facilities, Range Control coordinates the real-time control of ranges in coordination with the Federal Aviation Administration and other military users, and communicates with the operations conductors and all participants entering and leaving the range areas. The Federal Aviation Administration and the U.S. Coast Guard issue Notices to Airmen and Notices to Mariners, respectively.

During training and testing activities in the Study Area, the Navy ensures that the appropriate safety zone is clear of non-participants before engaging in certain activities, such as firing weapons. Inability to obtain a "clear range" could result in the delay, cancellation, or relocation of an event. This approach ensures public safety during Navy activities that otherwise could harm non-participants. Current Navy practices employ the use of sensors and other devices (e.g., radar and big-eye binoculars) to ensure public health and safety while conducting training and testing activities. The following subsections outline the current requirements and practices for human safety as they pertain to range safety procedures, range inspection procedures, exercise planning, and scheduling and coordinating procedures for the Navy.

Training activities must comply with Fleet Area Control and Surveillance Facility procedures. Fleet Area Control and Surveillance Facilities San Diego and Hawaii have published safety procedures for activities conducted both nearshore and offshore (U.S. Department of the Navy, 2014). These guidelines (and others) apply to range users as follows:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of in-water munitions must be coordinated with submarine operational authorities. The coordination also applies to towed sonar arrays and torpedo countermeasures.
- Aircraft or vessels expending munitions shall not commence firing without the permission of the Range Safety Officer for their specific range area.

- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Aircraft carrying munitions to or from ranges shall avoid populated areas to the maximum extent possible.
- Strict on-scene procedures include the use of ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data to confirm the firing range and target area are clear of civilian vessels, aircraft, or other non-participants.

Comprehensive safety planning instructions exist for specific testing activities, such as laser and electromagnetic energy testing (U.S. Department of Defense, 2009; U.S. Department of the Navy, 2008). These instructions provide guidance on how to identify the hazards, assess the potential risk, analyze risk control measures, implement risk controls, and review safety procedures. They apply to all testing activities including ground, waterborne, and airborne testing activities involving personnel, aircraft, inert minefields, equipment, and airspace. The guidance applies to system program managers, program engineers, test engineers, test directors, and aircrews that are responsible for incorporating safety planning and review when conducting test programs.

3.12.2.2.1 Aviation Safety

The Navy procedures regarding planning and management of special use airspace are provided in the Chief of Naval Operations Instruction 3770.2L, *Airspace Procedures and Planning Manual* (U.S. Department of the Navy, 2007). Scheduling and planning procedures for air operations on range complexes are issued through the Navy's Fleet Area Control and Surveillance Facilities San Diego and Hawaii (U.S. Department of the Navy, 2014).

Testing activities have their own procedures that require that safety be considered in any testing event. For example, the Navy's Operational Test Director's Manual prescribes policies and procedures for the planning, conducting, and reporting of Operational Test and Evaluation of new and improved naval weapons and warfare support systems (U.S. Department of the Navy, 2016a).

Aircrews involved in training or testing exercises must be aware that non-participating aircraft and ships are not precluded from entering the area and may not comply with Notices to Airmen or Notices to Mariners. Aircrews are required to maintain a continuous lookout for non-participating aircraft while operating in warning areas under Visual Flight Rules. In general, aircraft carrying munitions are not allowed to fly over public or commercial boats or ships.

3.12.2.2.2 Submarine Navigation Safety

Submarine crews use various methods to avoid collisions while they are surfaced, including visual and radar scanning, acoustic depth finders, and state-of-the-art satellite navigational systems. During submerged transit, submarines use all available ocean navigation tools, including inertial navigation charts that calculate position based on the submerged movements of the submarine. Submarines use these systems to avoid surface vessels as well as all other hazards to navigation.

3.12.2.2.3 Surface Vessel Navigation Safety

The Navy practices the fundamentals of safe navigation. As specified in Section 2.3.3 (Standard Operating Procedures), ships operated by or for the Navy have personnel assigned to stand watch at all times, day and night, when underway. Watch personnel undertake extensive training in accordance with the *Navy Lookout Training Handbook* or civilian equivalent, including on-the-job instruction and a formal

Personal Qualification Standard program (or equivalent program for supporting contractors or civilians), to certify that they have demonstrated all necessary skills (such as detection and reporting of floating or partially submerged objects). While on watch, personnel employ visual search techniques, including the use of binoculars and scanning techniques in accordance with the *Navy Lookout Training Handbook* or civilian equivalent. After sunset and prior to sunrise, watch personnel employ night visual search techniques, which could include the use of night vision devices. Watch personnel are primarily posted for safety of navigation, range clearance, and man-overboard precautions. For some specific testing activities, such as unmanned surface vehicle testing, a support boat would be used in the vicinity of the testing and operation to ensure safe navigation. Before firing or launching a weapon or radiating a non-eye-safe laser, Navy surface vessels are required to determine that all safety criteria have been satisfied. When applicable, the surface vessel would use aircraft and other boats to aid in navigation.

3.12.2.2.4 Sonar Safety

Surface vessels and submarines may use active sonar in the pierside locations listed in Chapter 2 (Description of Proposed Action and Alternatives) and during transit to training or testing exercise locations. To ensure safe and effective sonar use, the Navy applies the same safety procedures for pierside sonar use as described in Section 3.12.2.2 (Safety and Inspection Procedures).

The U.S. Navy Diving Manual, Appendix 1A, *Safe Diving Distances from Transmitting Sonar*, is the Navy's governing document for protecting divers during active sonar use (U.S. Department of the Navy, 2016b). The manual provides procedures for calculating safe distances from active sonar. These procedures are derived from experimental and theoretical research conducted at the Naval Submarine Medical Research Laboratory and the Navy Experimental Diving Unit. Safety distances vary based on conditions that include diver dress, type of sonar, and duration of time in the water. These safety distances would also be applicable to recreational swimmers and divers. Some safety procedures include measurements to be taken during testing activities to identify an exclusion area for non-participating swimmers and divers.

3.12.2.2.5 Electromagnetic Energy Safety

This section discusses electromagnetic energy transmitted through the air as a result of proposed activities. All frequencies (or wavelengths) of electromagnetic energy are referred to as the *electromagnetic spectrum* and include electromagnetic energy and radio frequency radiation. Communications and electronic devices such as radar, electronic warfare devices, navigational aids, two-way radios, cell phones, and other radio transmitters produce electromagnetic radiation. While such equipment emits electromagnetic energy, some of these systems are the same as, or similar to, civilian navigational aids and radars at local airports and television weather stations. Radio waves and microwaves emitted by transmitting antennas are another form of electromagnetic energy, collectively referred to as radio frequency radiation. Radio frequency energy includes frequencies ranging from 0 to 3,000 gigahertz. Exposure to radio frequency energy of sufficient intensity at frequencies between 3 kilohertz and 300 gigahertz can adversely affect people, munitions, and fuel.

To avoid excessive exposures to electromagnetic energy, military aircraft are operated in accordance with standard operating procedures that establish minimum separation distances between electromagnetic energy emitters and people, munitions, and fuels (U.S. Department of Defense, 2009). Thresholds for determining hazardous levels of electromagnetic energy to humans, munitions, and fuel have been determined for electromagnetic energy sources based on frequency and power output, and practices are in place to protect the public from electromagnetic radiation hazards (U.S. Department of

Defense, 2002, 2009). These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct exposure, posting warning signs, establishing safe operating levels, activating warning lights when radar systems are operational, and not operating some platforms that emit electromagnetic energy within 15 NM of shore. Safety planning instructions provide clearance procedures for non-participants in operational areas before conducting training and testing activities that involve in-water electromagnetic energy (e.g., mine warfare) (U.S. Department of Defense, 2009; U.S. Department of the Navy, 2008).

3.12.2.2.6 Laser Safety

Lasers produce a coherent beam of light energy. The Navy uses lasers for precision range finding, as target designation/illumination devices for engagement with laser-guided weapons, and for mine detection and mine countermeasures, as well as for non-lethal deterrent. Testing activities include high-energy laser weapons tests to evaluate the specifications, integration, and performance of a vessel- or aircraft-mounted, high-energy laser. The high-energy laser would be used as a weapon to disable small surface vessels. The Office of the Chief of Naval Operations Instruction 5100.27B/Marine Corps Order 5104.1C, *Navy Laser Hazards Control Program*, prescribes Navy and Marine Corps policy and guidance in the identification and control of laser hazards. The Navy observes strict precautions and has written instructions in place for laser users to ensure that non-participants are not exposed to intense light energy. Laser safety procedures for aircraft require an initial pass over the target before laser activation to ensure that target areas are clear. During actual laser use, aircraft run-in headings are also restricted to avoid unintentional contact with personnel or non-participants. Personnel participating in laser training activities are required to complete a laser safety course (U.S. Department of the Navy, 2008).

3.12.2.2.7 Explosive Munitions Detonation Safety

Pressure waves from in-water detonations can pose a physical hazard in surrounding waters. Before conducting an in-water explosive training or testing activity, Navy personnel establish an appropriately sized exclusion zone to avoid exposing non-participants to the harmful intensities of pressure waves. The U.S. Navy Diving Manual, Section 2.7.3, *Underwater Explosions*, provides procedures for determining safe distances from in-water explosions (U.S. Department of the Navy, 2016b). In accordance with training and testing procedures for safety planning related to detonations (see Section 3.12.2.2.8, Weapons Firing and Munitions Expenditure Safety), the Navy uses the following detonation procedures:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of in-water munitions must be coordinated with submarine operational authorities.
- Aircraft or vessels expending munitions shall not commence firing without permission of the Range Safety Officer or Test Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Detonation activities would be conducted during daylight hours.

3.12.2.2.8 Weapons Firing and Munitions Expenditure Safety

Navy explosives safety policy is based on the requirements of DoD 6055.9M-STD, *Ammunition and Explosives Safety Standards*. This DoD standard establishes uniform safety requirements applicable to ammunition and explosives and to associated and unrelated personnel and property exposed to the potentially damaging effects of an accident involving ammunition and explosives during, among other things, usage during training, testing, transportation, handling, storage, maintenance, and disposal (U.S. Department of Defense, 2012).

Safety is a primary consideration for all training and testing activities. The range must be able to safely contain the hazard area of the weapons and equipment employed. The hazard area is based on the size and net explosive weight of the weapon, and it includes a safety buffer around the target to account for items going off-range or malfunctioning. The size of the buffer zone is determined by the type of activity. For activities with a large hazard area, special sea and air surveillance measures are implemented to make sure the area is clear before the activities commence. Before aircraft can drop munitions, they are required to make a preliminary pass over the intended target area to ensure that it is clear of boats, divers, or other non-participants. Aircraft carrying munitions are not allowed to fly over surface vessels.

Training and testing activities are delayed, moved, or cancelled if there is a question about the safety of the public. Target areas must be clear of non-participants before conducting training and testing. When using munitions with flight termination systems (which terminate the flight of airborne missiles or launch vehicles when they veer from their targeted path), the Navy is required to follow standard operating procedures to ensure public health and safety. In those cases where a weapons system does not have a flight termination system, the size of the target area that needs to be clear of non-participants is based on the flight distance of the weapon plus an additional distance beyond the system's performance capability.

3.12.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) would potentially impact public health and safety. Table 2.6-1 (Proposed Training Activities) through Table 2.6-5 (Space and Naval Warfare Systems Command Proposed Testing Activities) present the proposed training and testing activity locations for each alternative (including the annual number of events). Each public health and safety stressor is introduced, and analyzed by alternative for both training and testing activities. Tables B-1 and B-2 in Appendix B (Activity Stressor Matrices) show the warfare areas and associated stressors that were considered for analysis of public health and safety. The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to public health and safety are the following:

- **In-water energy** (sonar and in-water explosions)
- **In-air energy** (radar and lasers)
- **Physical interactions** (aircraft, vessels, in-water devices/targets, munitions, seafloor devices)
- **Secondary stressors** (impacts to water quality from explosives and explosion byproducts, metals, chemicals other than explosives, and other materials)

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), the majority of the training and testing activities that would be conducted under Alternatives 1 and 2 are the same or similar as those currently being conducted or have been conducted in the past.

The potential for impacts on public health and safety were evaluated assuming the implementation of the Navy's standard operating procedures, as discussed in Section 2.3.3 (Standard Operating Procedures). Training and testing activities in the Study Area are conducted in accordance with guidance provided in Fleet Area Control and Surveillance Facility Instructions (U.S. Department of the Navy, 2014) (if activities are conducted in Fleet Area Control and Surveillance Facility areas) or Test and Safety Planning Instructions. These instructions provide standard operating procedures for all normal range events. They also provide range users with information that is necessary to operate safely and avoid affecting nonmilitary activities such as shipping, recreational boating, diving, and commercial or recreational fishing. Ranges are managed in accordance with standard operating procedures that ensure public health and safety.

3.12.3.1 In-Water Energy

In-water energy can come from acoustic sources or electromagnetic devices. Active sonar, in-water explosions, air guns, and vessel movements produce in-water acoustic energy. Sound travels from air to water during aircraft overflights. Electromagnetic energy can enter the water from mine warfare training devices and unmanned underwater vehicles. The potential for the public to be exposed to these stressors would be limited to individuals, such as recreational swimmers or scuba divers who are underwater and within unsafe proximity of a training or testing event.

In-water acoustic energy is generated from many of the proposed activities; however, not all would be considered in detail in this environmental impact statement/overseas environmental impact statement (EIS/OEIS) in terms of their impact on public health and safety because the public safety risks from some activities are deemed to be negligible. The public might intermittently hear noise from ships if they are in the general vicinity of a training or testing event, but there would be no impact on public health and safety because of the infrequency and short duration of events. In addition, underwater air guns are used during some pierside integrated swimmer defense training and testing activities, but public health and safety would not be put at risk because access to pierside locations by non-participants is controlled. Active sonar and in-water explosions are the only sources of in-water acoustic energy evaluated for potential impacts on public health and safety.

The proposed activities that would result in in-water acoustic energy include activities such as amphibious warfare, surface warfare, anti-submarine warfare, mine warfare, surface warfare testing, sonar maintenance, pierside sonar testing, and unmanned underwater vehicle testing. A limited amount of active sonar would be used during transit between range complexes and training and testing locations.

The effect of active sonar on humans varies with the frequency of sonar involved. Of the four types of sonar (very high-, high-, mid-, and low-frequency), mid-frequency and low-frequency sonar have the greatest potential to impact humans due to the range of human hearing capabilities.

In-water explosives cause a physical shock front that compresses the explosive material, and the pressure wave then passes into the surrounding water. Generally, the pressure wave would be the primary cause of injury. The effects of an in-water explosion depend on several factors, including the size, type, and depth of the explosive charge and where it is in the water column.

Electromagnetic energy is associated with systems such as the Organic Airborne and Surface Influence Sweep System that emit an electromagnetic field to simulate the presence of a ship. Electromagnetic energy can also be used in a defensive mode to cause nearby mines to explode. Unmanned underwater vehicles, some unmanned surface vehicles, and towed devices use electromagnetic energy, either for navigation or as a means to be targeted.

Electromagnetic energy dissipates quickly with distance from the source. Scientific literature does not conclude that there are adverse health effects from most levels of electromagnetic energy, which is why no federal standards have been set for occupational exposures to this type of energy. DoD Instruction 3222.03 provides guidance regarding management and implementation of the electromagnetic environmental effects program, including hazards of electromagnetic radiation to personnel (U.S. Department of Defense, 2015).

As previously stated, the potential for the public to be exposed to these stressors would be limited to individuals who are underwater and within unsafe proximity to an event. Scuba diving is a popular recreational activity that is typically concentrated around known dive attractions, such as reefs and shipwrecks. The Professional Association of Diving Instructors (one of several scuba diving instruction organizations) suggests that certified open-water divers limit their dives to 60 feet (ft.). More experienced divers are generally limited to 100 ft.; in general, no recreational diver should exceed 130 ft. of depth (Professional Association of Diving Instructors, 2011). These depths typically limit this activity's distance from shore.

Navy operations overlapping with recreational swimmers or divers would be unlikely. Recreational swimmers and divers are not precluded from operating in public boat lanes or adjoining areas near Navy pierside locations (which include shipyards); however, Navy operators are diligent in identifying recreational swimmers and divers to ensure that these would be avoided. Additionally, recreational divers would not be expected near Navy ships at sea. The locations of popular offshore diving spots are well-documented, and dive boats (typically well-marked) and diver-down flags would be visible from the ships conducting the training and testing. The U.S. Navy Diving Manual (U.S. Department of the Navy, 2016b) contains methodologies to determine appropriate safety distances associated with sonar use near Navy divers. These safety distances would also be used as safety buffers to protect public health and safety. If any unauthorized personnel are detected within the sonar activity safety buffer, the activity would be temporarily halted until the area is again cleared.

3.12.3.1.1 Impacts from In-Water Energy Under Alternative 1

Impacts from In-Water Energy Under Alternative 1 for Training Activities

Under Alternative 1, the Navy would conduct active sonar training activities such as anti-submarine warfare, mine warfare, and sonar maintenance at the Hawaii Range Complex, the Southern California (SOCAL) Range Complex, and other HSTT areas. Activities involving in-water explosions, such as surface warfare and mine warfare, would be conducted at established ranges and training locations. The Navy would conduct these activities throughout the Study Area.

As previously discussed, the Navy implements operating procedures designed to protect public health and safety. These procedures include:

- ensuring that training areas are clear before commencing hazardous activities,
- conducting all activities in accordance with established safety instructions,

- conducting in-water detonations only at established and approved locations,
- posting Navy Lookouts at all times during an exercise to ensure non-participants do not enter the area, and
- coordinating with the Coast Guard to issue Notices to Mariners notifying the public about durations and locations of potentially hazardous activities.

Consequently, the potential for training activities using in-water energy to impact public health and safety under Alternative 1 would be unlikely.

Impacts from In-Water Energy Under Alternative 1 for Testing Activities

Under Alternative 1, the Navy would conduct active sonar testing activities such as anti-submarine warfare, mine warfare, pierside sonar testing, unmanned underwater vehicle testing, and sonar maintenance in the HSTT Study Area. Pierside testing of active sonar would occur in Pearl Harbor and San Diego.

The Navy would conduct testing activities involving in-water detonations, such as surface warfare, anti-submarine warfare, mine warfare, and surface combatant sea trials at current locations, which include specific training areas in the Hawaii Range Complex and the SOCAL Range Complex.

As discussed in Impacts from In-Water Energy Under Alternative 1 for Training Activities, the Navy implements operating procedures designed to protect public health and safety. Under this alternative, these procedures would be implemented. Consequently, the potential for testing activities using in-water energy to impact public health and safety under Alternative 1 would be unlikely.

3.12.3.1.2 Impacts from In-Water Energy Under Alternative 2

Impacts from In-Water Energy Under Alternative 2 for Training Activities

Alternative 2 reflects an increase in sonar training over that presented in Alternative 1. Training locations would remain the same as those of Alternative 1. Alternative 2 assumes a maximum of three Composite Training Unit Exercises per year. The Navy would implement standard operating and safety procedures, as previously discussed. Therefore, potential for impacts on public health and safety beyond those identified for Alternative 1 would be unlikely.

The Navy would conduct activities involving in-water explosions, such as surface warfare, mine warfare, and civilian port defense, at current locations. In this case also, the Navy would implement standard operating and safety procedures. Therefore, potential for impacts on public health and safety beyond those identified for Alternative 1 would be unlikely.

Impacts from In-Water Energy Under Alternative 2 for Testing Activities

Under Alternative 2, the Navy would conduct active sonar testing activities (both at-sea and pierside) in the same areas and at the same levels identified under Alternative 1. The Navy would implement standard operating and safety procedures. Therefore, an increased potential for impacts on public health and safety beyond those identified for Alternative 1 would be unlikely.

The Navy would conduct testing activities involving in-water explosions, such as air warfare, surface warfare, anti-submarine warfare, mine warfare, surface combatant sea trials, littoral combat ship testing, ship shock trials, combat ship qualifications, at-sea explosive testing, and sonobuoy lot acceptance testing in the same areas identified under Alternative 1. Alternative 2 would increase the number of some testing activities involving in-water explosions. The Navy would implement standard

operating and safety procedures. Therefore, an increased potential for impacts on public health and safety beyond those identified for Alternative 1 would be unlikely.

3.12.3.1.3 Impacts from In-Water Energy Under the No Action Alternative

Impacts from In-Water Energy Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Various in-water energy stressors (e.g., acoustic and electromagnetic) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities. However, with regard to diminished military readiness, the No Action Alternative would have adverse impacts on public health and safety.

3.12.3.2 In-Air Energy

In-air energy stressors include sources of electromagnetic energy and lasers. The sources of electromagnetic energy include radar and electronic warfare systems. These systems operate similarly to other navigational aids and radars at civilian airports and television weather stations throughout the United States. Electronic warfare systems emit electromagnetic energy similar to that from cell phones, handheld radios, commercial radio stations, and television stations. The Navy follows documented safety procedures to protect Navy personnel and the public from electromagnetic energy hazards. These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct human exposure, posting warning signs, establishing safe operating levels, and activating warning lights when radar systems are operational.

High-energy lasers are used as weapons to disable surface targets. The Navy would operate high-energy laser equipment in accordance with procedures defined in the Office of the Chief of Naval Operations Instruction 5100.23G, *Navy Safety and Occupational Health Program Manual* (U.S. Department of the Navy, 2011). These high-energy light sources can cause eye injuries and burns. A comprehensive safety program exists for the use of lasers. Current Navy safety procedures protect individuals from the hazard of injuries caused by laser energy. Laser safety requirements for aircraft and vessels mandate verification that target areas are clear before commencement of an exercise. In the case of aircraft, during actual laser use, the aircraft run-in headings (i.e., the direction at which the aircraft's nose approaches the target) are restricted to preclude inadvertent lasing of areas where the public may be present.

Training and testing activities involving electromagnetic energy include electronic warfare activities that use airborne and surface electronic jamming devices to defeat tracking and communications systems. Training activities involving low-energy lasers include surface warfare and mine warfare; there are no training activities that use high-energy lasers.

3.12.3.2.1 Impacts from In-Air Energy Under Alternative 1

Impacts from In-Air Energy Under Alternative 1 for Training Activities

Under Alternative 1, the Navy would conduct electronic warfare training activities involving electromagnetic energy sources at current levels and locations, including the Hawaii OPAREA and the SOCAL Range Complex's Electronic Warfare Range. The Navy would conduct laser targeting activities and mine detection activities using lasers at current levels and locations, including the Hawaii Range

Complex's Warning Area 188 and the SOCAL Range Complex's Anti-Submarine Warfare Range and San Clemente Island Shore Bombardment Range.

It is unlikely that the public would be exposed to electromagnetic energy sources or lasers from training activities under Alternative 1, because the Navy would not conduct these activities in proximity to the public. Additionally, the Navy would employ strict safety procedures for the use of lasers and other electromagnetic energy sources, as discussed in Sections 3.12.2.2.5 (Electromagnetic Energy Safety) and Section 3.12.2.2.6 (Laser Safety). Consequently, the potential for training activities to impact public health and safety under Alternative 1 would be unlikely.

Impacts from In-Air Energy Under Alternative 1 for Testing Activities

Under Alternative 1, the Navy would conduct electronic warfare testing activities involving electromagnetic energy sources and low-energy lasers at locations identified under Alternative 1. High-energy laser weapons testing activities (the only testing activities using high-energy lasers) would occur only within designated areas of the Hawaii Range Complex and the SOCAL Range Complex.

The Navy would not conduct these testing activities in proximity to the public. Additionally, the Navy would employ strict safety procedures for the use of lasers and other electromagnetic energy sources, as discussed in Sections 3.12.2.2.5 (Electromagnetic Energy Safety) and Section 3.12.2.2.6 (Laser Safety). Consequently, the potential for testing activities to impact public health and safety would be unlikely.

3.12.3.2.2 Impacts from In-Air Energy Under Alternative 2

Impacts from In-Air Energy Under Alternative 2 for Training Activities

Alternative 2 would involve the same locations and number of training activities described under Alternative 1 for electromagnetic energy and lasers. The Navy would implement standard operating and safety procedures. Therefore, an increased potential for impacts on public health and safety beyond those identified for Alternative 1 would be unlikely.

Impacts from In-Air Energy Under Alternative 2 for Testing Activities

Alternative 2 would involve the same locations and number of testing activities described under Alternative 1 for electromagnetic energy and lasers. The Navy would implement standard operating and safety procedures. Therefore, an increased potential for impacts on public health and safety beyond those identified for Alternative 1 would be unlikely for testing activities.

3.12.3.2.3 Impacts from In-Air Energy Under the No Action Alternative

Impacts from In-Air Energy Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. In-air energy stressors (e.g., laser and electromagnetic) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities. However, with regard to diminished military readiness, the No Action Alternative would have adverse impacts on public health and safety.

3.12.3.3 Physical Interactions

This section evaluates potential impacts associated with the interaction of Navy aircraft, vessels, and equipment with general public. Public health and safety could be impacted by physical collisions

between Navy assets and the public. As described in Section 3.0.3.3.4 (Physical Disturbance and Strike Stressors), Navy aircraft, vessels, targets, munitions, towed devices, seafloor devices, and other training and testing expended materials could be directly, physically encountered by recreational, commercial, institutional, and governmental aircraft, vessels, and individuals such as swimmers, divers, and anglers.

Like private aircraft, Navy aircraft are required to observe and avoid other aircraft. In addition, the Federal Aviation Administration issues Notices to Airmen advising private and commercial pilots about scheduled Navy training and testing activities. Finally, Navy personnel are required to verify that the range is clear of non-participants before initiating any activity that could be potentially hazardous to the public. Together, these procedures would minimize the potential for adverse interactions between Navy and non-participant aircraft. Application of standard operating procedures would minimize the potential for interaction between private or commercial aircraft with Navy training or testing activities employing aircraft, munitions, and aerial targets.

Private and commercial vessels traversing the Study Area during training or testing activities may interact with Navy vessels, munitions, and surface targets. Naval Vessel Protection Zones established by U.S. Coast Guard regulations (33 CFR section part 165 subpart G) require other (non-Navy) vessels to slow down to a minimum speed within 500 yards of a Navy vessel greater than 100 ft. long; they are prohibited from approaching within 100 yards of a Navy vessel greater than 100 ft. long. Both Navy and public vessels operate under maritime navigational rules requiring them to observe and avoid other vessels. In addition, Notices to Mariners advise vessel operators about when and where Navy training and testing activities are scheduled. Finally, Navy personnel are required to verify that the range is clear of non-participants before initiating any potentially hazardous activity. Together, these procedures minimize the potential for adverse interactions between Navy and non-participant vessels.

Recreational diving within the Study Area takes place primarily at known diving sites such as shipwrecks and reefs. The locations of these popular dive sites are well-documented, dive boats are typically well-marked, and diver-down flags are visible from a distance. As a result, dive sites would be easily avoided by ships conducting training or testing activities. Interactions between training and testing activities and recreational divers, thus, would not be expected. Similar knowledge and avoidance of popular fishing areas would minimize interactions between training and testing activities and recreational fishing.

Commercial and recreational fishing activities could encounter military expended materials that could entangle fishing gear and pose a safety risk. The Navy recovers many surface targets after they are used to avoid them becoming a collision risk or entanglement risk. Unrecoverable pieces of military expended materials are typically small (such as sonobuoys), constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intended to sink to the bottom after their useful function is completed, so they would not pose a collision or entanglement risk to civilian vessels or equipment. Thus, these targets do not pose a safety risk to individuals using the area for recreation because the public would not likely be exposed to these items before they sank to the seafloor.

The footprint of military expended materials in the Study Area is discussed in Habitats, Section 3.5.3.4.3 (Impacts from Military Expended Materials). Figure 3.5-17 and Figure 3.5-18 illustrate the very small percentage of marine substrate (much less than 1 percent of the total area of documented soft bottom or hard bottom in their respective training or testing areas). Given the small footprint of military expended materials estimated here, it is unlikely the public would encounter military expended materials during recreational or commercial fishing activities.

Section 3.2 (Sediments and Water Quality) discusses the low failure rate of munitions, which indicates that most munitions operate as intended. While fishing activities may encounter undetonated munitions, it would be unlikely because of the deep waters and the low density of munitions within the large size of the Study Area. Depending on the circumstances (i.e., emergency or imminent threat), Navy Explosive Ordnance Disposal support or other resources could be asked to respond and safely dispose of any munitions.

Additionally, the public may encounter military expended materials, such as pieces of plastics or fabric that wash up on the seashore. Most of this material does not pose a potential for safety impacts; however, other items, such as flares may pose potential safety impacts. Flares, such as the ones dropped into the ocean by military planes to use as markers, contain chemicals designed to burn at high intensity, allowing them to be visible from long distances. The chemicals (e.g., phosphorous) in unexpended or partially-burned flares can reignite when exposed to air or water, resulting in severe burns if handled. The presence of any flares should be reported to appropriate agencies, such as the police or U.S. Coast Guard, who would then contact experienced ordnance disposal personnel for their proper disposal.

The analysis focuses on the potential for a direct physical interaction with aircraft, vessels, targets, or other expended materials. A vessel or aircraft transiting through the water or air (as would be involved in the vast majority of proposed activities) inherently involves the risk of collision with other vessels or aircraft. But this risk is greatly diminished by a shared set of international navigational rules for vessels and aircraft. The greatest potential for a physical interaction would be along the coast and near populated areas, because that is where public activities are concentrated.

3.12.3.3.1 Impacts from Physical Interactions Under Alternative 1

Impacts from Physical Interactions Under Alternative 1 for Training Activities

Under Alternative 1, the Navy would conduct training activities at current locations. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would not change from current conditions. The Navy implements strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities.

As discussed in Section 3.12.3.3 (Physical Interactions), there would be no impact on public health and safety from physical interactions with training activities, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving physical interactions. Because of the Navy's safety procedures, the potential for training activities to impact public health and safety under Alternative 1 would be unlikely.

Impacts from Physical Interactions Under Alternative 1 for Testing Activities

Because the potential for a physical interaction is not activity or location specific, the analysis for the training activities above applies to testing activities under Alternative 1. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be unlikely.

3.12.3.3.2 Impacts from Physical Interactions Under Alternative 2

Impacts from Physical Interactions Under Alternative 2 for Training Activities

Under Alternative 2, the Navy would increase the number of at-sea training activities over that presented in Alternative 1. While Alternative 2 would adjust locations and number of some training activities, the Navy would implement standard operating and safety procedures, as discussed in Section 3.12.3.3 (Physical Interactions). Therefore, the potential for impacts on public health and safety would remain unlikely.

Impacts from Physical Interactions Under Alternative 2 for Testing Activities

Under Alternative 2, the Navy would increase some types of testing activities. Because the potential for a physical interaction is not activity-specific or location-specific, the analysis for the training activities above applies to testing activities under Alternative 2. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 2 would remain unlikely.

3.12.3.3.3 Impacts from Physical Interactions Under the No Action Alternative

Impacts from Physical Interactions Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Physical interaction stressors (e.g., collision with a vessel, interaction with a military expended material) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would remain either unchanged or would improve slightly after cessation of ongoing training and testing activities. However, with regard to diminished military readiness, the No Action Alternative would have adverse impacts on public health and safety.

3.12.3.4 Secondary (Sediments and Water Quality)

Secondary stressors are defined as those stressors that could pose indirect impacts on public health and safety through degradation in water quality or changes to sediment. These stressors include the use of explosives, explosive chemical byproducts, and other materials/debris potentially generated (marine markers, flares, chaff, targets, and miscellaneous components of other materials).

3.12.3.4.1 Impacts from Sediments and Water Quality Under Alternative 1

Impacts from Sediments and Water Quality Under Alternative 1 for Training Activities

Section 3.2 (Sediments and Water Quality) considers the impacts on marine sediments and water quality from these stressors. The analysis in Section 3.2 (Sediments and Water Quality) determined that any impacts to water quality would be temporary and minimal. No state or federal standards or guidelines would be violated. Consequently, training under Alternative 1 would result in no indirect impacts on public health and safety associated with sediments and water quality.

Impacts from Sediments and Water Quality Under Alternative 1 for Testing Activities

The analysis in Section 3.2 (Sediments and Water Quality) determined that any impacts to water quality would be temporary and minimal. No state or federal standards or guidelines would be violated. Consequently, testing under Alternative 1 would result in no indirect impacts on public health and safety associated with sediments and water quality.

3.12.3.4.2 Impacts from Sediments and Water Quality Under Alternative 2

Impacts from Sediments and Water Quality Under Alternative 2 for Training Activities

The analysis in Section 3.2 (Sediments and Water Quality) determined that any impacts to water quality would be temporary and minimal. No state or federal standards or guidelines would be violated. Consequently, training under Alternative 2 would result in no indirect impacts on public health and safety associated with sediments and water quality.

Impacts from Sediments and Water Quality Under Alternative 2 for Testing Activities

The analysis in Section 3.2 (Sediments and Water Quality) determined that any impacts to water quality would be temporary and minimal. No state or federal standards or guidelines would be violated. Consequently, testing under Alternative 2 would result in no indirect impacts on public health and safety associated with sediments and water quality.

3.12.3.4.3 Impacts from Sediments and Water Quality Under the No Action Alternative

Impacts from Sediments and Water Quality Under the No Action Alternative for Training and Testing Activities

Under the No Action Alternative, the Navy would not conduct the proposed training and testing activities in the HSTT Study Area. Secondary stressors (e.g., chemicals affecting water or sediment quality) would not be introduced into the marine environment. Therefore, baseline conditions of the existing environment would either remain unchanged or would improve slightly after cessation of ongoing training and testing activities. However, with regard to diminished military readiness, the No Action Alternative would have adverse impacts on public health and safety.

3.12.4 Summary of Potential Impacts on Public Health and Safety

3.12.4.1 Combined Impacts of All Stressors Under Alternative 1

Activities described in this EIS/OEIS that have potential to impact public health and safety include those that release in-water energy or in-air energy or those that result in physical interactions, as well as those that have indirect impacts from changes to sediments and water quality. As described throughout this section, the Navy promotes a proactive and comprehensive safety program designed to reduce to the greatest extent possible any potential impacts on public health and safety from training and testing activities. Elements of this program include implementing strict navigation rules, coordinating and disseminating information on potentially hazardous activities, and the use of remote sensing technologies (e.g., radar, sonar) or trained Navy Lookouts to ensure that training and testing areas are clear of non-participants. Navy safety considerations are appropriate to the location and type of activity being conducted, no matter what number of activities are occurring concurrently; consequently, no elevated impacts from the combined effect of all stressors are expected.

3.12.4.2 Combined Impacts of All Stressors Under Alternative 2

As with Alternative 1, no elevated impacts under Alternative 2 are expected from the combined effect of all stressors. Navy safety considerations are appropriate to the location and type of activity being conducted, irrespective of the number of activities concurrently conducted.

3.12.4.3 Combined Impacts of All Stressors Under the No Action Alternative

Although Navy at-sea training and testing activities within the Study Area would cease under the No Action Alternative, with respect to combined impacts of stressors, there would be no appreciable

change in potential impacts on public health and safety, as these activities (currently or as proposed) would be unlikely to affect public health and safety. However, diminished military readiness under the No Action Alternative would adversely affect public health and safety.

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4 Cumulative Impacts

Final
Environmental Impact Statement/Overseas Environmental Impact Statement
Hawaii-Southern California Training and Testing

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4 CUMULATIVE IMPACTS

4.1 PRINCIPLES OF CUMULATIVE IMPACTS ANALYSIS

The approach taken herein to analyze cumulative effects meets the objectives of the National Environmental Policy Act (NEPA) of 1969, Council on Environmental Quality regulations, and Council on Environmental Quality guidance. Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] 1500-1508) provide the implementing procedures for NEPA. The regulations define "cumulative effects" as:

> *…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time* (40 CFR 1508.7).

The Council on Environmental Quality provides guidance on cumulative impacts analysis in Considering Cumulative Effects Under the NEPA (Council on Environmental Quality, 1997). This guidance further identifies cumulative effects as those environmental effects resulting "from spatial and temporal crowding of environmental perturbations. The effects of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the effects of the first perturbation." Noting that environmental impacts result from a diversity of sources and processes, this Council on Environmental Quality guidance observes that "no universally accepted framework for cumulative effects analysis exists," while also noting that certain general principles have gained acceptance. One such principle provides that "cumulative effects analysis should be conducted within the context of resource, ecosystem, and community thresholds—levels of stress beyond which the desired condition degrades." Thus, "each resource, ecosystem, and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." Therefore, cumulative effects analysis normally will encompass a region of influence or geographic boundaries beyond the immediate area of the proposed action, and a time frame including past actions and foreseeable future actions, to capture these additional effects. Bounding the cumulative effects analysis is a complex undertaking, appropriately limited by practical considerations. Thus, Council on Environmental Quality guidelines observe that it "is not practical to analyze cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful."

4.1.1 DETERMINATION OF SIGNIFICANCE

Per the *Council on Environmental Quality's Considering Cumulative Effects Under the NEPA* (Council on Environmental Quality, 1997), the "levels of acceptable change used to determine the significance of effects will vary depending on the type of resource being analyzed, the condition of the resource, and the importance of the resource as an issue." Furthermore, "this change is evaluated in terms of both the total threshold beyond which the resource degrades to unacceptable levels and the incremental contribution of the proposed action to reaching that threshold." In practice, "the analyst must determine the realistic potential for the resource to sustain itself in the future and whether the proposed action will affect this potential." In other words, for a proposed action to have a cumulatively significant impact to an environmental resource, two conditions must be met. First, the combined effects of all identified past, present, and reasonably foreseeable projects, activities, and processes on a resource, including the effects of the proposed action, must be significant. Second, the proposed action must make a measurable or meaningful contribution to that significant cumulative impact.

4.1.2 Identifying Region of Influence or Geographical Boundaries for Cumulative Impacts Analysis

The region of influence or geographic boundaries for analyses of cumulative impacts can vary for different resources and environmental media. Council on Environmental Quality guidance (Council on Environmental Quality, 1997) indicates that geographic boundaries for cumulative impacts almost always should be expanded beyond those for the project-specific analyses. This guidance continues, indicating that one way to evaluate geographic boundaries is to consider the distance an effect can travel, and it identifies potential cumulative assessment boundaries accordingly. For air quality, the potentially affected air quality regions are generally the appropriate boundaries for assessment of cumulative impacts from releases of pollutants into the atmosphere; however, greenhouse gases impact the entire atmosphere. For water resources and land-based effects, watershed boundaries may be the appropriate regional boundary. For wide-ranging or migratory wildlife, specifically marine mammals, fish, sea turtles, and sea birds, any impacts of the Proposed Action might combine with the impacts of other activities or processes within the range of the population.

A region of influence for evaluating the cumulative impacts of the Proposed Action is defined for each resource in Section 4.4 (Resource-Specific Cumulative Impacts). The basic region of influence or geographic boundary for the majority of resources analyzed for cumulative impacts in this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) is the entire Hawaii-Southern California Training and Testing (HSTT) Study Area (Figure 2.1-1). The Study Area includes two large marine ecosystems, the California Current and the Insular Pacific-Hawaiian, and one open ocean area, the North Pacific Subtropical Gyre (Figure 3.0-1 and Figure 3.0-2), although the geographic boundaries for cumulative impacts analysis for some resources are expanded to include activities outside the Study Area that might impact migratory or wide-ranging animals. Other activities potentially originating from outside the Study Area that are considered in this analysis include impacts associated with maritime traffic (e.g., vessel strikes and underwater noise) and commercial fishing (e.g., bycatch and entanglement).

4.2 Projects and Other Activities Analyzed for Cumulative Impacts

Cumulative analysis includes consideration of past, present, and reasonably foreseeable future actions. For past actions, the cumulative impacts analysis only considers those actions or activities that have had ongoing impacts that may be additive to impacts of the Proposed Action. Likewise, present and reasonably foreseeable future actions selected for inclusion in the analysis are those that may have effects additive to the effects of the Proposed Action as experienced by specific environmental receptors.

The cumulative impacts analysis makes use of the best available data, quantifying impacts where possible and relying on qualitative description and best professional judgement where detailed measurement is unavailable. Because specific information and data on past projects and actions are typically scarce, the analysis of past effects is often qualitative (Council on Environmental Quality, 1997). Likewise, analysis for ongoing actions is often inconsistent or unavailable. All likely future development or use of the region is considered to the greatest extent possible, even when foreseeable future action is not planned in sufficient detail to permit complete analysis (Council on Environmental Quality, 1997).

The cumulative impacts analysis is not bounded by a specific future timeframe. The Proposed Action includes general types of activities addressed by this EIS/OEIS that are expected to continue indefinitely, and the associated impacts could occur indefinitely. Likewise, some reasonably foreseeable future

actions and other environmental considerations addressed in the cumulative impacts analysis are expected to continue indefinitely (e.g., oil and gas production, maritime traffic, commercial fishing). While Navy training and testing requirements change over time in response to world events, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative impacts for the reasonably foreseeable future. Navy environmental planning and compliance for training and testing activities is an ongoing process, and the Navy anticipates preparing new or supplemental environmental planning documents covering changes in training and testing activities in the Study Area as necessary. These future environmental planning documents would include cumulative impacts analysis based on information available at that time.

Table 4.2-1 describes other actions that have had, continue to have, or would be expected to have some impact upon resources also impacted by the Proposed Action within the Study Area and surrounding areas. These activities are selected based on information obtained during the scoping process and Draft EIS/OEIS public comment period (Appendix H, Public Comment Responses), communications with other agencies, a review of other military activities, literature review, previous NEPA analyses, and other available information. Table 4.2-1 focuses on identifying past and reasonably foreseeable future actions (military mission, testing, and training; offshore energy development; ocean-dependent commercial industries; and research). Table 4.2-2 focuses on other major environmental stressors or trends that tend to be widespread and arise from routine human activities and multiple past, present, and future actions. For perspective of general project locations, please refer to Figures 2.1-1 through 2.1-10, which depict the Study Area and boundaries of individual training and testing locations, and Figures 3.0-1 and 3.0-2, which depict large marine ecosystems and open ocean areas within and adjacent to the Study Area. Many of the commercial stressors are also depicted in Figure 3.11-1 through Figure 3.11-24.

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Military Mission, Testing, and Training Activities: California						
Boost-Back and Landing of the Falcon 9 Full Thrust First Stage	Iridium Landing Area, Vandenberg Air Force Base, California, and Offshore Landing Contingency Option	The First Stage rocket to be tested is 12 feet in diameter and 160 feet in height and includes nine engines and two tanks holding 662,250 pounds of aluminum liquid oxygen and 260,760 pounds of rocket propellant. There are three options for First Stage testing: (1) it is dropped into the Pacific Ocean, approximately 261–435 nautical miles west of the Baja California coast, and is non-recoverable; (2) it is boosted-back and lands on concrete padding at SLC-4W; (3) it is landed on a conditional landing area on an autonomous barge located at least 27 nautical miles offshore of Vandenberg Air Force Base; and (4) it is boosted-back and lands on an autonomous barge within the Iridium Landing Area, especially if carrying heavier payloads and the rocket cannot return to Vandenberg Air Force Base (may be used up to six times per year) (U.S. Air Force, 2016a). Environmental effects from potential unsuccessful autonomous barge landing include the discharge of RP-1 jet fuel and debris into the marine environment. Negligible risk to marine animals from direct strike or behavioral or physiological impacts from explosion (Level B Harassment). Vessel noise and traffic may affect, but are not likely to adversely affect: Guadalupe fur seal, blue whale, fin whale, gray whale, humpback whale, sei whale, sperm whale, and sea turtles (green, loggerhead, olive Ridley, hawksbill, and leatherback).	Recovery of all marine debris to the greatest extent practicable	O	O	O
Homeporting Littoral Combat Ships on the West Coast	Naval Base Ventura County Point Mugu and Naval Base San Diego, California	Homeport up to 16 Littoral Combat Ships and unmanned aerial systems between Fiscal Year 2013 and Fiscal Year 2020. Homebasing up to 1,700 personnel and family members. No in-water construction is proposed (U.S. Department of the Navy, 2012d). No long-term environmental impacts anticipated. Increased marine traffic increases risks of underwater noise and vessel strikes; however, Navy vessels will adhere to standard operating procedures that have resulted in minimizing risk of inadvertent marine species strike.	NA	C	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Seal Beach Ammunition Pier and Turning Basin	Naval Weapons Station Seal Beach, Anaheim Bay, California	Construction of a replacement ammunition pier, associated waterfront facilities, and a new small boat access channel for civilian boat traffic. The project would include dredging for the pier, turning basin, and small boat access channel (U.S. Department of the Navy, 2017c). Environmental impacts have not been assessed yet, but would be associated with noise, sediment suspension, and potential disturbance and mortality of individuals during dredging, pile driving and other construction activities, and ongoing operations and increased vessel traffic in the project area.	No assessment has occurred; therefore, no specific mitigation measures identified.			C/O
Joint Logistics Over-the-Shore, Maritime Prepositioning Force, and Field Exercise Training	Marine Corps Base Camp Pendleton, California, Red and Gold beaches and associated inshore training areas, and within and adjacent to the Del Mar Boat Basin	Twelve annual amphibious training activities, which consist of one Joint Logistics Over-the-Shore Training exercise every three years, one Maritime Prepositioning Force exercise every year, and up to 10 Field Exercise activities every year (U.S. Department of the Navy, 2015a). On average, approximately 2,000 to 3,500 personnel take part in Joint Logistics Over-the-Shore Training exercises that last up to 90 days. Maritime Prepositioning Force exercises include an average of approximately 600 to 1,500 personnel and last around 30 days. Field Exercise activities last 7 to 14 days and typically involve 30 to 800 personnel. Activities include projection of combat power ashore, followed by the ship-to-shore movement of supplies and personnel to sustain further operations, which may involve pile driving, beach landing, and equipment transfer. The HSTT EIS/OEIS analyzes those portions of amphibious warfare training that occur at sea (up to the mean high tide mark), to include pile driving and vessel movement. The Joint Logistics Over-the-Shore Environmental Assessment (EA) analyzed the potential impacts associated with the land-based portions of amphibious training at Marine Corps Base (MCB) Camp Pendleton, and there has not been significant new information or substantial change in the action to warrant further review.	Restore beach, including excavation and reestablishment and stabilization of grade and slope. Observation for marine mammals, sea turtles, rocky reef, understory algal communities, surfgrass, kelp, sea fans, sea palms, grunion spawning, and other threatened and endangered species; ceasing of activities in response to sightings. Minimization of noise, especially associated with pile driving activity.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Joint Logistics Over-the-Shore, Maritime Prepositioning Force, and Field Exercise Training (continued)		The implementation of impact avoidance/minimization measures will mitigate environmental impacts from the exercises, which may include temporary and minor impacts on marine sediments, beach contours, and topography from anchors and surf zone/beach activities and direct and indirect impacts on marine organisms from strike, disturbance, noise, and turbidity.				
Fuel Pier Replacement and Dredging	Naval Base Point Loma, San Diego California	Replaced the existing fuel pier and dredged approximately 87,000 cubic yards of sediment to facilitate ongoing navigation in the vicinity of the pier (U.S. Department of the Navy, 2013b). Dredge material was disposed in SSTC Boat Lanes as beach nourishment. No increased operational impacts above those already occurring. No long-term environmental impacts from construction or dredging. Vessel traffic through the channel and to the pier would be maintained, as would the risk for vessel strikes; however, slow speeds would be maintained and the risk for inadvertent marine mammal strikes would be minimal.	N/A	C	O	O
Replacement of the Fuel Storage and Distribution System	Naval Base Coronado, Naval Auxiliary Landing Field, San Clemente Island, California	Retirement in place and replacement of the aging underground JP-5 jet fuel tanks and improvement of fuel receipt, storage, and delivery capabilities (U.S. Department of the Navy, 2012c). No long-term environmental impacts anticipated.	N/A	C		
Helicopter Wings Realignment and MH-60R/S Helicopter Transition	Naval Base Coronado - North Island, California	Added four west coast helicopter squadrons, including three new squadrons and the relocation of one east coast squadron, anticipated to increase helicopter operations by up to 30 percent. Construction included a new organizational maintenance hangar and supporting facilities to accommodate 800 support personnel (U.S. Department of the Navy, 2011a).	N/A	C	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Helicopter Wings Realignment and MH-60R/S Helicopter Transition (continued)		As determined by the California Coastal Management Program, the action would have no effect on coastal resources. Minimal noise increase would be largely contained within installation footprint, and risk of bird/aircraft strikes increased.				
The Transition from C-2A to Navy V-22 Aircraft at Fleet Logistics Centers	Naval Air Station North Island, San Diego, California	The Proposed Action provides facilities and functions to replace the C-2A Greyhound with the newer CMV-22B Osprey at either Naval Air Station North Island, California (within the consortium of Naval Base Coronado installations) or Chambers Field within Naval Station Norfolk, Virginia. The project expands logistics support and training operations, establishes a Navy V-22 training squadron and maintenance school, and constructs and renovates facilities to accommodate Navy V-22 squadron aircraft and personnel. The Proposed Action would be implemented over a 10-year period beginning in 2018. Eventually, the Navy training squadron and maintenance school would be established, either on the west or east coast, to support Navy training requirements. The Proposed Action is expected to be complete in the 2028 timeframe. Impacts would be chiefly terrestrial, but ongoing operations might include increased noise and disturbance over the marine environment resulting from additional operations and personnel.	Mitigation measures have yet to be identified.			C/O
Pier 12 Replacement and Dredging	Naval Base San Diego, California	Demolition and replacement of Pier 12 and associated pier utilities, dredging in berthing and approach for the new pier, dredged material disposal at an approved ocean disposal site and permitted upland landfill, and reuse of demolition concrete to create fish enhancement structures (artificial reefs) (U.S. Department of the Navy, 2011c). No long-term environmental impacts are anticipated.	N/A	C	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Pier 8 Replacement	Naval Base San Diego, California	Demolition of Pier 8 and construction of a new pier and associated utilities with the infrastructure necessary to support modern Navy ship classes (U.S. Department of the Navy, 2015b). Demolition would temporarily increase noise in the local marine environment. Marine mammals are not known to visit Naval Base San Diego and any occurrence in the project area would be very rare. Green sea turtles may occur in the project area.	Observation for marine mammals and sea turtles; ceasing of activities in response to sightings.			C
Military Mission, Testing, and Training Activities: Multiple Locations						
Navy Hawaii-Southern California Fleet Training and Testing	Over the air and seaspace within established operating and warning areas across the north-central Pacific Ocean, from the mean high tide line in Southern California west to Hawaii and the International Date Line, as well as Navy pierside locations in Pearl Harbor and San Diego Bay, and a transit corridor	The Navy At-Sea Policy directs the Navy to develop a comprehensive, programmatic approach to environmental compliance for exercises and training at sea (U.S. Department of the Navy, 2000). The Navy has evaluated impacts from past activities as well as present training and testing activities based on changing operational requirements, new platforms, and new systems. The Navy uses these analyses to support incidental take authorizations under the Marine Mammal Protection Act (MMPA). Prior to this EIS/OEIS, the 2013 Phase II HSTT Final EIS/OEIS provided the most recent comprehensive analysis of the full geographic scope of areas where Navy training and testing activities have historically occurred as well as those projected for a 5-year range (U.S. Department of the Navy, 2013a). The full breadth of activities, and their potential impacts, were similar in nature to those analyzed in this EIS/OEIS, and 57,940 hours of hull-mounted mid-frequency sonar use were anticipated between 2013 and 2018; although, in practice the actual hours of sonar were significantly lower (Figures 2.5-1 through 2.5-3). Likewise, the detonation of a maximum of 170,105 explosives was evaluated over the 5-year period, 58 percent of which were Explosive Class 1 (0.1 to 0.25 lb) (Section 2.5.4. Comparison of Proposed Sonar and Explosive Use in the Action Alternatives to the 2013–2018 MMPA Permit Allotment).	Mitigation measures established for most in-water activities, including specific lookout procedures and recommended mitigation zones and protection focus. A Scientific Advisory Group of leading marine mammal scientists assisted the development of an Integrated Comprehensive Monitoring Program, which coordinated monitoring efforts across all regions where the Navy trains.	O	O	

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Navy Hawaii-Southern California Fleet Training and Testing (continued)	on the high seas (see Figure 1.1-1)	During the 2013 HSTT Phase II EIS/OEIS effort, MMPA incidental take authorizations and incidental take statements under the Endangered Species Act (ESA) were issued by National Marine Fisheries Service (NMFS) to the Navy for three existing range complexes (Southern California Range Complex, Hawaii Range Complex, and Silver Strand Training Complex) plus pierside locations and areas on the high seas where maintenance, training, or testing may occur (*Federal Register* 78(247): 78016-78158, December 24, 2013; *Federal Register* 79(88): 26188-26189, May 7, 2014). Negligible to no impacts have been observed to populations of marine mammals, sea turtles and other marine reptiles, birds, marine vegetation, marine invertebrates, and fish from acoustic, energy, physical disturbance and strike, entanglement, ingestion, and other secondary stressors associated with Navy training and testing activities. Monitoring occurred during training and testing events and generally through the Integrated Comprehensive Monitoring Program (Section 3.0.1.1, Marine Species Monitoring and Research Programs).				
Surveillance Towed Array Sensor System Low Frequency Active Sonar	Pacific (including the Study Area), Atlantic, and Indian Ocean and Mediterranean Sea. Undersea, 12 NM away from any coastline, 400 ft. below surface	Training and testing with Surveillance Towed Array Sensor System Low Frequency Active Sonar systems has been analyzed for potential environmental effects in a study area that overlaps with the Hawaii Range Complex. The Navy utilizes Surveillance Towed Array Sensor System Low Frequency Active Sonar systems onboard several stalwart-class auxiliary general ocean surveillance ships in the North Pacific (which includes waters east of Japan; the north Philippine Sea; the west Philippine Sea; offshore Guam; the Sea of Japan; the East China Sea; the South China Sea; offshore Japan, and northeast of Japan), the Central North Pacific (which includes waters north and south of Hawaii) and the Indian oceans (which includes waters within the Arabian Sea, the Andaman Sea and northwest of Australia). The Navy is currently conducting covered Surveillance Towed Array Sensor System Low Frequency Active Sonar activities pursuant to a National Defense Exemption (under the MMPA). This exemption expires in August of 2019 and the Navy is in the process of updating its relevant environmental planning and compliance documents.	Monitoring (visual, passive acoustic, and active acoustic) and enforcing delay/suspension protocols. Use of "fish finder" (HF/M3 sonar) detects, locates, and tracks marine mammals and, to an extent, sea turtles, that may pass close enough to the Surveillance Towed Array Sensor System Low Frequency Active sonar's transmit array to enter the mitigation zone.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Surveillance Towed Array Sensor System Low Frequency Active Sonar (continued)		Additional information can be found here: http://www.surtass-lfa-eis.com/ The Navy has been operating Surveillance Towed Array Sensor System Low Frequency Active Sonar systems since 2002 and plans to continue into the reasonably foreseeable future (U.S. Department of the Navy, 2017a). In general, the operation of Surveillance Towed Array Sensor System Low Frequency Active Sonar has low to moderate potential to affect marine mammals, sea turtles, and fishes. Anticipated impacts on turtles include ESA harassment, including non-auditory, auditory, behavioral, masking, or physiological stress impacts when turtles are in close proximity. Impacts to marine mammals are anticipated to be Level B harassment, including auditory or behavioral impacts. However, due to the infrequent of use SURTASS within the HSTT Study Area, these impacts are not likely to affect wide-ranging individuals that traverse the HSTT Study Area.		O	O	O
U.S. Coast Guard Training Activities	U.S. Coast Guard District 11, Southern California and District 14, Hawaii Southward from the Dana Point Harbor to the Mexico border	The U.S. Coast Guard performs maritime humanitarian, law enforcement, and safety services in estuarine, coastal, and offshore waters. Equipment utilized by the Southern California Coast Guard includes 25-foot response boats, 41-foot utility boats, and 87-foot patrol boats, as well as HH-60 helicopters. Training events include search and rescue, maritime patrol training, boat handling, and helicopter and surface vessel live-fire training with small arms. Similarly, the Coast Guard's 14th District carries out its mission and conducts unit training in and around Hawaii. U.S. Coast Guard training in Hawaii includes surface vessel live-fire training with small- and medium-caliber weapons, primarily conducted in Warning Areas 189, 193, and 194 within the Hawaii Range Complex.	Establishing and monitoring safety zones; observation for marine mammals and sea turtles; ceasing of activities in response to sightings. Enhanced environmental protection measures for marine protected species and areas occurring in District 11 and 13, including broadcasting Notice to Mariners advising caution in known areas of high marine protected species.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
U.S. Coast Guard Training Activities (continued)		U.S. Coast Guard mission and training activities contribute vessel noise and could result in collisions with marine mammals and sea turtles. Sonar detection systems could have impacts on marine mammals, including toothed whales and pinnipeds, but only short-term, minor, adverse effects would be expected as the high frequency is not unlike common commercial fish finder systems (U.S. Coast Guard, 2013). Gunnery activities could contribute military expended material to the benthic environment; however, results of Navy modeling efforts discussed for the Proposed Action indicate a low risk that marine mammals or sea turtles would be struck by military expended material during training activities, and it is likely that similar U.S. Coast Guard activities would have a similarly low risk.	concentration in bays (U.S. Coast Guard, 2010)			
Introduction of the P-8A Multi-Mission Maritime Aircraft into the U.S. Navy Fleet	NAS Whidbey Island, Washington; Marine Corps Base Kaneohe Bay, Oahu, Hawaii; Naval Air Station North Island, San Diego CA	Provide facilities and functions to support the homebasing of 12 P-8A Mission Maritime Aircraft fleet squadrons (72 aircraft) and one fleet replacement squadron (12 aircraft) at established maritime patrol home bases (U.S. Department of the Navy, 2008c). Project did not involve in-water or over-water construction activities, although air operations would increase. Increased population would increase nearshore population density, including additional participation in recreation and consumptive activities.		C	O	O
Military Mission, Testing, and Training Activities: Hawaii						
Basing of MV-22 and H-1 Aircraft in Support of III Marine Expeditionary Force Elements in Hawaii	Hawaii Kaneohe Bay, Oahu, and the islands of Kauai, Oahu, Molokai, Maui, and Hawaii Kaneohe Bay, Hawaii, Army Training Areas	Basing up to two Marine Medium Tiltrotor squadrons with a total of 24 MV-22 Osprey aircraft and one Marine Light Attack Helicopter squadron with 15 AH-1 Cobra and 12 UH-1 Huey attack and utility helicopters. Conducting aviation training, readiness, and special exercise operations at training facilities statewide (U.S. Department of the Navy, 2012b). Basing facilities would be developed at Marine Corps Base Hawaii Kaneohe Bay; conducting aviation operations at training areas on the islands of Kauai, Oahu, Molokai, Maui, and Hawaii; and constructing improvements at three existing training facilities.		O	O	C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Basing of MV-22 and H-1 Aircraft in Support of III Marine Expeditionary Force Elements in Hawaii (continued)	on Oahu (Kahuku Training Area, Kawailoa Training Area, Schofield Barracks East Range, and Dillingham Military Reservation), and Pohakuloa Training Area, and Molokai Training Support Facility	For the second MV-22 squadron, construct new and renovate existing facilities near the southeast end of the runway at Marine Corps Base Hawaii Kaneohe Bay (U.S. Department of the Navy, 2015f). Noise impacts from the new aircraft mix are expected to be less than the previous aircraft mix, reducing impacts on Hawaiian monk seal habitat. Increased population would increase nearshore population density, including additional participation in recreation and consumptive activities.				
Long-Range Strike Weapons Systems Evaluation Program	Pacific Missile Range Facility, Kauai, Hawaii 44 miles offshore Kauai in the Barking Sands Underwater Range Extension	The long-range evaluation tests include live and inert weapon systems deployed from aircraft for detonation in the air as well as at and below the water surface (U.S. Air Force, 2016b). Missions in 2017–2020 would occur once a year over 5 consecutive days. Detonation would produce underwater noise and explosions; however, due to shallow detonations, it is not anticipated that cratering would occur at the seafloor. Metals would sink, disperse, or bind to sediments. Individual fish in the area may be killed by the strike or the associated pressure bubble. An Incidental Take Authorization for marine mammals and sea turtles (hawksbill, loggerhead, olive Ridley, leatherback, and Central North Pacific distinct population segment of green sea turtle) was issued for the 2016 event; and a similar Authorization is anticipated for the 2017–2020 tests (U.S. Air Force, 2016c).	Observation for marine mammals and sea turtles; ceasing of activities in response to sightings.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Photovoltaic and Battery Energy Storage Systems	Pacific Missile Range Facility, Kauai, Hawaii	Proposed renewable energy project consisting of combined utility-scale photovoltaic array on 87 acres and 94 acres. The project improves power quality and energy resiliency in support of the Pacific Missile Range Facility by supplementing the more vulnerable and lower quality power from the local power plant (U.S. Department of the Navy, 2015e). The solar array system could generate up to 44 megawatts of direct current electrical power and would feed this electricity into the Kauai Island Utility Cooperative electrical grid for all users, public and military. New electrical transmission lines would be installed either overhead or underground. Environmental impacts are primarily terrestrial, but may offset energy demand and expand the existing energy portfolio that would reduce the need for development of offshore energy resources (i.e., fuel tanker traffic, wind energy development).				C/O
T-Pier Demolition	Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii	Demolition of Facility 1662, the former Naval Ocean Systems Command Pier, to include removal of concrete decking, support pilings, and existing utility lines associated with the pier. No long-term environmental impacts are anticipated; short-term noise and turbidity in the nearshore marine environment during demolition activities expected.				C
Pali Kilo Beach Cottages Expansion	Marine Corps Base Hawaii, Kaneohe Bay, Pali Kilo District, Oahu, Hawaii	Existing services include 12 single and duplex recreational cottages. Expansion would occur on a previously developed 0.44-acre site used to store emergency generators and other portable equipment and would construct 19 new cottages (49 total new lodging units) adjacent to the shoreline. Construction would be implemented throughout 2016 to 2026 (U.S. Department of the Navy, 2016b). The proposed action is generally terrestrial; however, future impacts on nearshore environments and essential fish habitat are possible resulting from increased recreational activity. With mitigation measures,	Construction best management practices and conservation measures; measures addressing ocean recreation behavior (designation of watercraft launch areas, controlling vehicle access, etc.), and extensive outreach and guest education.	O	O	C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Pali Kilo Beach Cottages Expansion (continued)		construction and operation may affect, but are not likely to adversely affect, ESA-listed sea turtles or the Hawaiian monk seal.				
Cove Outdoor Recreation Center and Marina Improvements	Marine Corps Base Hawaii, Kaneohe Bay, Oahu, Hawaii	Improvement of the Cove facilities to address deficiencies and increased demand for outdoor recreational resources, including construction of a wave attenuator to protect existing and proposed boating/recreation facilities; construction of additional boat slips, storage, parking, and pavilion; onshore and underwater improvements to three existing boat launches and seawall improvement (U.S. Marine Corps, 2010). Although temporary noise increases in the marine environment may be experienced as associated with construction activities, the project is not likely to adversely affect Hawaiian monk seal, Hawaiian stilt, green sea turtle, and hawksbill sea turtle and was exempt from a negative determination from the Hawaii Coastal Zone Management Program. Ongoing impacts associated with increased capacity and use of recreation resources may occur.	Mitigation and best management practices, including minimizing shading from built structures and enforcement of appropriate boating practices.	C/O	C/O	C/O
Submarine Drive-In Magnetic Silencing Facility	Joint Base Pearl Harbor-Hickam, Beckoning Point, Oahu, Hawaii	Construction of a new drive-in submarine magnetic silencing facility was completed in December 2010. The project replaced existing submarine deperming piers and structures and constructed land-based support facilities. Deperming is accomplished by wrapping heavy gauge copper cables around the hull and superstructure of the vessel; then very high electrical currents are pulsed through the cables to erase the permanent magnetism from ships and submarines. This camouflages them against magnetic detection vessels, marine mines with magnetic detection sensors, and interference with communications and navigation equipment (U.S. Department of the Navy, 2008a, 2008b).		C	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Submarine Drive-In Magnetic Silencing Facility (continued)		No ongoing environmental impacts are associated with construction activities; however, use of the facility is ongoing and risk for impacts associated with vessel traffic (such as strikes and noise) are present but negligible due to the reduced speed of vessels in this location.				
Naval Special Warfare Undersea Enterprise Consolidation	Joint Base Pearl Harbor-Hickam, Oahu, Hawaii	Consolidation of continental U.S.-based Naval Special Warfare Undersea Enterprise units and an existing unit currently located at Joint Base Pearl Harbor-Hickam. Approximately 200,000 square feet of working space and supporting infrastructure would be provided through adaptive reuse of a historic property on Ford Island (Building 55), improvements to existing facilities, and new construction within the existing unit's Pearl City Peninsula compound. Personnel and dependents would increase the population on Oahu by approximately 1,200, and implementation would occur over a 5 to 10 year period (U.S. Department of the Navy, 2011b). The Proposed Action would not involve in-water or over-water construction activities, and in-water operations are anticipated to remain consistent with normal base activity. Increased population would increase nearshore population density, including additional participation in recreation and consumptive activities.		C	O	O
Naval Special Warfare Operations Training	Selected coastal nearshore waters and selected shoreline and inland locations throughout the State of Hawaii (Oahu, Hawaii, Kaui, Maui, Molokai, Lanai)	Historical and proposed Special Operations Forces includes water-based training, land-based training, and air-based training (U.S. Department of the Navy, 2018). Water-based training generally includes diving/swimming, launching/recovering small vehicles designed to operate underwater (submersible) as discreet activities, or in combination and inserting and extracting naval special operations personnel or equipment using watercraft. Land-based training would include personnel transiting over the beach on foot, simulating building clearance activities using simulated munitions, in limited areas engaging in high angle climbing, and using observation techniques in a pre-arranged scenario. Air-based training would include the use of unmanned aircraft systems or aircraft utilizing drop zones or landing zones for	Aircraft flight restrictions would reduce risk of adverse effect on migratory bird populations.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Naval Special Warfare Operations Training (continued)		parachute or rope suspension training activities (Naval Special Warfare Command, 2016). Environmental impacts may include additional stress on or temporary disturbance to nearshore marine resources; however, Level A or Level B harassment of marine mammals is not anticipated.				
U.S. Outer Continental Shelf Energy Development						
Oil and Gas Leasing Programs	Federal Waters: Outer Continental Shelf, approximately 200 to 350 NM seaward from California jurisdictional boundary	Twenty-three oil and gas production facilities, operated by six different companies, are located off the coast of California (Bureau of Ocean Energy Management, 2017b). Twenty-two of these facilities produce oil and gas, while the other is a processing facility. There are 43 active leases encompassing 217,669 acres with an associated 213 miles of pipeline in the Pacific Continental Shelf Oil Region, Southern California Planning Area. Hawaii does not produce offshore oil or gas (U.S. Energy Information Administration, 2017). Oil and gas leasing activities may occur on a given lease tract for 40 – 70 years and include geophysical (sonar) surveys, exploration drilling, development and production wells; installation and operation of platforms, pipelines, and support facilities; transport of hydrocarbons using pipelines or tankers to processing locations; and decommissioning. The Final Five-Year Program does not propose additional lease sales for the Pacific Outer Continental Shelf; but existing activities would continue. The majority of oil and gas structures and the pipelines linking those structures with onshore processing and refining facilities are located north of the Study Area, with one (near Long Beach) that overlaps with Navy testing ranges and Operational Areas (OPAREAs) (Figures 3.11-2 and 3.11-3). Potential impacts associated with Outer Continental Shelf federal oil and gas leasing activities include those associated with noise, traffic, waste discharges, sediment disturbance, and risk of accidental spills (Bureau of	Avoidance/protection of sensitive benthic communities, including no activity zone within 500 feet of live bottom habitat, 1,000 feet of deep-water live corals, and 500 feet of chemosynthetic habitats. Avoidance of impacts within National Marine Sanctuaries, and air gun exploration timing restrictions pertinent to sea turtle requirements. Site-specific mitigation measures evaluated per project at lease sale offering.	C/O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Oil and Gas Leasing Programs (continued)		Ocean Energy Management, 2016a). These impacts are generally assumed to be negligible due to the dispersed and relatively small footprint of normal operations. In the event of small to catastrophic spills, however, impacts grow increasingly detrimental to marine life.				
	Outer Continental Shelf	The Executive Order *Implementing an America-First Offshore Energy Strategy* (April 2017) and Department of the Interior Secretary Order 3350 *Implementing the America-First Offshore Energy Strategy* (May 2017) require the immediate development of a new 5-Year Outer Continental Shelf Oil and Gas Leasing Program with full consideration of areas currently withdrawn from exploration, leasing, and development. Additionally, the Executive and Secretarial Orders require the expedited consideration of NMFS Incidental Take Authorization requests and seismic permitting applications; review of costs, opportunity costs, and adequacy of previous consultations for National Marine Sanctuaries and Marine Monuments; reconsideration of the Bureau of Safety and Environmental Enforcement *Oil and Gas and Sulfur Operations in the Outer Continental Shelf-Blowout Preventer Systems and Well Control Rule* (April 2016); and ceasing all promulgation of the Offshore Air Quality Control, Reporting, and Compliance Proposed Rule (2016). Additionally, the Executive and Secretary Orders require a review with intent to rescind or revise the National Oceanic and Atmospheric Administration (NOAA) *Technical Memorandum NMFS-OPR-55, Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (July 2016).				O
	State Waters: Pacific Outer Continental Shelf, 0 to 3 miles offshore of California	There are four offshore wells operating in California state waters within the Project Area (California Department of Conservation, 2017). Hawaii does not produce oil or gas (U.S. Energy Information Administration, 2017). Activities and potential impacts for these programs are similar as described above for the federal program.	Site-specific mitigation measures evaluated per project at lease sale offering.	C	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Oil and Gas Structure Removal Operations	Outer Continental Shelf, all water depths	Decommissioning seafloor obstructions (wellheads, caissons, casing strings, platforms, and mooring devices) includes the explosive and non-explosive severing of structures and subsequent salvage and site-clearance operations (Minerals Management Service, 2005). Decommissioning operations generally occur after lease expiration, when the well or facility is no longer deemed economically viable, or when the physical condition of the structure becomes unsafe or a navigation hindrance. Potential environmental impacts, such as injury or death to marine mammals, fish, sea turtles, and other animals due to nearby underwater blasts and site-clearance trawling activities would be mitigated to negligible most of the time, with occasional impacts being potentially adverse but not significant (Minerals Management Service, 2007). The effects of bottom-disturbing activities, such as anchoring and toppling structures, on sensitive benthic habitat and resources may include physical damage to hard bottom features, increased turbidity, and covering or smothering of sensitive habitats with re-suspended sediments. Site-specific NEPA analyses will be conducted on individual applications specifying supplementary mitigation.	General blasting criteria and scenario-specific requirements such as avoidance of hard bottom habitats and anchor restrictions for support vessel and transport use; use of turtle exclusion devices and 30 minute limits for site-clearance trawling; and observation for marine mammals and turtles, pausing activities in response to sightings	C	C	C
Commercial Wind Energy Development	Pacific Ocean Outer Continental Shelf Federal waters (approximately 200 to 350 nautical miles seaward from California and Hawaii state	Although the Bureau of Ocean Energy Management and the State of California are planning for potential leasing for offshore wind in federal waters, no projects have been developed or proposed in California to date (Bureau of Ocean Energy Management, 2017a). Three offshore wind projects have been proposed for federal waters around Oahu, Hawaii (U.S. Energy Information Administration, 2017). Commercial-scale offshore wind facilities are similar to onshore wind facilities, and, depending on rotor size and spacing requirements, can include from 14 (110 meter rotor diameter) to 40 (150 meter rotor diameter) turbines in one Outer Continental Shelf block (3 statute miles by 3 statute miles) (Bureau of Ocean Energy Management, 2013).	Implementation of proper siting and mandatory design criteria; sonic pingers and/or turtle exclusion devices to minimize entanglement and entrainment potential; adherence to U.S. Coast Guard oil spill response plans; use of environmentally friendly chemicals.			C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Commercial Wind Energy Development (continued)	jurisdictional boundary)	Average leaseholds are 8 blocks and current technology limits development to waters no deeper than 100 meters. Development includes installing the substructure, which is typically a large steel tube (up to 20 feet in diameter) driven 80 to 100 feet below the mudline in 15–100 feet water depths, with the pole and turbine mounted on top (Minerals Management Service, 2007). Each turbine is connected by power cable to an electric service platform/substation, typically located somewhere within the turbine array, from which buried high voltage cables transmit the power to an onshore substation for integration into the onshore grid. Total heights can reach upwards of 460 feet with blade tip speeds from 140 to 180 miles per hour over a rotor-swept area between 1.1 and 3.3 acres (American Wind Wildlife Institute, 2017). Site characterization activities include geophysical surveys, sub-bottom sampling, and biological surveys. Site assessment activities include installation of meteorological towers and meteorological buoys, data collection, and decommissioning of the towers and buoys (Bureau of Ocean Energy Management, 2012). Most impacts occur during the construction phase, which involves the highest amount of vessel traffic, noise generation (pile driving), seafloor disturbance (transmission cabling), and air emissions; however, ongoing impacts would occur from vessel and turbine strikes; moderate operational noise; disturbance of nesting areas; alteration of key habitat; or potential fuel, oil, or dielectric fluid spills (Minerals Management Service, 2007). Potential population-level impacts on marine mammals, fish, birds, and sea turtles would be mitigated in site-specific environmental review and permitting processes. In particular, impacts on sea turtles could be minor to moderate because of the technologies' potential to impede sea turtle movement and the potential of entrainment in overtopping devices. Additionally, if related onshore facilities are located in nesting areas, operation could cause minor to				

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Commercial Wind Energy Development (continued)		moderate adverse impacts on sea turtles due to hatchling disorientation from lighting, with possible major impacts if turtle nests or aggregates of hatchlings are destroyed. Proper siting, design, and other mitigation measures would minimize potential impacts on coastal sediment transport processes, marine navigation, commercial shipping, fishing activities, seafloor habitats, marine life, areas of special concern, archaeological sites, and U.S. Department of Defense training and exercise activities.				
Marine Hydrokinetic		Emerging waterpower technologies offer the potential to capture energy from waves, thermal gradients, tides, and ocean currents. Presently, there is significant research into the performance and economic viability of hydropower technologies. There is one project in the licensing process off the coast of Oregon, one in Alaska, and two projects underway in the Atlantic Ocean (Federal Energy Regulatory Commission, 2017a, 2017b). Concerns regarding waterpower technologies include the potential for collisions, noise, physical disturbance, disruption of marine species' behavioral patterns, impacts on local community and fishing industry, ability to monitor projects, cumulative impacts of multiple hydrokinetic projects along the coasts, habitat alteration due to anchors and cables, and release of toxins and chemicals by the projects or by vessels servicing the projects. Other considerations include habitat disturbance and the displacement of benthic organisms. These concerns provide the potential for habitat loss and changes to the ecology of a region (Pacific Fishery Management Council, 2011); however, initial studies have indicated that with appropriate protocols for siting and design, these impacts are likely to be minimal (Union of Concerned Scientists, 2008).				C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Marine Corps Base Hawaii Wave Energy Test Site	Marine Corps Base Hawaii, Oahu, Hawaii, off the north coast of Mokapu Peninsula In water depths of approximately 197 feet and 262 feet 6,500 feet and 8,200 feet	The Marine Corps Base Hawaii Wave Energy Test Site has constructed two wave energy test sites and is testing offshore wave energy conversion devices. Construction included installation and operation of moorings, trunk power and communications transmission cables, in-water scientific data gathering equipment, and associated shoreside electrical transmission and monitoring equipment. Ongoing environmental considerations for operation and maintenance include noise, entanglement and collision hazard, electrical leakage, heat, and electric and magnetic fields. It was determined that construction and operation are not likely to adversely affect any ESA-listed species or their designated or proposed critical habitat (U.S. Department of the Navy, 2012a).	Surveying for and avoidance of marine resources (especially ESA-listed species and coral substrate) prior to all activities.	C/O	O	O
Other Commercial Industries						
Maritime Traffic (Section 3.11.2.1, Commercial Transportation and Shipping)	U.S. West Coast/Pacific Ocean	The California and Hawaii coasts are heavily traveled by commercial, recreational, and government marine vessels with several commercial ports near Navy OPAREAs (see Figures 3.0-11 through 3.0-14, 3.11-1 through 3.11-6 and Tables 3.11-1 through 3.11-4). The United States has grown increasingly dependent on international trade over the past 50 years. As a result, the number of active ports in the Study Area increased, ship traffic increased, and ships are larger. In 2015, privately owned, ocean-going merchant vessels over 1,000 gross tons and transporting various types of cargo made approximately 82,044 calls at U.S. ports (U.S. Maritime Administration, 2016). Key California ports include Los Angeles, Long Beach, San Diego, and Port Hueneme. In 2015, nearly 4,500 port calls from privately owned, ocean-going merchant vessels over 1,000 gross tons and transporting various types of cargo occurred at these four ports (U.S. Maritime Administration, 2016). Based on the assumption that every port call has two ship transits, one inbound and one outbound, approximately 9,000	Continued adherence to state and federal marine traffic and operations regulations.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Maritime Traffic (Section 3.11.2.1, Commercial Transportation and Shipping) (continued)		ship transits of ocean-going merchant vessels occurred at the four ports in 2015 (see Table 3.11-4 and Figure 3.11-7). From 2011 to 2015, total estimated vessel presence in the Southern California Study Area was a total of 28,493,000 hours, 96 percent of which was non-military craft (Table 3.0-6). Primary environmental concerns regarding increased maritime traffic include vessels striking marine mammals and sea turtles, introduction of non-native species through ballast water, and underwater sound from ships and other vessels. Additionally, air and water quality in busy ports can be diminished due to engine emissions and fuel leaks. Secondary impacts include development and maintenance of port infrastructure, which often include dredging requirements to maintain channel depths and habitat loss and degradation in coastal habitats.				
	Hawaii	Ten harbors located on six major Hawaiian Islands serve the commercial cargo, passenger, and fishing industries. Major inter-island ports include Honolulu (Oahu), Barbers Point (Oahu), Hilo (Hawai'i), Kawaihae, and Kahului (Maui) (see Figures 3.0-10 and 3.0-11 and Table 3.11-2). The commercial harbors system receives 98 percent of all consumable goods, building materials and fuel imported to Hawaii. In 2015, 723 port calls from privately owned, ocean-going merchant vessels over 1,000 gross tons and transporting various types of cargo occurred at the four Hawaii ports (Honolulu, Barbers Point, Kahului, and Hilo) (U.S. Maritime Administration, 2016). Based on the assumption that every port call has two ship transits, one inbound and one outbound, approximately 1,446 ship transits of ocean-going merchant vessels occurred at the four ports in 2015 (see Table 3.11-5 and Figure 3.11-8). From 2011 to 2015, total estimated vessel presence in the Hawaii Study Area was a total of 4,371,000 hours, 92 percent of which was non-military craft (Table 3.0-6).	Continued adherence to state and federal marine construction and operational regulations.	O	O	C/O
	Kalaeloa Barbers Point, Honouliuli, Ewa	Oahu is served by two commercial harbors: Honolulu Harbor and Kalaeloa Barbers Point Harbor, which receive nearly all consumable goods and materials brought to Hawaii for shipment to neighbor Islands.		O	O	C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Maritime Traffic (Section 3.11.2.1, Commercial Transportation and Shipping) (continued)	District, Kapolei, Oahu	Kalaeloa Barbers Point Harbor is in the planning stages to implement harbor improvements, including the addition of berthing, yard space, and other infrastructure including a fuel pier and fuel terminal at Piers 3 and 4. Pier construction in harbor waters and dredging (both new and maintenance) will include impacts on the marine environment such as temporary turbidity, underwater noise/vibration due to pile-driving, habitat fragmentation, and dispersal of invasive species (Hawaii Department of Transportation, 2017). Long-term effects on marine resources along the harbor walls from shading from permanent pier structures and armoring preventing vegetation regrowth. Increased vessel traffic and harbor operations could also cause long-term effects on threatened and endangered species, although potential impacts are expected to be minimal as there are no known use or occurrence of sea turtles, whales, dolphins, or monk seals within the harbor.				
Commercial Fishing (Section 3.11.2.2 [Commercial and Recreational Fishing])		Twenty major fisheries in Hawaiian waters include tuna, billfish, bottom fish, other species of pelagic fish, and a smaller invertebrate fishery. These fisheries all have gear, seasonal, and geographical prohibitions depending on the ecological conditions of the area and the target species (Section 3.11.2.2.1.1, Commercial Fishing). Commercial landings for all fisheries in 2015 in Hawaiian waters exceeded 36 million pounds (see Table 3.11-5). Thirty-nine fisheries in Southern California include groundfishes (e.g.,	Various bycatch mitigation technologies, quotas, and seasonal restrictions required per the fishery-specific permit process.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Commercial Fishing (Section 3.11.2.2 [Commercial and Recreational Fishing]) (continued)		flatfishes, skates, some sharks, and rockfishes), highly migratory species (e.g., tuna, billfish, some sharks, dolphinfish, and swordfish), coastal pelagic species (e.g., anchovies, mackerel, and sardines), and invertebrates (e.g., California spiny lobster, several crab species), and market squid are harvested and sold commercially. The NMFS issues fishing vessel, dealer, and commercial operator permits and fishing authorizations as required under the various Federal Fishery Regulations. Commercial landings for all fisheries in 2017 in California waters exceeded 140 million pounds (see Table 3.11-7). Commercial fishing can adversely affect fish populations, non-target species, and habitats. Bycatch includes the unintentional capture of fish, marine mammals, sea turtles, seabirds, and other non-targeted species that occur incidental to normal fishing operations. Fisheries bycatch has been identified as a primary driver of population declines in several groups of marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al., 2010). Commercial fishing often includes the use of mobile fishing gear, such as bottom trawls, which increases turbidity, alters surface sediment and bottom habitats, removes prey (leading to declines in predator abundance), removes predators, and generates marine debris. Ghost fishing occurs when lost and abandoned fishing gear, such as gill nets, purse seines, and long lines, continue to ensnare fish and other marine animals without human oversight and removal. Lost gear fouls and disrupts bottom habitats and has the potential to entangle, or be ingested by, marine animals.				

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Recreational Fishing (Section 3.11.2.2 [Commercial and Recreational Fishing]) (continued)		Although target species vary from year to year, from 2013 through 2017, recreational fishers caught just under 12 million fish in marine and estuarine waters in Hawaii (see Figure 3.11-6 and 3.11-12). Recreational fishing is also significant in southern California, where over 3.3 million days of recreational fishing were recorded in 2013 (National Marine Fisheries Service, 2015b) (see Figure 3.11-15, 3.11-22 through 3.11-24). More than 200 for-hire fishing vessels operate from 15 separate ports between Point Conception and the U.S.–Mexico border (California Marine Life Protection Act Initiative, 2009). Recreational fishing includes impacts from vessel traffic (strike, noise, water pollution, marine debris) and can compound impacts on fish stocks already experiencing exploitation. Recreational fishing and boat traffic usually occurs nearshore rather than in the deeper open ocean, and recreational traffic typically frequents popular locations, which can concentrate damage in these areas from anchors or other bottom-disturbing equipment.	Operational regulations, seasonal restrictions, licensing, and quotas used to manage mitigate negative effects of recreational fishing.	O	O	O
Coastal Land Development and Tourism (Section 3.11.2.4, Tourism)	California and Hawaii Coastline	Coastal land development adjacent to the Study Area is both intensive and extensive, including development of homes, businesses, recreation, vacation, and ship traffic at port facilities and marinas. The Study Area coastline also includes extensive coastal tourism (hotels, resorts, restaurants, food industry, and vacation homes) and its supporting infrastructure (retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, and recreational fishing and whale watching). New development in the coastal zone requires a permit from the state or local government per the Coastal Zone Management Act (Chapter 6, Regulatory Considerations). Tourism is the single biggest industry in Hawaii, and on any given day, over 200,000 visitors are in Hawaii (Hawaii Tourism Authority, 2015). In 2016, nearly 9 million tourists arrived in Hawaii (Hawaii Tourism Authority, 2017). Significant activities include SCUBA diving, snorkeling	Site-specific mitigation often determined during Coastal Consistency Review by the respective state's Coastal Zone Management Program	C/O	C/O	C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Coastal Land Development and Tourism (Section 3.11.2.4, Tourism) (continued)		and whale watching (see Figures 3.11-17 through 3.11-19). Likewise, tourism is a substantial industry in Southern California (National Ocean Economics Program, 2015). Coastal development intensifies use of coastal resources through dune and nearshore habitat loss and disturbance, point and nonpoint source water pollution, entrainment in outflows and other structures, and air quality degradation. SCUBA diving and snorkeling have the potential to degrade reef systems through disturbance and specimen collecting, and collisions between whale watching ships and whales are common.				
Undersea Communications Cables	Oceans worldwide	Submarine cables provide the primary means of voice, data, and Internet connectivity between the mainland United States and the rest of the world (Federal Communications Commission, 2017). The Federal Communications Commission grants licenses authorizing cable applicants to install, own, and operate submarine cables and associated landing stations in the United States. Cables are installed by specialized boats across flat ocean surfaces and dug into the seabed in shallow areas. Over 550,000 mi. of cables currently exist in the world's oceans. Potential impacts of installation and maintenance activities would include noise and vessel strikes from boat traffic and increased seafloor disturbance and sedimentation in localized areas where the cable is installed. Likewise, electromagnetic fields are generated by some cables that may be sensed by and affect the migration behavior of some fish, sharks, rays, and eels (Bureau of Ocean Energy Management, 2016c).	Continued adherence to international marine construction and operational regulations.	C/O	C/O	C/O
Aquaculture		Aquaculture is the farming of aquatic organisms such as fish, shellfish, and plants. Globally, 29 percent of stocks are fished at biologically unsustainable levels, and aquaculture helps meet demand and offsets stress to wild populations (National Marine Fisheries Service, 2015c). Aquaculture production reached an all-time high of 97 million metric tons in 2013 and is the fastest growing form of food production, at 6 percent		C/O	C/O	C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures[1]*	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Aquaculture (continued)		per year globally. Forty-seven percent of aquaculture operations occur in the Pacific Ocean. The threats of aquaculture operations on wild fish populations include reduced water quality, competition for food, predation by escaped or released farmed fishes, spread of disease and parasites, and reduced genetic diversity (Kappel, 2005). These threats become apparent when farmed fish escape and enter the natural ecosystem (Hansen & Windsor, 2006; Ormerod, 2003). The Marine Aquaculture Policy provides direction to enable the development of sustainable marine aquaculture (National Marine Fisheries Service, 2015c).				
	7.2 kilometers (4.5 statute miles) west of Mission Bay in San Diego, California	Establishment of the first commercial-scale offshore aquaculture project in U.S. federal waters, which will gradually expand to produce up to 5,000 metric tons per year (expected by year eight) of yellowtail jack, white seabass, and striped bass (Hubbs-Seaworld Research Institute, 2008; U.S. Army Corps of Engineers, 2015). Submersible sea cages will be deployed and improved as the project progresses. The project could have potential impacts to marine biological resources and water quality, both of which will be extensively mitigated, in order to minimize marine mammal, sea turtle, bird, and predator fish entanglement, proper mesh size netting will be used and the farm will be located away from known seal and sea lion haul-out areas. The project will also implement a comprehensive health management program to prevent the transfer of pathogens or diseases to wild fish stocks as well as a comprehensive loss-control plan to prevent escape from containment and potential impacts to genetic integrity of wild population.	Ongoing monitoring of seafloor chemistry below cages (sediments, water quality) and benthic infaunal communities; abatement measures due to excess feed, fecal matter, antibiotics, and other chemicals; appropriate exclusion netting to avoid entanglement of marine mammals, sea turtles, birds, and predator fish species; avoidance of anchoring on hard bottom habitats; vessel operation protocols			C/O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Research and Conservation						
Geological and Geophysical Oil and Gas Survey Activities	Outer Continental Shelf	Offshore geological and geophysical research may include seismic airgun surveys and high resolution geophysical surveys supporting oil and gas, renewable energy, and marine minerals exploration (Bureau of Ocean Energy Management, 2014b). Seismic surveys are accomplished by towing a sound source such as an air gun array that emits acoustic energy in timed intervals behind a research vessel. Seismic pulses are typically emitted at intervals of 5 to 60 seconds and source levels are 230.7 decibels referenced to 1 micropascal (dB re 1 µPa) for the large air gun array and 210.3 dB re 1 µPa for the small array. Seismic air gun surveys are loud enough to penetrate hundreds of km into the ocean floor, even after going through thousands of meters of ocean (Weilgart, 2013). Oil exploration is less prevalent in the Pacific Ocean as it is in the Gulf of Mexico and may potentially become in the Atlantic, but it may occur or increase within the existing Pacific Ocean lease tracts discussed above. Vessel strikes and especially seismic sound production in excess of 180 dB could cause adverse impacts on marine mammals (Bureau of Ocean Energy Management, 2014a). Additionally, air guns are known to kill zooplankton for at least 0.75 miles from the point of origination (Tollefson, 2017). All seismic surveys conducted by U.S. vessels are subject to required mitigation measures, the MMPA authorization process administered by the NMFS, as well as the NEPA process associated with issuing MMPA.	Typically include establishing and monitoring (visual, passive acoustic, and active acoustic) safety and acoustic exclusion zones and enforcing delay/ suspension and spacing protocols. Seasonal management may include avoidance of critical habitat for specific vulnerable species. Maximum sound level thresholds established and enforced.			
Academic Research	Global	Wide-scale academic research is conducted in the study area by federal entities, such as the Navy and the National Oceanic and Atmospheric Administration/NMFS, as well as state and private entities and other partnerships, such as the California Cooperative Oceanic Fisheries Investigations program. Although academic research aims to capture data without disturbing the ambient conditions of the ocean environment, vessels contribute traffic,	NMFS and states manage scientific research permits for certain activities	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Academic Research (continued)		noise, and strike hazard; seismic activity contributes noise; and various other collection methods, such as trawling, could be disruptive to the ecosystems under observation. Impacts from academic research operations can be similar to the impacts expected from oil and gas air gun survey activities.				
Field Operations at National Marine Sanctuaries and Marine National Monuments (see Section 6.1.2, Marine Protected Areas)	Sanctuaries located in the West Coast and Pacific Islands	NOAA conducts field operations within Marine Sanctuaries and Monuments, which include vessel operations; vessel maintenance; aircraft operations; non-motorized craft operations; SCUBA or snorkel operations; onshore field work; deployment of autonomous underwater vehicles, remotely operated vehicles, gliders, or drifters; deployment of remote sensing equipment (including sonar); deployment of equipment on the seafloor; and other sampling activities (*Federal Register* 83 [152]: 38684–38685, August 7, 2018). The field operations primarily support resource protection, research, and education objectives of the National Marine Sanctuaries Act. The Programmatic EA of Field Operations in the West Coast National Marine Sanctuaries (Office of National Marine Sanctuaries, 2018a) and the Programmatic EA of Field Operations in the Pacific Islands National Marine Sanctuaries (Office of National Marine Sanctuaries, 2018b) analyze the options of maintaining the status quo and existing level of operations in National Marine Sanctuaries and Monuments for the next 5 years, or increasing the number of small boat operations and stopping the requirement for small boat best management practices in some locations.	Mitigation measures are determined on a project-by-project basis in accordance with the ESA, MMPA, Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation Management Act, and the National Historic Preservation Act.	O	O	O

Table 4.2-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Project	*Location*	*Project Description*	*Summary of Impact Minimization and Mitigation Measures*[1]	*Project Timeframe C = Construction O = Operation*		
				Past	*Present*	*Future*
Field Operations at National Marine Sanctuaries and Marine National Monuments (see Section 6.1.2, Marine Protected Areas) (continued)		These discontinued management practices may include existing actions such as enforcing permit and consultation mitigations, vessel speed restrictions, night operation prohibitions, onboard marine mammal and other species observer (unless specified as required or recommended mitigation measures), restrictions on transporting live organisms and ballast water discharges, disinfecting research tools and gear, and safe distance requirements from protected species.				
Naval Undersea Warfare Center Division Fixed Surface Ship Radiated Noise Measurement System	Barbers Point, Oahu, Hawaii and Surrounding Ocean, 3.5 miles offshore in Fleet Operational Readiness Accuracy Check Site	Includes the installation and operation of a hydrophone array, undersea data transmission cable, and a shore station cable landing to measure underwater vessel noise (propulsion, ship machinery, and flow noise) (U.S. Department of the Navy, 2015c). Temporary impacts associated with sediment suspension during drilling operations for undersea cable installation are anticipated. Negligible impacts to marine wildlife are anticipated during construction, but may include avoidance by individuals. No long-term impacts anticipated.	Industry best management practices for drill fluid management, avoidance of ESA-listed marine mammals, sea turtles, fish, Essential Fish Habitat, and vegetation; diver-assisted avoidance of live coral or coral reef ecosystem and weighting cables for long-term stability; and full restoration in ʻEwa hinahina critical habitat.	C	O	O

Table 4.2-2: Ocean Pollution and Ecosystem Alteration Trends

Stressor	*Location*	*Description*
Climate Change (Section 3.1, Air Quality; Section 3.2.2.2.4, Climate Change on Water Quality)	Global	Predictions of long-term negative environmental impacts due to climate change include sea level rise; changes in ocean surface temperature, acidity/alkalinity, and salinity; changing weather patterns with increases in the severity of storms and droughts; changes to local and regional ecosystems (including the potential loss of species); shrinking glaciers and sea ice; thawing permafrost; a longer growing season; and shifts in plant and animal ranges, fecundity, and productivity. Anthropogenic greenhouse gas emissions have changed the physical and chemical properties of the oceans, including a 1-degree Celsius temperature rise, increased carbon dioxide absorption, decreased pH, and alteration of carbonate chemistry, decline in dissolved oxygen, and disruption of ocean circulation (Poloczanska et al., 2016). Observations of species responses that have been linked to anthropogenic climate change are widespread, and trends include shifts in species distribution to higher latitudes and to deeper locations, earlier onset of spring and later arrival of fall, declines in calcification, and increases in the abundance of warm-water species. Climate change is likely to negatively impact the Study Area and will contribute added stressors to all resources in the Study Area (as noted in the discussion for each resource in the Sections to follow).
Noise	Global	Ambient noise is the collection of ever-present sounds of both natural and human origin. Ambient noise in the ocean is generated by sources that are natural physical (earthquakes, rainfall, waves breaking, and lightning hitting the ocean); natural biological (snapping shrimp and the vocalizations of marine mammals), and anthropogenic (human-generated) sources. Anthropogenic sources have substantially increased ocean noise since the 1960s, and include commercial shipping, oil and gas exploration and production activities (including air gun, sonar, drilling, and explosive decommissioning), commercial and recreational fishing (including vessel noise, fish-finding sonar, fathometers, and acoustic deterrent and harassment devices), military (testing, training and mission activities), shoreline construction projects (including pile driving), recreational boating and whale-watching activities, offshore power generation (including offshore windfarms), and research (including sound from air guns, sonar, and telemetry). The contribution of military and non-military vessel traffic to the underwater noise experienced in the Study Area is discussed in Section 3.0.3.3.1.4 (Vessel Noise).

Table 4.2-2: Ocean Pollution and Ecosystem Alteration Trends (continued)

Stressor	*Location*	*Description*
Marine Debris (Section 3.2.2.2.3,Marine Debris and Water Quality)	Global	Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment. An estimated 75 percent or more of marine debris consists of plastic, and approximately 80 percent of marine debris originates onshore and 20 percent from offshore sources (Derraik, 2002; Hardesty & Wilcox, 2017). Marine debris is governed internationally by the 1972 London Convention and 1996 London Protocol and regulated in the U.S. through the Marine Protection, Research, and Sanctuaries Act. Marine debris has been discovered to be accumulating in gyres throughout the oceans, and two major accumulation zones exist in the Pacific Ocean and in the Atlantic east of Bermuda. The Hawaiian Archipelago is located within the North Pacific Gyre, which consolidates debris originating in various areas of the Pacific Ocean. Anthropogenic marine debris is also widespread along the continental shelf and upper slope of the U.S. West Coast (Washington to southern California). Military expended materials (ammunition boxes, helmets, rocket boosters and launchers, etc.) were the highest contributors to recovered metals in deeper waters off California in areas known for Navy activities and military dump sites, including around Catalina and San Clemente Islands (Keller et al., 2010). Recent studies in the Southern California Bight found that marine debris (primarily plastic) occurred in about one-third of seafloor areas surveyed (Moore et al., 2016). Microplastic particles were more prevalent in shallow nearshore areas (ports, marinas, bays, and estuaries) than in offshore areas. Marine debris degrades marine habitat and water quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service, 2006).
Pollution (Section 3.2, Sediments and Water Quality)	Global	Common ocean pollutants are generally derived from land-based activities and include toxic compounds such as metals, pesticides, and other organic chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from nonpoint sources (stormwater runoff from watersheds), point sources (wastewater treatment plant discharges), other land-based sources (windblown debris), spills, dumping, vessels, and atmospheric deposition. Bilge water is a mix of water, oily fluids, lubricants and grease, cleaning fluids, and other wastes that are pumped out periodically from vessel holding tanks, either to a reception facility on shore or treated with a bilge oil-separator and discharged at sea. Discharging sewage is largely prohibited under the Clean Water Act. The main risk of oil or other petroleum product spills is from ships, whether carrying petroleum to and from ports or in fuel tanks, and from pipelines and onshore facilities that transport and store oil and gas.
	Hawaii	One of the largest oil tanker spills in the Study Area occurred in 1989 when the tanker Exxon Houston broke away from its moorings and ran aground Barbers Point on Oahu, spilling approximately 117,000 gallons (U.S. Coast Guard, 1992).
	California	In 1969, a federal platform offshore Santa Barbara experienced a blowout in one of its wells; an estimated 80,000 barrels (3,360,000 gallons) of oil was released into the ocean. Since 1969, about 883 barrels of oil have been spilled

Table 4.2-2: Ocean Pollution and Ecosystem Alteration Trends (continued)

Stressor	*Location*	*Description*
Pollution (Section 3.2, Sediments and Water Quality) (continued)		due to natural gas and oil operations offshore California. This spillage represents the cumulative loss from small spills ranging in size from a few drops to a 163-barrel spill from a pipeline in State waters carrying Outer Continental Shelf production to shore. Several redundancies are provided in all platform systems associated with drilling and production operations to ensure safety and to prevent flow from wells during a contingency such as an earthquake. Sewage outflow systems in both Hawaii and California can impact nearshore water quality. For example, during wet weather/heavy rain events, hundreds of millions of gallons of untreated wastewater can enter the inshore waters of the Southern California Range Complex in San Diego resulting in beach closures and impacts on training due to stormwater runoff from Mexico's Tijuana River (U.S. Department of the Navy, 2015d).
Harmful Algal Blooms (Section 3.2.1.1.2.3, Coastal Water Quality, and Section 3.3.2.1.2.3, Disease and Parasites)	Global	Elevated nutrient loading has also been identified as a potential contributing cause of the increased incidence of harmful algal blooms, proliferations of certain marine and freshwater toxin-producing algae (National Oceanic and Atmospheric Administration, 2016, 2017b). Of the 5,000 known species of phytoplankton, there are about 100 species known to be toxic or harmful. Harmful algal blooms cause human illness and animal mortalities, including species of fish, bird, and marine mammals (Anderson et al., 2002; Corcoran et al., 2013; Sellner et al., 2003). Harmful algal blooms can be natural phenomena but are occurring in increasing size and frequency due to human-induced nonpoint source water pollution (National Oceanic and Atmospheric Administration, 2016, 2017b). With the projection of warming ocean waters, these harmful blooms may become more prevalent—beginning earlier, lasting longer, and covering larger geographic areas (Edwards, 2013; Moore et al., 2008).
Hypoxic Zones (Section 3.6.2.1.4.1, Water Quality)	Global	Hypoxia, or low oxygen, is an environmental phenomenon where the concentration of dissolved oxygen in the water column decreases to a level that can no longer support living aquatic organisms. Hypoxia occurs from the rapid growth and decay of algal blooms in response to excess nutrient loading (primarily nitrogen and phosphorus from agriculture runoff, sewage treatment plants, bilge water, and atmospheric deposition). Animals that encounter the Dead Zones flee, experience physiological stress, or suffocate (National Oceanic and Atmospheric Administration, 2016; Texas A&M University, 2011, 2014). Hypoxic zones can be natural phenomena but are occurring in increasing size and frequency due to human-induced nonpoint source water pollution (National Oceanic and Atmospheric Administration, 2016, 2017b).

4.3 CUMULATIVE IMPACTS ON ENVIRONMENTAL RESOURCES

Since the information available on past, present, and reasonably foreseeable actions varies in quality and level of detail, impacts of these actions were quantified where available data made it possible; otherwise, professional judgment and experience were used to make a qualitative assessment of impacts. Due to the large-scale of the Study Area and multiple activities and stressors interacting in the ocean environment (Table 4.2-1 and Table 4.2-2), the analysis for the incremental contribution to cumulative stress that the Proposed Action may have on a given resource is largely qualitative and speculative. Chapter 3 (Affected Environment and Environmental Consequences) includes a robust discussion of cumulative effects in a meaningful sense. To a great extent, the Chapter 3 (Affected Environment and Environmental Consequences) analysis is cumulative in that it takes into account the current condition of each resource as impacted by past and present human activity, and by prospects for recovery reflecting relevant future activity. Chapter 3 (Affected Environment and Environmental Consequences) includes discussion of the "general threats", an analysis of aggregate project effects, and a broader level analysis specific to areas where impacts are concentrated (i.e., ranges/OPAREAS). Therefore, the Chapter 3 (Affected Environment and Environmental Consequences) analysis is referenced and briefly summarized in each section below to provide context and perspective to the rationale for the conclusions that the Proposed Action would have an insignificant contribution to the cumulative stress experienced by these resources, when specific past, present, and reasonably foreseeable future actions are added to the analysis.

In this chapter, cumulative impacts were analyzed for each resource addressed in Chapter 3 (Affected Environment and Environmental Consequences) for the Proposed Action. Analysis was not separated by Alternative because the data available for the cumulative effects analysis was mostly qualitative in nature and, from a landscape-level perspective, these qualitative impacts are expected to be generally similar.

Under Alternative 1 or Alternative 2 of the Proposed Action, the Navy would implement the mitigation detailed in Chapter 5 (Mitigation) to avoid or reduce potential impacts on biological, socioeconomic, and cultural resources in the Study Area.

4.4 RESOURCE-SPECIFIC CUMULATIVE IMPACTS

In accordance with Council on Environmental Quality guidance (Council on Environmental Quality, 1997), the following cumulative impacts analysis focuses on impacts that are "truly meaningful." The level of analysis for each resource is commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences) or the level to which impacts from the Proposed Action are expected to mingle with similar impacts from existing activities. A full analysis of potential cumulative impacts is provided for marine mammals, reptiles, and invertebrates. Rationale is also provided for an abbreviated analysis of the following resources: air quality, sediments and water quality, vegetation, habitat, fishes, marine mammals, reptiles, birds, cultural resources, socioeconomics, and public health and safety.

4.4.1 AIR QUALITY

As described in Section 3.1.2.1.1 (Region of Influence), the region of influence for air quality is dependent on the type of pollutant, emission rates, other emission sources, and meteorology. For inert pollutants, the region of influence is generally limited to a few miles downwind from the source. For a photochemical pollutant, such as ozone, the region of influence may extend much farther downwind.

The concentration of many small emission sources in a particular airshed, under the right circumstances, could incrementally contribute to regional air quality degradation.

The context for air quality analysis provided in Section 3.1 (Air Quality) includes adherence to state and federal plans enacted to achieve and maintain air quality, and these plans were developed with direct, indirect, and cumulative impacts in mind. As the plans are developed, the establishment of significance criteria includes an inventory of existing emissions and the development of thresholds that ensure new activities avoid or mitigate significant air quality impacts. A majority of the activities included in the Proposed Action are ongoing, and any emissions associated with these activities that reach land are captured in any ambient air monitoring data collected and used to quantify area air quality.

Unlike other resource areas, the analytical construct for this air quality analysis in Section 3.1 (Air Quality) is effectively a quantified look at applicable training and testing activity emissions and a region's ability to maintain or recover air quality as measured by the criteria air pollutants in light of other, existing emissions. As a whole, the air quality throughout the Study Area is generally very good or excellent as shown by ongoing monitoring of all criteria pollutants against National Ambient Air Quality Standards and State Ambient Air Quality Standards (Section 3.1.2.2, Existing Air Quality). A small proportion of nonattainment and maintenance areas are generally concentrated in the inland, urban, industrialized areas off the coast of Southern California. Much of the air pollutants found in offshore areas are transported there from adjacent land areas by low-level offshore winds, so concentrations of criteria air pollutants generally decrease with increasing distance from land. The good quality of the ocean atmosphere, including Hawaii and the Transit Corridor, results from the relatively low number of air pollutant sources, as well as the size, topography, and prevailing meteorological conditions throughout the Study Area.

Other activities in the Study Area that contribute to emissions of criteria air pollutants include other vessel traffic and oil and gas production activities, as well as from landside power-generating stations, petroleum refining, agriculture, other industry, vehicle traffic, and volcanoes (Hawaii). Oil and gas production is regulated under state and federal programs to ensure new activities avoid or mitigate significant air quality impacts (Bureau of Ocean Energy Management, 2016b). Sulfur dioxide, nitrogen dioxide, and particulate matter air emissions from non-military vessel operations operating within 200 miles of coastal areas off the U.S. and Canada and the U.S. Caribbean Sea area (around Puerto Rico and the U.S. Virgin Islands) are regulated by the International Maritime Organization. These areas are known as Emission Control Areas and were created because of the ability of these pollutant emissions to travel long distances, thus potentially impacting coastal zones and further inland.

As noted above, the majority of proposed activities are ongoing and would be captured in most states' air quality measurements. As detailed in Section 3.1 (Air Quality) sources of emissions from the proposed alternatives would include Navy vessels, aircraft, and to a lesser extent, munitions training and testing activities conducted throughout the Study Area. The Proposed Action would result in localized and temporarily elevated emissions, but criteria pollutant emissions in nonattainment or maintenance areas would not exceed *de minimis* thresholds. Hazardous air pollutant emissions are anticipated to be small and were dismissed as a stressor of impact.

It is anticipated that emissions resulting from the Proposed Action would be released outside of state waters and would quickly disperse in the open ocean environment. These emissions would largely disperse rather than concentrate due to meteorological and air chemistry processes, and these emissions could mix with emissions from other vessel traffic in the open ocean. The incremental additive

impacts from these combined emissions occurring beyond state water boundaries would be minor, localized, intermittent, and unlikely to contribute to future degradation of the ocean atmosphere in a way that would harm ocean ecosystems or nearshore communities. Thus, based on the analysis presented in Section 3.1 (Air Quality) and given the meteorology of the Study Area, the frequency and isolation of proposed training and testing activities, and the quantities of expected emissions, it is anticipated that the incremental contribution of the Proposed Action beyond state waters, when added to the impacts of all other past, present and reasonably foreseeable future actions would not result in measurable additional impacts to air quality in the Study Area or beyond.

A cumulative analysis of greenhouse gas emissions and climate change is provided in Section 3.1 (Air Quality).

4.4.2 Sediments and Water Quality

The region of influence for sediments and water quality includes estuaries, nearshore areas, and the open ocean. Although most impacts from anthropogenic sources tend to be geographically isolated in proximity to the source, more widespread impacts can extend over time into the offshore ocean environment due to transport through currents, storms, and persistent winds as well as vertical mixing in the water column. The fate of materials deposited in the marine environment and the formation of degradation or corrosion products depends on geochemical conditions that may influence precipitation by chemical reaction, adsorption, and biodegradation. Transport mechanisms, such as advection by currents, dispersion, and dissolution can cause wide distribution of chemicals and small, buoyant particle debris. While this dynamic movement generally causes chemical contaminants and debris to degrade or dilute, it can also concentrate materials in areas of the seafloor or water column. Persistent currents, upwelling, eddies, and large-scale gyres can result in convergence zones that accumulate debris, particularly plastics, in the marine environment (e.g., the “garbage patches” in the North Pacific Ocean and east of Bermuda).

In order to protect sediment and water quality, several U.S. and international laws govern the discharge of fouling materials into the marine environment. Both nearshore discharge as well as discharges from open ocean activities and vessels in federal waters are regulated by the U.S. Environmental Protection Agency (USEPA) and state environmental programs through the Clean Water Act National Pollutant Discharge Elimination System. The deliberate disposal of waste or other matter into the ocean is governed internationally by the 1972 London Convention and 1996 London Protocol, implemented in the U.S. through the Marine Protection, Research, and Sanctuaries Act. The International Convention for the Prevention of Pollution from Ships is incorporated into U.S. law and addresses pollution generated by normal vessel operations (Section 3.2.1.2, Methods lists applicable water and sediment quality standards, regulations, and guidelines).

Sediment quality of the Study Area is detailed in Section 3.2.2.1 (Sediments) and is generally rated “good” by the USEPA with most instances of lower quality in nearshore waters adjacent to population centers or areas that are geologically more enclosed (e.g., Pearl Harbor) (Table 3.2-1 and 3.2-2; Figures 3.2-2 and 3.2-3). Poor sediment quality related to metals contamination occurs in Waimea Bay, Kauai; Pearl Harbor; Keehi Lagoon on Oahu; Hilo Bay on Hawaii; and other harbors. Off the California coast, sediments are rated good except for areas adjacent to Los Angeles (outside of the Study Area), and farther south in the California Bight from Santa Catalina Island to the Mexico border. The outer continental shelf and submarine canyons are experiencing decreasing sediment quality, likely due to the

migration of sediments contaminated in the past by poorly regulated waste and chemical disposal processes.

Water quality of the Study Area is detailed in Section 3.2.2.2 (Water Quality). Threats to water quality are detailed in Section 3.2.2.2.3 (Marine Debris and Water Quality). Population growth is the primary cause of impacts on coastal water quality, including marine debris, land-based garbage, and solid wastes that deposit toxic chemicals and nutrients in the ocean. Water quality in the open ocean portion of the Study Area tends to be rated good, but in nearshore areas water quality ranges from good to poor, and is often compromised due to increased use of and development in coastal waters (see Figures 3.2-4 and 3.2-5). Pearl Harbor is on the Clean Water Act Section 303(d) List of Water Quality Limited Segments as are many of the streams draining into the San Diego Bay. Persistent organic pollutants such as polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and pesticides; nutrients; bacteria; and some metals are common components of discharge into rivers, bays, and the ocean. The major pollutant encountered in the open ocean is oil from accidental spills (including chemical dispersants used in response to spills) as well as natural seeps.

All past, present, and reasonably foreseeable activities listed in Table 4.2-1, and the stressors listed in Table 4.2-2, affect marine sediments and water quality. In particular, activities contributing to climate change, continued runoff and discharge from nearshore land uses and coastal land development, maritime traffic, leakages and spills from oil and gas development, commercial fishing, mineral extraction, offshore energy development and removal operations, and marine trash impact water and sediment quality. Commercial, recreational, and institutional vessels discharge water pollutants into the Southern California portion of the HSTT Study Area as part of normal operations. Shipboard waste-handling procedures governing the discharge of Hawaii-Southern California nonhazardous waste streams have been established for commercial and Navy vessels. These categories of wastes include solids (garbage) and liquids, including “black water” (sewage); “grey water” (water from deck drains, showers, dishwashers, laundries, etc.); and oily wastes (oil-water mixtures). Global climate change is linked to increasing ocean acidity (pH), increasing sea surface temperatures, and increasing frequency and intensity of storms. These factors influence marine chemistry and the transport and persistence of chemical contaminants within sediment and the water column. Chemicals that remain in particulate form below a certain temperature may dissolve into the water column at a higher rate as water temperatures rise, and they may become more widely dispersed due to storms or changing currents. Particularly in nearshore areas and bays, the concentration of Navy stressors in designated ranges and ports may combine with non-Navy stressors, which may also be concentrated in these areas, to exacerbate already impacted sediments and water quality (Figures 2.1-1 through 2.1-10).

The analysis in Section 3.2 (Sediments and Water Quality) indicates that certain training and testing activities could result in localized, short- and long-term impacts on sediment and water quality. Activities that use explosive munitions would introduce explosives byproducts, metals, and other constituent chemicals directly into the water column when the munition detonates or into marine sediments if an explosive munition fails to detonate. Explosives byproducts from munitions that detonate are expected to disperse rapidly near the water’s surface after detonation. Explosive materials and metal corrosion products from munitions that fail to detonate and thus reside on the seafloor would be released into adjacent sediments (within a few feet) over the long-term (years to decades). However, analysis of decades-old munitions dump sites in multiple locations, including Hawaii, indicates that chemical contaminant concentrations in impacted sediment would not be expected to differ substantially from the chemical composition of control sediments located within the general area of impact (see Section

3.2.3 Environmental Consequences). Other military expended materials, such as marine markers and flares, chaff, unrecovered towed and stationary targets, sonobuoys, fiber optic cables, and miscellaneous plastic and rubber components of other expended objects are expected to sink to the seafloor and become buried in sediments. Depending on the environmental conditions, including the availability of oxygen in sediments, water temperature at the seafloor and the type of material (e.g., metal or plastic), expended material may degrade relatively quickly or persist in the environment indefinitely. Plastics and other buoyant, persistent materials could incrementally contribute to marine "garbage patches" or other areas with accumulated debris.

Short-term impacts from activities using vessels may include increased turbidity and suspension of sediments in the water column (dependent on water depth). Most explosives are fully consumed in detonation, and chemical, physical, or biological changes to sediments or water quality, if detectable, would be below applicable standards, regulations, and guidelines and would be within existing conditions or designated uses. Military expended materials associated with the Proposed Action do not generally include the same chemical constituents typically affecting coastal water quality. With the exception of the few training and testing activities that occur in bays and harbors, it is unlikely that short-term increases in turbidity from training and testing activities would overlap in time and space with other past, present, or future actions. For example, training and testing with explosives would not occur near an oil rig structure-removal operation that could use explosives or at the same time or place as other bottom-disturbing activities such as trawling or laying electrical transmission or communications cables.

It is possible that Navy stressors would combine with non-Navy stressors, particularly in more heavily used nearshore areas and bays, such as Pearl Harbor and San Diego Bay, to exacerbate already impacted sediments and water quality. Although impacts may occur coincident with other stressors in areas with degraded existing conditions, most of the Navy impacts on water quality, such as increases in turbidity, are expected to be isolated and short-term, with disturbed sediments and particulate matter quickly dispersing within the water column or settling to the seafloor and turbidity conditions returning to background levels. The Proposed Action could incrementally contribute to increases in persistent metal and plastic materials accumulating in the offshore marine environment. However, the relatively minute concentrations of Navy stressors are not likely to meaningfully contribute to sediment or water quality degradation, and it is anticipated that the incremental contribution of the Proposed Action when added to the impacts of all other past, present and reasonably foreseeable future actions would not result in measurable additional impacts on sediment or water quality in the Study Area or beyond.

4.4.3 VEGETATION

The Study Area for vegetation includes the sunlit portions of the open-ocean, coastal, and inshore waters, including the surface, water column and benthic habitat to a maximum depth of roughly 200 meters. Vegetation of the Study Area includes algae (phytoplankton and seaweeds), and vascular plants that include seagrasses, emergent marsh vegetation such as cordgrass, and mangroves. Commercial activities are conducted under permits and regulations that require companies to avoid and minimize impacts on sensitive vegetation, and some harvested seaweeds are managed under Fishery Management Plans and in Hawaii are regulated by the Department of Land and Natural Resources.

Seagrasses are susceptible to damage from storms and human activities but can regrow quickly if the root structure is intact and the substrate is not eroded away. Stressors include decreased light penetration and impacts on photosynthesis, particularly from sustained turbidity and nutrient loading,

which can cause algal blooms. They are also susceptible to changes in environmental factors such as salinity, pH, water temperature, and physical damage. Section 3.3.2.1.2 (General Threats) includes an extensive discussion of the existing stressors to marine vegetation, including diminished water quality from excessive nutrient input, siltation, pollution (from oil, oil spills, and cleanup chemicals; sewage; and trash), climate change, fishing practices (trawling and raking), anchoring, shading from structures, propeller/vessel traffic, construction and dredging, commercial harvest, and introduced or invasive species. Many of these stressors are components of other activities in the Study Area described in Table 4.2-1. The coverage of seagrass in the Study Area has decreased over time; from 1879 to 2006 global seagrass coverage decreased by 75 percent (Waycott et al., 2009). By comparison, algae includes a much greater diversity of species, forms, life histories, and environmental tolerances, and are thus resilient to stressors and able to rapidly recolonize disturbed environments (Levinton, 2009).

Mitigation measures within the Navy's seafloor resource mitigation areas would avoid or reduce potential impacts of the Proposed Action on vegetation species that are associated with shallow-water coral reefs, precious coral beds, live hard bottom, artificial reefs, and shipwrecks, and pre-activity observations monitor for the occurrence and avoidance of seagrasses, macroalgae, *Sargassum,* and detached (free-floating) kelp. However, even with these mitigation measures, vegetation may be impacted directly by explosions, interactions with vessels, in-water and seafloor devices, and military expended materials. The analysis presented in Section 3.3 (Vegetation) indicates that impacts on marine vegetation are limited to destroying or damaging individual plants, and no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation are anticipated due to relatively fast growth, resilience, and abundance of the affected species in anticipated activity areas. Likewise, the short-term, localized nature of most activities further diminishes the potential effects on marine vegetation.

The effects of other past, present, and reasonably foreseeable actions on vegetation occur primarily in the coastal and inshore waters and are associated with coastal development, maritime commerce/dredging, and the discharge of sediment and other pollutants. The Proposed Action is not expected to substantially contribute to losses of vegetation that would interfere with recovery in these regions. The incremental contribution of the Proposed Action would be insignificant as most of the proposed activities would occur in areas where seagrasses and other attached marine vegetation do not grow; impacts would be localized; recovery would occur quickly; and the Proposed Action would not compound impacts that have been historically significant to marine vegetation (loss of habitat due to development; nutrient loading; shading; turbidity; or changes in salinity, pH, or water temperature). Although vegetation is impacted by stressors throughout the Study Area, the Proposed Action is not likely to incrementally contribute to population- or ecosystem-level changes in the resource, and it is anticipated that the incremental contribution of the Proposed Action, when added to the impacts of all other past, present and reasonably foreseeable future actions, would not result in measurable additional impacts on vegetation in the Study Area or beyond.

4.4.4 INVERTEBRATES

4.4.4.1 Region of Influence

The region of influence for invertebrates includes the entire Study Area as invertebrates occur in all habitats and depths, including both the water column and benthic habitat. It has been estimated that nearly 6,000 species of invertebrates are present in the Insular Pacific Hawaii large marine ecosystem and over 8,000 species may occur in the California Current large marine ecosystem (Fautin et al., 2010). Invertebrate groups in the Study Area are listed in Table 3.4-2 and include microscopic zooplankton that

drift with currents (e.g., invertebrate larvae, copepods, protozoans), larger invertebrates living in the water column (e.g., jellyfish, shrimp, squid), and benthic invertebrates that live on or in the seafloor (e.g., clams, corals, crabs, worms). Shallow-water corals typically occur in water depths less than 30 m. Corals are specifically extensive throughout the Hawaiian Archipelago, which supports over 250 separate species. Deep-water corals occur at depths below 50 m (potentially extending to about 3,000 m) where there is no or low sunlight penetration. Deep-water corals typically do not form biogenic reefs, but rather form mounds of intermediate substrate over hard bottom areas. Corals may also occur in a transition zone of reduced light levels, called the mesophotic zone, between the water depths typically associated with shallow-water and deep-water species.

4.4.4.2 Resource Trends

As discussed in Section 3.4.2.1 (General Background), marine invertebrates are ecologically and economically important, performing essential ecosystem services such as coastal protection, nutrient recycling, food for other animals, and habitat formation, as well as providing income from tourism and commercial fisheries. The health and abundance of marine invertebrates are vital to the marine ecosystem and the sustainability of the world's fisheries. Invertebrates are fished for food (e.g., shrimps, lobsters, crabs, scallops, clams, oysters, sea urchins, sea cucumbers, squids, and octopuses); harvested for jewelry, curios, and the aquarium trade; and some are known to secrete medicinal compounds of interest to the health industry.

Two abalone species (black abalone and white abalone) found in the Study Area are listed as endangered under the ESA, and two additional abalone species (green abalone and pink abalone) are designated as Species of Concern. Abalones occur on hard substrate from the intertidal zone to depths of 30 to 60 m, depending on the species. NMFS maintains a species website that provides additional information on the biology, life history, species distribution (including maps), and conservation of invertebrates in the Study Area (accessible at: https://www.fisheries.noaa.gov/invertebrates).

4.4.4.3 Impacts of Other Actions

Section 3.4.2.1.4 (General Threats) includes an extensive discussion of the existing stressors to marine invertebrates, including overexploitation and destructive fishing practices, habitat degradation resulting from pollution and coastal development, disease, invasive species, oil spills, oil and gas seismic air gun exploration, global climate change and ocean acidification, human-generated noise, and bioprospecting for pharmaceutical products. Stressors specific to reef-building corals, which are generally located in more shallow zones with adequate sunlight penetration and a mean annual water temperature greater than about 64 degrees Fahrenheit, include thermal stress, disease, tropical storms, coastal development and pollution, erosion and sedimentation, tourism/recreation, fishing, trade in coral and live reef species, vessel anchoring or groundings, marine debris, predation, invasive species, military and other security-related activities, and hydrocarbon exploration. Primary threats to deep-water or cold-water corals include bottom fishing, marine debris, hydrocarbon exploration, petroleum contamination, cable and pipeline placement, waste disposal (such as lost fishing equipment or dredged sediments), and other various bottom-disturbing activities. Deep corals are susceptible to physical disturbance due to the branching and fragile growth form of some species, slow growth rate (colonies can be hundreds of years old), and low reproduction and recruitment rates. All activities described in Table 4.2-1 and stressors described in Table 4.2-2 have the potential to impact marine invertebrates due to their ubiquitous presence and relative vulnerability.

Climate Change. As detailed in Section 3.4.2.1.4.2 (Climate Change), one of the primary threat to corals and other types of invertebrates is the occurrence of global climate change, which has and is projected to continue to seriously impact coral reefs in the near and known future. The effects of climate change include increased water temperature, ocean acidification, increased frequency or intensity of cyclonic storm events, and sea level rise, which can cause direct damage to these crucial and sensitive ecosystems as well as increase their susceptibility to and resilience from encounters with all other threats, including disease, pathogens, and genetic disorders.

Increases in ocean temperature can lead to coral stress, bleaching, and mortality. Coral bleaching, which occurs when corals expel the symbiotic algae living in their tissues, is a stress response often tied to atypically high sea temperatures or changes in light availability but also can be attributed to nutrients, toxicants, and pathogens (National Oceanic and Atmospheric Administration, 2017a). Bleaching events have increased in frequency in recent decades and coral bleaching on a global scale has occurred during the summers of 2014, 2015, and 2016. Compared to other regions of the world, few major coral bleaching events have occurred in the Hawaiian Islands. The first known large-scale bleaching event occurred in 1996, primarily affecting portions of the Main Hawaiian Islands. A second event occurred in 2002 in the Northwestern Hawaiian Islands. More recently, bleaching events were documented at Kane'ohe Bay on the northeast coast of Oahu in 2014 and other portions of the Main Hawaiian Islands in 2014 and 2015. NOAA coral reef watch modeling has the main Hawaiian Islands bleaching annually by 2040 under current carbon emission levels (van Hooidonk et al., 2014).

In addition to elevated sea temperatures, atypically low sea temperatures may also cause mortality to corals and most other reef organisms, suggesting that widening climate extremes could proliferate bleaching events. Likewise, ocean acidification has the potential to reduce calcification and growth rates in species with calcium carbonate skeletons, including shellfish, corals, and sponges, certain kinds of algae, and possibly even lobsters and sea cucumbers. In addition to physical effects, increased acidity may result in behavioral changes in some species, such as burrowing behavior and juvenile dispersal patterns of the soft-shell clam and reduction in the loudness and number of snaps in the snapping shrimp.

Although the potential effects that climate change could have on future storm activity are uncertain, numerous researchers suggest that rising temperatures could result in little change to the overall number of storms, but that storm intensity could increase. Increased storm intensity could result in increased physical damage to individual corals and reefs constructed by the corals (which support numerous other invertebrate taxa), overturning of coral colonies, and a decrease in structural complexity (due to disproportionate breakage of branching species). However, large storms such as hurricanes may also have positive impacts on corals, such as lowering the water temperature and removing less resilient macroalgae from reef structures, which can overgrow corals.

Sea level rise could affect invertebrates by modifying or eliminating habitat, particularly estuarine and intertidal habitats bordering steep and artificially hardened shorelines. Likewise, changes in ocean circulation patterns could affect the planktonic food supply of filter- and suspension-feeding invertebrates. Cumulative effects of threats from fishing, pollution, and other human disturbance may reduce the tolerance of corals and other invertebrates to global climate change.

4.4.4.4 Impacts of the Proposed Action That May Contribute to Cumulative Impacts

The analysis presented in Section 3.4 (Invertebrates) indicates that the Proposed Action could impact marine invertebrates through acoustic stressors (sonar and other transducers, air guns, pile driving,

vessel noise, weapons noise), explosives (explosions in water), energy stressors (in-water electromagnetic devices, high-energy lasers), physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices, pile driving), entanglement (wires and cables, decelerators/parachutes, biodegradable polymers), and ingestion of military expended materials. Potential impacts include short-term behavioral and physiological responses (Celi et al., 2015; Edmonds et al., 2016; Roberts et al., 2016). Some stressors could also result in injury or mortality to a relatively small number of individuals. The potential for impacts on ESA-listed abalone species (Table 3.4-1) would be minimized by mitigation designed to avoid seafloor resource mitigation areas where abalones are located. For example, the Navy will not conduct certain activities within a specified distance of shallow-water coral reefs, precious coral beds, live hard bottom, artificial reefs, and shipwrecks (Chapter 5, Mitigation). These measures will help avoid potential impacts on invertebrates that inhabit these areas, including several areas inhabited by ESA-listed abalone species.

4.4.4.5 Cumulative Impacts on Invertebrates

Some direct impacts on invertebrates are expected, and the impacts of the Proposed Action could be cumulative with other actions that cause disturbance and mortality of marine invertebrates. However, it is anticipated that the incremental contribution of the proposed alternatives would be insignificant for the following reasons:

- Invertebrates are generally abundant and relatively short-lived, thus, with the exception of sessile species located near areas of repeated Navy activities (e.g., pierside locations, established channels near large naval port facilities); few individuals would likely be affected repeatedly by the same event.
- With the exception of some species such as deep-water corals, invertebrates generally have high reproductive rates, short reproductive cycles, and resilient dispersal mechanisms; thus, local communities are likely to reestablish quickly.
- Most of the proposed activities would impact small, dispersed, deep water areas where marine invertebrates are more sparsely distributed. Navy activities may occur in the same general area (ranges), but do not occur at the same specific point each time and would therefore be unlikely to affect the same individual invertebrates.
- Marine invertebrates are not particularly susceptible to energy, entanglement, or ingestion stressors resulting from Navy activities, and none of the alternatives would result in or interact with impacts that have been historically significant to marine invertebrates, such as overfishing, nutrient loading, disease, or the presence of invasive species.
- None of the alternatives would result in long-term or widespread changes in environmental conditions such as turbidity, salinity, pH, or water temperature that could impact marine habitats or interact with existing trends affecting these parameters.
- The Navy will not conduct certain activities within a specified distance of surveyed shallow-water coral reefs, precious coral beds, live hard bottom, artificial reefs, or shipwrecks. All features that have been identified are included in Chapter 5 (Mitigation).

Although the aggregate impacts of other stressors in the ocean environment continue to have significant impacts on some marine invertebrate species in the study area, particularly the effects of global climate change on corals, the Proposed Action is not likely to incrementally contribute to population-level stress and decline of the resource. Due to the effects of global climate change, corals may be less resilient to additional stressors; however, it is not anticipated that the Navy will cause direct effects to surveyed reef systems. As impacts would be isolated, localized, and not likely to overlap with other relevant

stressors, it is anticipated that the incremental contribution of the Proposed Action, when added to the impacts of all other past, present and reasonably foreseeable future actions, would not result in measurable additional impacts on invertebrates in the Study Area or beyond.

4.4.5 HABITATS

Habitats refers to the marine and estuarine nonliving (abiotic) substrates found throughout the Study Area, which are often colonized by biotic (vegetation and invertebrate) communities. Habitats vary according to geographic location, underlying geology, hydrodynamics, atmospheric conditions, and suspended particulate matter. Habitat types within the Study Area are described in Table 3.5-1 and depicted on Figures 3.5-1 through 3.5-8. There are basically three types of abiotic substrates based on the grain size of unconsolidated material, referred to as soft, intermediate, and hard. The soft habitats are generally comprised of fine grains that are more fluid and dynamic, whereas hard substrate does not repair and thus is susceptible to long-term scarring and damage. Artificial structures, such as shipwrecks oil and gas platforms, underwater cables, and outflows also provide habitat for many marine organisms. Additionally, as detailed in Chapter 6, Other Regulatory Considerations, there are 380,000 square km of designated National Marine Sanctuaries in the total HSTT Study Area (8.32 percent of total Study Area), but none occurring within Range Complexes, Testing Ranges, or OPAREAs.

Section 3.5.2.1.4 (General Threats) includes an extensive discussion of the existing stressors to abiotic marine habitats, including urbanization (modification of shorelines and estuaries, dredging and maintenance of ports, bays, and harbors, and creation of artificial structure habitats such as breakwaters, jetties, rock groins, seawalls, oil and gas platforms, docks, piers, wharves, underwater cables and pipelines, artificial reefs); accumulation of marine debris; and commercial activities (oil/gas development, telecommunications infrastructure, steam and nuclear power plants, desalinization plants, alternative energy development, shipping and cruise vessels, commercial fishing, aquaculture, and tourism operations). The impact of commercial fishing trawling practices has a significant impact on bottom habitats. Most activities in Table 4.2-1 are conducted under permits and regulations that require the avoidance and minimization of impacts on marine habitats, especially shoreline and sensitive hard bottom and biogenic habitats (e.g., coral reefs and shellfish beds). Tourism is an additional stressor in urbanized areas. Nearshore coral reefs along the more developed main Hawaiian Islands have been impacted by trampling; damage from divers and swimmers touching, kicking, breaking, sitting, or standing on coral; and improper boat anchoring. Within the highly urbanized Southern California portion of the Study Area, human visitation and disturbances impact rocky intertidal (trampling, overturning of rocks, collecting) and sandy beach (mechanical beach grooming) habitats.

The analysis presented in Section 3.5 (Habitats) indicates that marine habitats could be affected by underwater detonations, interactions with vessels (including wave erosion and sediment suspension), military expended materials, or seafloor devices. Potential impacts include localized disturbance of the seafloor, cratering of soft bottom sediments, and structural damage to hard bottom habitats. Although some direct impacts on abiotic habitats are expected, it is anticipated that the incremental contribution of the Proposed Action would be cumulatively insignificant for the following reasons:

- Most detonations would occur at or near the water surface and would not affect bottom habitats.
- Impacts to soft bottom habitat from bottom-laid explosives would be confined to a limited area, and it is anticipated that soft bottom habitats would recover (fill in) quickly.

- Proposed Action activities are not likely to occur at the same time/place as other activities in the Study Area, including commercial fishing operations, which have a large effect on bottom habitats. Thus, it is likely that soft bottom habitats would have the opportunity to recover from the Proposed Action before impacts from fishing or other operations could interact or compound additional stress to the ecosystems.
- Per analysis detailed in Section 3.5.3.2.1 (Impacts from Explosives) and Appendix F (Military Expended Material and Direct Strike Impact Analyses), the area of hard bottom potentially impacted represents a negligible percentage in each of the range complexes (less than 0.1 percent) of the total hard bottom habitat in the Study Area (Figures 3.5-1 through 3.5-8). The Navy will implement mitigation to avoid or reduce potential impacts from explosives, physical disturbance, and strike stressors on seafloor resources, including shallow-water coral reefs, live hard bottom, and artificial reefs, as described in Chapter 5 (Mitigation) and National Marine Sanctuaries, as described in Chapter 6 (Regulatory Considerations). Potentially sensitive habitats such as artificial reefs, hard bottom, shallow water coral reefs, and shipwrecks are typically avoided. Training and testing units are reminded of the presence of potentially sensitive areas through the Protective Measures Assessment Protocol program, which limits certain activities in these areas within the HSTT Study Area.

Although it is anticipated that damage to abiotic soft bottom habitat resulting from the Proposed Action would be limited and would recover, many other activities in the ocean are also impacting ocean bottom habitat. However, it is not likely that past, present, and future impacts would overlap Proposed Action activities in place or time before the craters or other impressions in soft bottom substrate fill in. Likewise, hard bottom habitat would be avoided to the greatest extent possible. Based on the analysis presented in Section 3.5 (Habitats) and the reasons summarized above, it is anticipated that the incremental contribution of the Proposed Action, when added to the impacts of all other past, present and reasonably foreseeable future actions, would not result in measurable additional impacts on habitats, including National Marine Sanctuaries, in the Study Area or beyond.

4.4.6 FISHES

The general region of influence for fishes extends beyond the Study Area boundaries for some species because the Study Area represents only a portion of the available habitat during its lifecycle, such as anadromous species that spend part of their lifecycle in freshwater. Fishes are usually not distributed uniformly throughout the Study Area, but are typically associated with a specific habitat type (e.g., soft bottom, reef, or open water) or can utilize a variety of habitats at different life stages. The distribution and specific habitats in which an individual of a single fish species occurs may also be influenced by its size, sex, reproductive condition, and other factors such as water temperature and depth. The highest number and diversity of fishes typically occur where the habitat is most diverse; thus, coastal ecosystems tend to support a greater diversity of species than oceanic and deep-sea habitats (Moyle & Cech, 2004).

It is estimated that there are currently over 34,000 species of fish worldwide (Eschmeyer & Fong, 2017), with greater than half that number of species inhabiting the oceans. There are approximately 1,260 marine fish species reported in the Study Area, approximately 65 percent of which occur in the coastal zone and the remaining 35 percent occurring in the deeper oceanic zone. Table 3.6-2 lists the groups of fishes known to occur in the Study Area.

Table 3.6-1 lists the regulatory status and occurrence of ESA-listed fishes known to occur in the Study Area. Fishes are protected by the ESA, the Magnuson-Stevens Fishery Conservation and Management Act, and the Sustainable Fisheries Act. The Study Area overlaps with the jurisdiction of two regional

fishery management councils (Western Pacific Regional Fishery Management Council [includes Hawaii, American Samoa, Guam, and the Northern Mariana Islands] and Pacific Fishery Management Council [includes Washington, Oregon, and California]), as well as the range of the highly migratory species (e.g., sharks, billfish, swordfish, and tunas), which are managed by NMFS. Despite regulation, oversight, and technological improvements, the commercial fishing industry continues to have significant impacts on fish populations, including overfishing and bycatch of non-target species (Moyle & Cech, 2004). By the end of 2015, 28 fish stocks were on the overfishing list and 38 stocks were on the overfished list, while the number of rebuilt fish stocks since 2000 increased to 39 (National Marine Fisheries Service, 2016b). The current aggregate impacts of past and present human activities are significant for some fish species, especially those that are globally in serious decline. Very few ocean habitats remain unaffected by human influence, and these stressors have shaped the condition of marine fish populations, particularly those species with large body size, late maturity ages, and/or low fecundity such as sharks, Pacific cod, and Pacific bluefin tuna (Reynolds et al., 2005).

Section 3.6.2.1.4 (General Threats) includes an extensive discussion of the existing stressors, which often act on fish populations simultaneously, including habitat alteration (coastal development, deforestation, road construction, dam development, water control structures, and agricultural activities), exploitation and bycatch (commercial and recreational fisheries), vessel strikes, diseases and parasites (susceptibility and incidence increases with habitat alteration and exposure to individuals that escaped sea farms), introduction of non-native species, pollution (oil spills, marine debris, noise, hypoxia, and harmful algal blooms), and climate change. The additional threat of living in a noisy environment, such as produced by offshore wind energy developments, construction noise within inshore waters such as pile-driving, sonar, seismic activity, shipping, and offshore construction projects, may contribute to cumulative stress as experienced by some fish populations.

It is anticipated that the Proposed Action would affect fish species within the Study Area, including ESA-listed fish species. The analysis presented in Section 3.6 (Fishes) indicates that fishes could be affected by acoustic stressors (sonar and other transducers, air guns, pile driving, vessel noise, and weapons noise), explosives, energy stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices, pile driving), entanglement (wires and cables, decelerators/parachutes), and ingestion of military expended materials. The majority of potential impacts include short-term behavioral and physiological responses. For example, fish species that are exposed to sonar and other transducers within their hearing range or that are within close proximity to vessel or weapons noise may experience brief periods of masking or behavioral reactions, such as startle or avoidance responses, or no reaction at all. Other stressors (such as explosives) could also result in injury or mortality to a relatively small number of individuals. Overall, long-term consequences for most individual fishes or populations are unlikely because exposures from the majority of stressors are intermittent, transient, and unlikely to repeat over short periods.

An individual fish could be exposed to a combination of stressors from multiple activities over the course of its life, and multiple stressors may have synergistic effects such as reducing its overall fitness and ability to recover quickly from additional, compounding stressors. If the health of an individual fish is compromised, it is possible this condition could alter the animal's expected response to stressors associated with the Proposed Action. Exposure to multiple stressors is most likely to occur in nearshore areas where training and testing activities are more concentrated and overlap the other nearshore stressors listed in Table 4.2-1 and Table 4.2-2. Likewise, animals with a home range intersecting concentrated Navy activities may be subjected to elevated exposure risks compared to those fishes that

simply transit the area. Fishes that are malnourished, diseased, or experience temporary hearing loss, injury, or disorientation from acoustic stressors could suffer behavioral and physiological consequences such as decreased ability to detect and avoid predators, oncoming vessels, or entanglement risks.

The aggregate impacts of past, present, and other reasonably foreseeable future actions contributing multiple water quality, noise, and physical risks to fishes would likely continue to have significant effects on individual fishes and fish populations. However, Navy training and testing activities are generally isolated from other activities in space and time and the majority of the proposed training and testing activities occur in well-known, previously established training range areas; are spatially distributed and not generally concentrated in any one location for any extended period of time; have few participants; and are of a short duration. Although it is possible that the Proposed Action could contribute incremental stressors to a small number of individuals, which would further compound effects on a given individual already experiencing stress, it is not anticipated that the Proposed Action has the potential to put additional stress on entire populations. Therefore, it is anticipated that the incremental contribution of the Proposed Action, when added to the impacts of all other past, present and reasonably foreseeable future actions, would not result in measurable additional significant impacts on fishes in the Study Area or beyond.

4.4.7 MARINE MAMMALS

4.4.7.1 Region of Influence

The general region of influence for marine mammals extends beyond the Study Area boundaries as for some species the Study Area represents only a portion of the full extent of the species' range during their lifecycle. Baleen whales (e.g., humpbacks) and toothed whales (e.g., sperm whales and killer whales) seasonally migrate great distances, as do some pinnipeds (e.g., elephant seals, fur seals, sea lions). Pinnipeds will spend time on land, and except for brief excursions, otters occur mostly in coastal habitats remaining close to the coast. Activities are evaluated for their potential impact on individual marine mammals, on stocks and populations as appropriate, and on species or distinct population segments listed under the ESA.

Table 3.7-1 lists the current abundance of marine mammal species that utilize the Study Area and describes the locations within the Study Area that they may be encountered. There are 39 marine mammal species known to exist in the Study Area, including 7 mysticetes (baleen whales), 25 odontocetes (dolphins and toothed whales), 6 pinnipeds (seals and sea lions), and the southern sea otter. Populations are varied; while the average population of certain dolphin and some whale populations include thousands of individuals (such as humpback whales in Hawaii and the short-beaked common dolphin in the southern California portion of the HSTT Study Area), other stock populations are unknown or estimated to be in the hundreds (such as some stocks of spinner dolphins in Hawaii). As with other marine resources, distribution is patchy and can be temporarily concentrated in specific areas depending on the species.

4.4.7.2 Resource Trends

Relevant information on the status, distribution, population trends, and ecology is presented for each species and stock in the HSTT Study Area in Section 3.7.2 (Affected Environment). The current aggregate impacts of past human activities are significant for some marine mammal species, many of which were in serious decline across the world's oceans. Other populations, such as the humpback whale, are increasing in abundance in much of their range (National Marine Fisheries Service, 2015d). All marine mammals in the U.S. are protected under the MMPA, and some species receive additional protection

under the ESA. Of the 39 species of marine mammals known to exist within the Study Area, there are 10 populations listed as endangered under the ESA and classified as strategic stocks under the MMPA (humpback whale, blue whale, fin whale, sei whale, gray whale [Western North Pacific stock], sperm whale, false killer whale [Main Hawaiian Islands Insular stock], Guadalupe fur seal, Hawaiian monk seal, and southern sea otter).

4.4.7.3 Impacts of Other Actions

4.4.7.3.1 Overview

Section 3.7.2.1.5 (General Threats) discusses the specific stressors within the affected environment that impact marine mammal populations in the Study Area, which include water quality degradation (chemical pollution), commercial industries (fisheries bycatch, explosive pest deterrents, and other interactions), noise, hunting, vessel strike, marine debris, disease and parasites, power plant entrainment, and climate change. Potential impacts of actions that affect marine mammals include mortality, injury, disturbance, and reduced fitness, including reproductive, foraging, and predator avoidance success. The susceptibility of marine mammals to these outcomes often depends on proximity, severity, or vulnerability to the stressor and vulnerability can be increased as multiple stressors compound on an individual.

Stranded marine mammals include alive or dead individuals that swim or float to shore and are incapable of returning to sea or individuals that have wandered outside of their "normal" habitat. Investigations of stranded marine mammals can provide indications of the general threats to marine mammals in a given location, and causes of strandings include navigation error, predator avoidance, population and climate shifts, infectious disease, parasite infestation, starvation, pollution exposure, trauma (e.g., injuries from ship strikes or fishery entanglements), sound (human-generated or natural), harmful algal blooms and associated biotoxins, tectonic events such as underwater earthquakes, and ingestion or interaction with marine debris (National Marine Fisheries Service, 2016b). The activities as described in Table 4.2-1 each potentially contribute multiple stressors in the region of influence experienced by marine mammals, including vessel traffic, underwater noise, and water pollution (Table 4.2-2). For example, most actions include marine vessel operations, which contribute to vessel strikes and underwater noise. Many of the actions also contribute underwater noise from sources other than vessels, including use of explosives for oil rig removal, seismic surveys, construction activities, and other military operations. Bycatch and entanglement, the main threats to marine mammal populations, are chiefly associated with fishing. While Table 4.2-1 discusses these stressors for individual actions, their aggregate impacts specific to marine mammals are detailed in Section 3.7.2.1.5 (General Threats) and further described below. Data availability is inconsistent between species and activities, but quantitative estimations are presented where available.

4.4.7.3.2 Commercial Fishing and Entanglement

Past and present commercial fishing activities have had a profound effect on some marine mammal species and, despite continued improvements in bycatch avoidance and the implementation of regulatory efforts, fisheries interactions continue to be the primary human-related source of mortality for most marine mammal stocks (Knowlton et al., 2012; Roman et al., 2013; Van der Hoop et al., 2013). In recent years, the overall number of commercial fishing vessels has decreased, which may be attributed to changes in environmental conditions, fishing regulations, and market forces (California Department of Fish and Wildlife, 2008). Eleven ports in Southern California contain both commercial fishing fleets and commercial passenger fishing vessels (i.e., recreational) that use the ocean areas

within the Southern California Range Complex portion of the Study Area (Naval Undersea Warfare Center, 2009).

4.4.7.3.2.1 Bycatch

Potential impacts from commercial fishing activities include marine mammal injury and mortality from bycatch, which refers to when animals are caught in commercial fishing operations targeting a different species. Total bycatch interactions are difficult to estimate as numbers are based on observations by NMFS staff or on numbers received from individual operations that self-report bycatch interactions. In 1994, the MMPA was amended to formally require the development of a take reduction plan when bycatch exceeds a level considered unsustainable by the marine mammal population and will lead to marine mammal population decline. Although marine mammal bycatch has generally declined since the implementation of take reduction measures, and new management practices and consistent regulatory oversight could result in future reductions, bycatch is expected to remain a leading cause of mortality for the reasonably foreseeable future (Read et al., 2006).

At least in part as a result of the MMPA bycatch amendment, estimates of bycatch in the Pacific declined by a total of 96 percent from 1994 to 2006 (Geijer & Read, 2013). Cetacean bycatch declined by 85 percent from 342 in 1994 to 53 in 2006, and pinniped bycatch declined from 1,332 to 53 over the same time period. In the Hawaii portion of the Study Area, bycatch has contributed substantially to the decline of the Hawaiian population of false killer whales (Oleson et al., 2010). Between 2008 and 2012, 27 known instances of false killer whale injury or mortality from bycatch were observed during Hawaii longline fishery activities as well as similar cases for 11 other species (Bradford & Forney, 2014; Bradford & Lyman, 2015; Bradford & Forney, 2016).

The impacts of bycatch on marine mammal populations vary based on removal rates, population size, and reproductive rates. Small populations with relatively low reproductive rates are most susceptible. Bycatch rates for about 12 percent of United States marine mammal stocks (almost all cetaceans) exceed their Potential Biological Removal levels (Read, 2008). The Potential Biological Removal level is the number of animals that can be removed each year without preventing a stock from reaching or maintaining its optimal sustainable population-level.

Fisheries operations also result in profound changes to the structure and function of marine ecosystems that adversely affect marine mammals, including loss of prey species and alteration of benthic structure. Overfishing of many fish stocks results in significant changes in trophic structure, species assemblages, and pathways of energy flow in marine ecosystems (Jackson et al., 2001; Myers & Worm, 2003). These ecological changes may have important, and likely adverse, consequences for populations of marine mammals (DeMaster et al., 2001). For instance, depletion of preferred prey could lead to a less nutritional diet and decreased reproductive success.

4.4.7.3.2.2 Entanglement

As discussed in Section 3.7.2.1.5 (General Threats), entanglement in fishing gear, such as abandoned or partial nets, fishing line, and the ropes and lines connected to fishing gear, is another major threat to marine mammals in the Study Area. National Oceanic and Atmospheric Administration Marine Debris Program (2014) reports that abandoned, lost, or otherwise discarded fishing gear still constitutes the vast majority of mysticete entanglements. In the Southern California portion of the Study Area, there were 36 marine mammal bycatch entanglements from civilian fishing activities off San Diego from 2010 through 2014 (Carretta et al., 2016). For the area off the coasts of northern California, Oregon, and Washington between 1982 and 2010, Saez et al. (2013) reported there were 272 large whales entangled

in fishing gear (whales in this area of the United States West Coast are generally from the same stock as in the Southern California portion of the HSTT Study Area).

For cetaceans in Hawaii during the 5-year period between 2007-2012, there were 48 humpback whales, a sperm whale, a bottlenose dolphin, three spinner dolphins, and a pantropical spotted dolphin entangled in fishing gear (Bradford & Lyman, 2015). One humpback whale was injured, and it is believed that interaction with fishing gear debris led to the mortality of a second humpback whale and a spinner dolphin (Bradford & Lyman, 2015). Over the 30-year period between 1982 and 2012, approximately 11 Hawaiian monk seals annually have been observed entangled in fishing gear or other marine debris, with nine documented deaths (Carretta et al., 2015).

4.4.7.3.2.3 Recreational Fishing and Hunting

Recreational fishing also impacts marine mammals. In Hawaii in 2013, 14 Hawaiian monk seals were observed hooked and one was observed with an embedded fishing spear (Carretta et al., 2015). Along the U.S. West Coast, hook and line entanglements and gunshot wounds are two of the primary causes of pinniped injuries found in strandings (Carretta et al., 2013). Within the Southern California portion of the Study Area, there were 50 marine mammal hook and line interactions (48 pinnipeds, 2 dolphins) reported off San Diego from 2010 through 2014 (Carretta et al., 2016).

With the enactment of the MMPA, hunting-related mortality has decreased over the last 40 years; however, unregulated harvests and extensive illegal whaling activity still occur in areas outside of U.S. waters. Between 1948 and 1979, the Union of Soviet Socialist Republics' whale harvest totaled 195,783 in the North Pacific Ocean. Subsistence harvest of marine mammals by Russian and Alaska Natives occurs in the North Pacific, Chukchi Sea, and Bering Sea affecting marine mammal stocks that may be present in the HSTT Study Area. For example, in 2 years of hunting (2010 and 2011) on St. Paul Island and St. George Island in the Bering Sea there were 878 northern fur seals harvested for subsistence (Testa, 2012). In Russian waters in 2013, there were 127 gray whales "struck" during subsistence whaling by the inhabitants of the Chukchi Peninsula between the Bering and Chukchi Sea (Ilyashenko & Zharikov, 2014). These gray whales, harvested in Russian waters, may be individuals from either the endangered Western North Pacific stock or the non-ESA-listed Eastern North Pacific stock that may migrate through the Southern California portion of the HSTT Study Area.

4.4.7.3.2.4 Other Fishery Interactions

Common practice in offshore waters off Southern California, Washington, and Alaska include the routine use of non-military explosives at-sea for explosive pest control, or marine mammal deterrents known as "seal bombs." Seal bombs are used by commercial fishermen to deter marine mammals from preying upon their catch or to prevent interaction or entanglement with fishing gear (U.S. Department of the Navy, 2016a). This practice is not observed in Hawaii. In the Southern California region, several fisheries including purse seine and set gillnet fisheries use seal bombs as deterrents (Baumann-Pickering et al., 2013). In the 7 months from May to November 2013, over 24,000 explosions identified as seal bombs were recorded at a passive acoustic monitoring site off Long Beach, California approximately 10 kilometers north of the Southern California portion of the HSTT Study Area (Debich et al., 2015). From August 2012 to August 2013, there were fewer than 400 underwater explosions resulting from Navy training and testing in the entire Southern California portion of the HSTT Study Area (Baumann-Pickering et al., 2013). The prevalent and continued use of seal bombs seems to indicate that, while a potential threat, their use has had no significant effect on populations of marine mammals given that it

is likely that individuals, if not larger groups of marine mammals, have been repeatedly exposed to this explosive stressor.

4.4.7.3.3 Maritime Traffic and Vessel Strikes

Maritime traffic has increased over the past 50 years, and vessel traffic is expected to continue to increase in the Study Area due to continued economic globalization, widening of the Panama Canal, and increases in energy development and other offshore activities. While increased risks come with increased vessel traffic, risks of vessel strikes could be minimized by ongoing and future education and awareness, marine mammal reporting, ship speed reduction measures, and maritime traffic planning and management. An examination of vessel traffic within the HSTT Study Area determined that Navy vessel occurrence is two orders of magnitude lower than that of commercial traffic. The study also revealed that while commercial traffic is relatively steady throughout the year, Navy vessel use is episodic and based on specific exercises being conducted at different times of the year (Mintz, 2012); however, Navy vessel use within inshore waters occurs regularly and routinely consists of high-speed small vessel movements.

Most reported marine mammal vessel strikes involve commercial vessels and occur over or near the continental shelf (Laist et al., 2001). The most vulnerable marine mammals are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein, 2002; Laist & Shaw, 2006; Nowacek et al., 2004). Marine mammals such as dolphins, porpoises, and pinnipeds that can move quickly throughout the water column are not as susceptible to vessel strikes.

From 2007 to 2012 in Hawaii, there were 39 vessel collisions between humpback whales and vessels (Bradford & Lyman, 2015). Lammers et al. (2013) reported that from 1975 to 2011, 61 percent of witnessed collisions between humpback whales and vessels in Hawaii involved tour vessels. The U.S. Coast Guard and the U.S. Navy report all vessel collisions with whales, thus, under-reporting of collisions by other vessel types may make the characterization of the civilian vessel percentage an underestimate. Within the Southern California portion of the Study Area, there were 7 marine mammal vessel or boat strikes reported off San Diego from 2010 through 2014 (Carretta et al., 2016). The strikes were on two California sea lions, one fin whale, two gray whales, and two humpback whales. None of these strikes was from Navy vessels or boats (National Marine Fisheries Service, 2015b).

4.4.7.3.4 Ocean Pollution

As discussed in Table 4.2-2, multiple pollutants from numerous sources are present in, and continue to be released into, the oceans. These releases that affect marine mammals include water pollution as well as the discharge of marine debris and the proliferation of ambient as well as impulsive noise in the underwater ecosystem. Section 3.7.2.1.5 (General Threats) provides an overview of these potential impacts, which include morbidity and mortality from acute toxicity; disruption of endocrine cycles and developmental processes causing reproductive failures or birth defects; suppression of immune system function; and metabolic disorders resulting in cancer or genetic abnormalities (Reijnders et al., 2009). The effects of exposure to and concentration of persistent organic pollutants in marine mammals, especially from pesticides, includes the accumulation of DDT and PCBs in certain species, and high concentrations of organochlorines in tissues appear to have occurred with increasing frequency disease outbreaks involving marine mammals. In addition, experimental and other evidence has shown that persistent contaminants often found in the tissues of marine mammals have deleterious effects on reproduction and the immune system (O'Shea et al., 1999).

4.4.7.3.5 Ocean Noise

Ocean noise as a general stressor in modern oceans is described in Table 4.2-2 and specific stressors to marine mammals in Section 3.7.2.1.5 (General Threats). Noise is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, avoiding predators, and communicating with other individuals. Noise can cause behavioral disturbances; mask other sounds (including their own vocalizations); and may result in injury, including hearing loss in the form of temporary threshold shift (TTS) or permanent threshold shift (PTS) or, and, in some cases, death.

Anthropogenic noise is generated from a variety of sources throughout the region of influence, including commercial shipping, oil and gas exploration and production activities (including air gun, drilling, and explosive decommissioning), commercial and recreational fishing (including vessel noise, fish-finding sonar, fathometers, acoustic deterrent, and harassment devices), shoreline construction projects (including pile driving), recreational boating and whale-watching activities, offshore power generation (including offshore windfarms), and research (including sound from air guns, sonar, and telemetry).

Shipping channels leading to and from the ports of Los Angeles and Long Beach between the Channel Islands National Marine Sanctuary and the coast may have degraded the habitat for blue, fin, and humpback whales due to the loss of communication space where important habitat for these species overlaps with elevated noise from commercial vessel traffic (Redfern et al., 2017). The San Pedro Channel is at the northeastern corner of the Southern California portion of the HSTT Study Area and is where the Traffic Separation Scheme's southern entrance and exit is located for these same ports (Los Angeles and Long Beach). A similar concentration of commercial vessel traffic moving through the San Pedro Channel into and out of the Southern California portion of the HSTT Study Area is also likely to impact marine mammal communication space in a similar manner.

The military activities addressed in Table 4.2-1 include various training and testing operations that contribute vessel noise, underwater and surface explosions, and sonar. Use of mid-frequency sonar between 1950 and 2001 has been correlated with 12 of 126 beaked whale mass strandings during five separate exercises (U.S. Department of the Navy, 2017b). Of these exercises, four were multi-nation (North Atlantic Treaty Organization countries) and one was solely an U.S. Navy exercise occurring near the Bahamas. In the Bahamas event, seven stranded animals died, and ten returned to the water. Although sonar activity has historically been correlated to various negative impacts on marine mammals, with the implementation of required mitigation measures, sonar operations are not expected to result in mortality to any stock of marine mammals and minimal injury or behavioral changes are anticipated. Although various other military training and testing activities involve surface or undersea detonations or gunnery exercises, these are generally mitigated through monitored exclusion zones, and are infrequent, isolated events. As described in Table 4.2-1, many activities incorporate best management practices or standard operating procedures to minimize noise generation. Likewise, any in-water construction that may occur at naval piers would utilize dampening and attenuation technologies and other practices that reduce impacts on bottlenose dolphins and other sensitive receptors in the vicinity of pile driving activities.

4.4.7.3.5.1 Water Pollution

Section 3.7.2.1.5 (General Threats) provides an overview of these potential impacts, which include morbidity and mortality from acute toxicity (although mortality has not yet specifically been shown in marine mammals); disruption of endocrine cycles and developmental processes causing reproductive

failures or birth defects; suppression of immune system function; and metabolic disorders resulting in cancer or genetic abnormalities (Reijnders et al., 2009). The effects of exposure to and concentration of persistent organic pollutants in marine mammals, especially from pesticides, includes the accumulation of dichlorodiphenyltrichloroethane and polychlorinated biphenyls in certain species, and high concentrations of organochlorines in tissues appear to have occurred with increasing frequency among marine mammals infected with secondary diseases. In addition, experimental and other evidence has shown that persistent contaminants often found in the tissues of marine mammals have deleterious effects on reproduction and the immune system (O'Shea et al., 1999).

4.4.7.3.5.2 Marine Debris and Ingestion

Interactions between marine mammals and marine debris, including derelict fishing gear (as discussed in Section 4.4.7.3.2.2 Entanglement) and plastics, are significant sources of injury and mortality (Baulch & Perry, 2014), and the percentage of marine mammal species with documented records of entanglement in or ingestion of marine debris has increased from 43 to 66 percent over the past 18 years (Bergmann et al., 2015). Ingestion of plastic bags and Styrofoam has been identified as a cause of injury or death of minke whales and deep-diving odontocetes, including beaked whales, pygmy sperm whales, and sperm whales. On the United States West Coast, marine debris resulted in mortalities to 90 pinnipeds (the majority was California sea lions), two gray whales, and one each of the following species: humpback whale, minke whale, bottlenose dolphin, long-beaked common dolphin, and harbor porpoise (Carretta et al., 2016). From 2010 through 2014, within the Southern California portion of the Study Area, there were six marine mammal entanglements in marine debris (four pinnipeds, two dolphins) from marine debris reported off San Diego (Carretta et al., 2016).

4.4.7.3.6 Power Plant Entrainment

Coastal power plants use seawater as a coolant during power plant operation. Intakes into these plants can sometimes trap (i.e., entrain) marine animals that swim too close to the intake pipe. There have been no entrainments of marine mammals reported for Hawaii. Within the Southern California portion of the Study Area, there were 97 marine mammal power plant entrainments (all pinnipeds) reported from San Diego, CA between 2010 and 2014 (Carretta et al., 2016).

4.4.7.3.7 Disease, Parasites, and Algae

Section 3.7.2.1.5.3 (Disease and Parasites) discusses the effects of disease and parasites in marine mammals. Just like humans, older animals are affected by disease and likewise can disease spread through a population affecting a significant number of otherwise healthy individuals. Mass die-off events can also occur as a result of toxic algal blooms, which may be increasing in frequency due to human nutrient input and climate change, and the spread of certain parasites (toxoplasmosis, hookworms, lungworms, and thorny-headed worms) to seals, sea lions, otters, and pinnipeds from feral cats.

4.4.7.4 Impacts of the Proposed Action That May Contribute to Cumulative Impacts

Impacts of the Proposed Action are detailed in Section 3.7 (Marine Mammals). Impacts that may contribute to cumulative impacts on marine mammals can be generally categorized as mortality, injury (Level A harassment under the MMPA), and behavioral responses and TTS (Level B harassment under the MMPA). These impacts would be associated with certain acoustic (sonar and other transducers), physical disturbance, and strike stressors. Although behavioral impacts are possible from the remaining acoustic stressors (noise from air guns, weapons firing/launch/impact, aircraft, and vessels), energy

stressors (in-water electromagnetic devices and high energy lasers), physical disturbance and strike stressors (in-water devices, military expended materials, and seafloor devices), entanglement stressors (wires and cables, decelerators/parachutes, and biodegradable polymers), ingestion stressors (munitions and military expended materials other than munitions), and secondary stressors, these stressors are not expected to result in behavioral harassment, TTS, PTS, injury, or mortality of marine mammals.

The analysis presented in Section 3.7 (Marine Mammals) concluded that some stressors associated with the Proposed Action could impact individuals of certain marine mammal species, but impacts are not expected to decrease the overall fitness of any marine mammal population. Species most likely to be impacted by training and testing activities are those that are most abundant in the Study Area, primarily delphinid species (dolphins and small whales) that have stocks with tens of thousands of animals. From a cumulative perspective, any potential impacts on species with small populations, especially ESA-listed species, are of particular concern, and the Navy has consulted with the NMFS, as required by Section 7(a)(2) of the ESA. NMFS issued a final Biological Opinion concluding that the Navy's proposed testing and training activities were not likely to jeopardize any ESA-listed marine mammals and provided measures that will minimize or avoid incidental take of such species. These measures are consistent with those included in the MMPA authorization for the same activities. The Navy will implement mitigation to avoid or reduce potential impacts from acoustic, explosive, and physical disturbance and strike stressors on marine mammals, as described in Chapter 5 (Mitigation).

As determined in Section 3.7.4 (Summary of Potential Impacts on Marine Mammals) it is not anticipated that the Proposed Action will result in measurable impacts to marine mammal populations. The majority of the proposed activities are unit level training and small testing activities, which are conducted in the open ocean. Unit level events occur over a small spatial scale (one to a few square miles) and with few participants (usually one or two) or short duration (the order of a few hours or less). Additionally, training and testing activities are generally separated in space and time in such a way that it would be unlikely that any individual marine mammal would be exposed to stressors from multiple Navy activities within a short timeframe. Furthermore, research and monitoring efforts have included before, during, and after-event observations and surveys; data collection through conducting long-term studies in areas of Navy activity; occurrence surveys over large geographic areas; biopsy of animals occurring in areas of Navy activity; and tagging studies where animals are exposed to Navy stressors. To date, the findings from the research and monitoring (U.S. Department of the Navy, 2017b) and the regulatory conclusions from previous analyses by NMFS (National Marine Fisheries Service, 2015a; National Oceanic and Atmospheric Administration, 2013) are that the majority of Navy training and testing activities are not expected to have deleterious impacts on the fitness of any individuals or long-term consequences to populations of marine mammals.

4.4.7.4.1 Mortality

NMFS has previously concluded that the use of sonar and other transducers under the Proposed Action in the HSTT Study Area is possible but not expected to result in marine mammal mortality (National Marine Fisheries Service, 2015a; National Oceanic and Atmospheric Administration, 2013). Mitigation measures discussed in Chapter 5 (Mitigation) are designed to avoid or reduce potential impacts of explosives, especially higher-order impacts such as injury and death. However, the acoustic analysis indicates that certain marine mammal species could be exposed to underwater pressure waves resulting from explosive detonations that could lead to mortality of up to 10 individuals over a 5-year period. The protections afforded by mitigation measures are conservatively factored into the quantitative analysis

process. For a general discussion of strandings and their causes, as well as strandings in association with U.S. Navy activity, see the technical report titled Marine Mammal Strandings Associated with U.S. Navy Sonar Activities (U.S. Department of the Navy, 2017b). Although relatively unlikely, vessel strikes could result in mortality of a very small number of individuals of certain marine mammal species under the Proposed Action, and this likelihood is further reduced through implementation of the extensive standard operating procedures and mitigation, including newly developed large whale notification messaging systems. Based on historical records and the probability analysis presented in Section 3.7.3.4 (Physical Disturbance and Strike Stressors), the Navy predicts that large whales may potentially be struck by a large vessel as a result of training and testing activities in the offshore portion of the Study Area. While the species involved in a strike cannot be quantifiably predicted, the affected animals may include humpback whale, blue whale, Bryde's whale, fin whale, sei whale, gray whale, minke whale, and sperm whale.

4.4.7.4.2 Cumulative Impacts on Marine Mammals

In general, bycatch, vessel strikes, and entanglement are leading causes of injury and direct mortality to marine mammals throughout the region of influence, and, although mitigated to the greatest extent practicable, the Proposed Action could also result in injury and mortality to individuals of some marine mammal species from underwater explosions, vessel strikes, and potential auditory injury (i.e., PTS) from sonar. Implementation of measures discussed in Chapter 5 (Mitigation) would help avoid or reduce, but not absolutely eliminate, the risk for potential impacts, and any incidence of injury and mortality that might occur under the Proposed Action could be additive to injury and mortality associated with other actions in the region of influence. While it is more likely that an individual of an abundant, common stock or species would be affected, there is a chance that a less abundant stock could be affected.

Ocean noise is already significantly elevated over historic, natural levels, and acoustic stressors (underwater explosions and sonar, as well as increased Navy vessel noise) associated with the Proposed Action could also result in additive acoustic impacts on marine mammals. However, sonar is known to be neither a major threat to marine mammal populations nor a significant portion of the overall ocean noise budget (Bassett et al., 2010; Baumann-Pickering et al., 2010; International Council for the Exploration of the Sea, 2005; McDonald et al., 2006). Other current and future actions such as characterization, construction, and operation of offshore wind energy projects; seismic surveys; and construction, operation, and removal of oil and gas facilities could result in underwater sound levels that could cause behavioral harassment, TTS, PTS, or injury. Additionally, the constant elevation in ambient noise may produce physiological stress in individuals to which the Proposed Action would contribute.

Sounds from many of these sources travel over long distances, and it is possible that some would overlap in time and space with sounds from underwater explosions or Navy sonar use, in particular distant shipping noise, which is more widespread and continuous. It is not known whether the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on marine mammals. However, these activities are widely dispersed, the sound sources are intermittent, and mitigation measures would be implemented. Furthermore, safety, security, and operational considerations would preclude some training and testing activities in the immediate vicinity of other actions, further reducing the likelihood of simultaneous or overlapping exposure. For these reasons, it is unlikely that an individual marine mammal would be simultaneously exposed to sound levels from multiple actions that could cause behavioral harassment, TTS, PTS, or injury.

If the health of an individual marine mammal were compromised, it is possible this condition could alter the animal's expected response to stressors associated with the Proposed Action. The behavioral and physiological responses of any marine mammal to a potential stressor, such as underwater sound, could be influenced by various factors, including disease, dietary stress, body burden of toxic chemicals, energetic stress, percentage body fat, age, reproductive state, and social position. Synergistic impacts are also possible; for example, animals exposed to some chemicals may be more susceptible to noise-induced loss of hearing sensitivity (Fechter & Pouyatos, 2005). While the response of a previously stressed animal might be different from the response of an unstressed animal, no data are available at this time that accurately predict how stress caused by various ocean pollutants would alter a marine mammal's response to stressors associated with the Proposed Action.

In summary, the aggregate impacts of past, present, and other reasonably foreseeable future actions continue to have significant impacts on some marine mammal species in the Study Area. The Proposed Action could contribute incremental stressors to individuals, which would further compound effects on a given individual already experiencing stress. However, with the implementation of standard operating procedures reducing the likelihood of overlap in time and space with other stressors and the implementation of mitigation measures reducing the likelihood of impacts, the incremental stressors anticipated from the Proposed Action are not anticipated to be significant.

Furthermore, the regulatory process administered by NMFS, which includes Stock Assessments for all marine mammals and a 5-year review for all ESA-listed species, provides a backstop that informs decisions on take authorizations and Biological Opinions. Stock Assessments include estimates of Potential Biological Removal that stocks of marine mammals can sustainably absorb. MMPA take authorizations require that the proposed action have no more than a negligible impact on species or stocks, and that the proposed action imposes the least practicable adverse impact on the species. MMPA authorizations are reinforced by monitoring and reporting requirements so that NMFS is kept informed of deviations from what has been approved. Biological Opinions for federal and non-federal actions are similarly grounded in status reviews and conditioned to avoid jeopardy and to allow continued progress toward recovery after taking into account the effects of incidental take. These processes help to ensure that, through compliance with these regulatory requirements, the Navy's Proposed Actions will not have a measurable effect on the resource.

4.4.8 REPTILES

4.4.8.1 Region of Influence

The general region of influence for reptiles includes the coastal waters and nesting beaches of the Hawaiian Islands, coastal waters of California, and in open ocean areas, potentially including the transit corridor. The sea turtle species occurring in the Study Area include green turtles (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), olive Ridley turtle (*Lepidochelys olivii*), leatherback turtle (*Dermochelys coriacea*), and loggerhead turtle (*Caretta caretta*). In general, sea turtles spend most of their time at sea, with female turtles returning to land to nest and often migrating long distances between feeding grounds and nesting beaches. As with other marine resources, distribution is patchy and can be concentrated in specific areas depending on the species, season, habitat, activity, and age of the individuals. The yellow-bellied sea snake (*Pelamis platura*) has been sighted with increasing frequency in waters off California, which has been attributed to both periodic El Niño cycles and longer oceanic warming trends. Yellow-bellied sea snakes often occur in large numbers associated with long lines of debris in pelagic and open ocean areas. Breeding areas are believed to be closer to shore within warmer waters outside of the Study Area (Brischoux et al., 2016).

4.4.8.2 Resource Trends

All sea turtles in the Study Area have experienced significant decline in population numbers over the past hundred years and are ESA-listed (Table 3.8-1). Because sea turtles are so long-lived, and because reliable data are only available for approximately the past 20 years, it is not possible to determine a reliable trend in abundance for most species; however, recent data show an increase in nesting trends for most species at some locations within the Study Area. The abundance and trends of sea snake populations are relatively unknown.

4.4.8.3 Impacts of Other Actions

4.4.8.3.1 Overview

Section 3.8.2.1.5 (General Threats) discusses the specific stressors within the affected environment that impact sea turtle and sea snake populations in the Study Area, which include water quality (marine debris and chemical contaminants), commercial industries (fisheries bycatch and other interactions, hunting/exploitation, vessel strike, oil and gas development, wind and hydrokinetic energy development, shoreline development and recreation, dredging, military activities, invasive species, disease, habitat destruction (loss of seagrass habitat and nesting beaches), and climate change. Potential impacts of actions that affect reptiles include mortality, injury, disturbance, and reduced fitness, including reproductive, foraging, and predator avoidance success.

The susceptibility of sea turtles to these outcomes often depends on proximity, severity, or vulnerability to the stressor, and vulnerability can be increased as multiple stressors compound on an individual. The abundance of the species, potential impacts that may affect localized nesting sites, and individual fatalities could have considerable impacts in localized populations.

The activities as described in Table 4.2-1 each potentially contribute multiple stressors in the Study Area experienced by reptiles, including vessel traffic, underwater noise, and water pollution (Table 4.2-2). For example, most actions include the operation of marine vessels, which contribute to vessel strikes and underwater noise. Many of the actions also contribute underwater noise from sources other than vessels, including use of explosives for oil rig removal, seismic surveys, construction activities, and military operations. Bycatch and entanglement, among the main threats to reptile populations in the Study Area, are chiefly associated with fishing and are discussed separately. While Table 4.2-1 discusses these stressors for individual actions, their aggregate impacts specific to reptiles are detailed in Section 3.8.2.1.5 (General Threats) and further described below.

4.4.8.3.2 Commercial Fishing and Harvest

Past and present commercial fishing activities have had a profound global effect on the recovery and conservation of marine turtle populations and, despite continued improvements in bycatch avoidance and the implementation of regulatory efforts, fisheries interactions continue to be the primary human-related source of mortality for most sea turtles (National Research Council of the National Academies, 1990; Wallace et al., 2010). Among fisheries that incidentally capture sea turtles, certain types of trawl, gillnet, and longline fisheries generally pose the greatest threat. One comprehensive study estimated that worldwide, 447,000 turtles are killed each year from bycatch in commercial fisheries (Wallace et al., 2010). In United States' fisheries, bycatch resulted in 71,000 sea turtle deaths per year prior to effective protective sea turtle regulations (enacted in the mid-1990s); however, current mortality estimates are 94 percent lower than pre-regulation estimates (Finkbeiner et al., 2011). In the Pacific, NMFS requires measures (e.g., gear modifications, changes to fishing practices, and time/area

closures) to reduce sea turtle bycatch in the Hawaii- and California-based pelagic longline fisheries and the California/Oregon drift gillnet fishery. The main threat to sea snakes globally is fisheries bycatch, although the impact is relatively low, with prawn fisheries presenting the highest risk to sea snakes.

In Pacific fisheries, the Hawaii pelagic shallow and deep set longline, and California set gillnet, drift gillnet, and pelagic deepset longline fisheries impact loggerhead, leatherback, green, and olive Ridley sea turtles. Within the HRC, a total of 146 turtle interactions were recorded between 2004 and 2016, including 7 green, 62 leatherback, 63 loggerhead, 11 olive Ridley, and 3 unidentified (National Marine Fisheries Service, 2016a). During the same timeframe in the Hawaiian portion of the Study Area, a total of 36 turtle interactions were recorded, including 9 leatherback, 4 loggerhead, and 23 olive Ridley. From 2011 to 2013, an estimated 55, 40, and 73 sea turtles were caught in the Hawaii-based deepset pelagic longline and 32, 13, and 17 in the shallow-set pelagic longline fishery (National Marine Fisheries Service, 2016b). The predominant sea turtles caught in 2012 and 2013 were leatherback, olive Ridley, and loggerhead, with olive Ridley representing the predominant species caught. In 2011, green sea turtles were the predominant species caught, but were not represented in the 2012 and 2013 bycatch observations. In California, five leatherback sea turtles were estimated as bycatch in 2012, but no sea turtles were observed caught in all other observed fisheries and years. Coastal gillnet and other fisheries conducted from a multitude of smaller vessels are of increasing concern. These fisheries, called artisanal fisheries, can collectively have a great impact on local turtle populations, especially leatherbacks and loggerheads (National Marine Fisheries Service, 2016b).

Globally, large-scale commercial exploitation also contributes to global decline in marine turtle populations. Currently, 42 countries and territories allow direct take of turtles and collectively take in excess of 42,000 turtles per year, the majority of which (greater than 80 percent) are green sea turtles (Humber et al., 2014). Illegal fishing for turtles and nest harvesting also continues to be a major cause of sea turtle mortality, both in countries that allow sea turtle take and in countries that outlaw the practice (Lam et al., 2011; Maison et al., 2010). For example, Humber et al. (2014) estimated that in Mexico 65,000 sea turtles were illegally harvested between 2000 and 2014. The authors, however, have seen legal and illegal direct take of sea turtles trending downward over the past three decades—citing a greater than 40 percent decline in green sea turtle take since the 1980s, a greater than 60 percent decline in hawksbill and leatherback take, and a greater than 30 percent decline in loggerhead take (Humber et al., 2014).

4.4.8.3.2.1 Maritime Traffic and Vessel Strikes

Maritime traffic has increased over the past 50 years, and vessel traffic is expected to continue to increase in the Study Area in response to continued economic globalization, increases in energy development, and other offshore activities. Vessel strike has been identified as one of the important mortality factors in several nearshore turtle habitats worldwide. Precise data are lacking for sea turtle mortalities directly caused by ship strikes; however, live and dead turtles are often found with deep cuts and fractures indicative of collision with a boat hull or propeller (Hazel et al., 2007; Lutcavage et al., 1997). For example, scientists in Hawaii reported that 2.5 percent of green turtles found dead on the beaches between 1982 and 2003 were killed by boat strike (Chaloupka et al., 2008), and in the Canary Islands, 23 percent of stranded sea turtles showed lesions from boat strikes or fishing gear (Oros et al., 2005). Denkinger et al. (2013) reports that boat strikes in the Galapagos Islands were most frequent at foraging sites close to a commercial and tourism port.

Some vessel strikes could cause temporary impacts, such as diverting the turtle from its previous activity or causing minor injury. Major strikes could cause permanent injury or death from bleeding, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle's recovery from a strike may be influenced by its age, reproductive state, and general condition. Numerous living sea turtles bear scars that appear to have been caused by propeller cuts or collisions with vessel hulls (Hazel et al., 2007; Lutcavage et al., 1997), suggesting that not all vessel strikes are lethal. While increased risks come with increased vessel traffic, risks of vessel strikes could be minimized by ongoing and future education and awareness, ship-speed reduction measures, and maritime traffic planning and management.

4.4.8.3.3 Coastal Land Development

The population along the United States coastline grew from 47 million in 1960 to 87 million in 2008, and during this timeframe, the Pacific Coast grew by 17 million people (U.S. Census Bureau, 2010). Human development now dominates the coastline almost continuously throughout its extent. The limited space for development in coastal areas results in greater population density in these locations. In the United States (excluding Alaska), non-coastal counties average 98 persons per square mile while coastal counties average 300 persons per square mile.

Female sea turtles migrate to their natal beaches to lay eggs, and pervasive coastal development often interferes with successful nesting at these locations. Shared use between turtles and human interests on increasingly populated and utilized beach areas has intensified the tendency for female turtles and their hatchlings to encounter various barriers and hazards accessing, nesting, and leaving these beaches. Beachfront construction of homes, hotels, restaurants, and roads; seawall construction, shoreline armoring, and beach erosion; ports and marinas; beach replenishment; nearshore dredging; and oil and gas activities can all prevent beach access and emigration; beach-going vehicles and watercraft cause injury and mortality; and abandoned debris and equipment are often insurmountable obstacles for both mother and offspring (SeeTurtles.org, 2017). Populated areas also often have excess nighttime lighting that confuses hatchlings' instincts to orient toward the moon to arrive at the ocean, and in this journey they often fall into and can remain trapped within pits and scars left on the beach. Conservation awareness has increased on many popular U.S. beaches and tourist destinations, but nesting success remains imperiled in many others.

4.4.8.3.4 Ocean Pollution

As discussed in Table 4.2-1 and Table 4.2-2, multiple pollutants from numerous sources are present in, and continue to be released into, the oceans. Section 3.8.2.1.5.1 (Water Quality) provides an overview of these potential impacts on sea turtles, which include the ingestion of and entanglement in marine debris as well as toxicity from bisphenol-A, phthalates, and heavy metals. Sea turtles often mistake debris for prey; one study found 37 percent of dead leatherback turtles had ingested various types of plastic (Mrosovsky et al., 2009). Other marine debris, including derelict fishing gear and cargo nets, can entangle and drown turtles in all life stages.

4.4.8.3.5 Ocean Noise

Ocean noise as a general stressor in modern oceans is described in Table 4.2-2. Anthropogenic noise is generated from a variety of sources throughout the region of influence, including commercial shipping, oil and gas exploration and production activities (including air gun, drilling, explosive decommissioning), commercial and recreational fishing (including vessel noise, fish-finding sonar, fathometers, acoustic deterrent and harassment devices), shoreline construction projects (including pile driving), recreational

boating and whale-watching activities, offshore power generation (including offshore windfarms), and research (including sound from air guns, sonar, telemetry). The military activities addressed in Table 4.2-1 include various training and testing activities that also contribute vessel noise, underwater and surface explosions, and sonar; however, due to the low risk of encounter and the implementation of required mitigation measures, sonar operations are not expected to result in mortality to any sea turtles and only minimal injury or behavioral changes are anticipated. Although various other military training and testing activities involve surface or undersea detonations or gunnery exercises, these are generally mitigated through monitored exclusion zones, and are infrequent, and isolated events. Further, as described in Section 3.0.3.3.1.4 (Vessel Noise) it is estimated that the overall contribution of Navy vessel noise is less than 8 percent of the overall total vessel broadband noise in the HSTT study area.

In general, the potential concerns associated with ocean noise and sea turtles are not as well defined as those for marine mammals. While it is well known that many species of marine mammals use sound as a primary sense for navigating, finding prey, and communicating with other individuals, little is known about how sea turtles use sound in their environment. Based on knowledge of their sensory biology (Bartol & Musick, 2003; Bartol & Ketten, 2006; Ketten & Moein-Bartol, 2006; Levenson et al., 2004), sea turtles may be able to detect objects within the water column (e.g., vessels, prey, predators) via some combination of auditory and visual cues. However, research examining the ability of sea turtles to avoid collisions with vessels shows they may rely more on their vision than auditory cues (Hazel et al., 2007). Similarly, while sea turtles may rely on acoustic cues from breaking waves to identify nesting beaches, they also appear to rely on other nonacoustic cues for navigation, such as magnetic fields (Lohmann & Lohmann, 1992, 1996) and light (Avens, 2003). Additionally, sea turtles are not known to produce sounds underwater for communication. As a result, sound may play a limited role in a sea turtle's environment.

Nonetheless, as discussed in Section 3.8.3.1 (Acoustic Stressors), sea turtles could experience a range of impacts from ocean noise, depending on the sound source. The impacts could include permanent or temporary hearing loss, changes in behavior, physiological stress, and auditory masking. In addition, potential impacts from use of explosives could range from physical discomfort to nonlethal and lethal injuries.

4.4.8.3.6 Offshore Energy Development

Offshore energy development, including oil and natural gas extraction in coastal and deep waters on the continental shelf and renewable energy projects can degrade sea turtle habitats during pre-construction, construction, and operation phases. Prior to any drilling or pile driving operations, vessel traffic and seismic disturbances through exploration activities can degrade sea turtle coastal and open ocean foraging habitats.

4.4.8.4 Impacts of the Proposed Action That May Contribute to Cumulative Impacts

The cumulative impacts analysis is generally focused on green, hawksbill, olive Ridley, leatherback, and loggerhead sea turtles, all of which are ESA-listed species. The analysis presented in Section 3.8 (Reptiles) concludes that some stressors associated with the Proposed Action could impact individuals of certain sea turtle species, but impacts are not expected to decrease the overall fitness of any sea turtle population. From a cumulative perspective, potential impacts on listed species are of particular concern, and mitigation measures designed to avoid or reduce potential impacts are discussed in Chapter 5 (Mitigation).

Impacts from the Proposed Action that may contribute to cumulative impacts on sea turtles can be generally categorized as behavioral responses, temporary and PTS, non-auditory injury (modeled as slight lung injury and gastrointestinal tract injury), and mortality. As summarized below, these impacts would be associated with certain acoustic and physical strike stressors:

- The use of sonar and other transducers may result in behavioral responses, TTS, and PTS in sea turtles, including ESA-listed sea turtles.
- Explosives may result in behavioral responses, TTS, PTS, injury, and mortality in sea turtles, including ESA-listed sea turtles.
- Vessel strikes may cause injury or mortality in sea turtles, including ESA-listed sea turtles.

The remaining acoustic stressors (noise from air guns, weapons firing/launch/impact, aircraft overflight, vessels), energy stressors (electromagnetic, high energy lasers), physical disturbance and strike stressors (in-water devices, military expended materials, seafloor devices), entanglement stressors (cables, wires, decelerators/parachutes), ingestion stressors (munitions, military expended materials other than munitions), and secondary stressors are not expected to result in temporary or PTS, injury, or mortality of sea turtles under the Proposed Action, including ESA-listed sea turtles. The Proposed Action would not introduce significant light sources that would disorient nesting turtles or their hatchlings. Because Navy training and testing activities analyzed in this EIS/OEIS do not co-occur with nesting activities, it is unlikely that stressors presented to sea turtles would contribute to other anthropogenic threats not caused by Navy activities.

Although sea turtles could be exposed to sound and energy from explosive detonations throughout the Study Area, the estimated impacts on individual sea turtles are unlikely to affect populations. Injured sea turtles could suffer reduced fitness and long-term survival. Sea turtles that experience TTS or PTS may have reduced ability to detect relevant sounds such as predators or prey, although some experiencing TTS would recover quickly, possibly in a matter of minutes. It is uncertain whether some permanent hearing loss over a part of a sea turtle's hearing range would have long-term consequences for that individual because the sea turtle hearing range is already limited (Section 3.8.3.1, Acoustic Stressors). Any significant behavioral reactions to acoustic stimuli could lead to a sea turtle expending energy and missing opportunities to secure resources. However, most individuals are not likely to experience long-term consequences from behavioral reactions because exposures would be intermittent and spatially distributed, allowing exposed individuals to recover. Since long-term consequences for most individuals are unlikely, long-term consequences for populations are not expected.

The Proposed Action is not anticipated to have any effect on sea turtle nesting beaches in the region of influence. The training and testing activities associated with the Proposed Action do not contribute to factors that impact nesting habitats for these species.

In summary and as determined in Section 3.8.4 (Summary of Potential Impacts on Reptiles), it is not anticipated that the Proposed Action would result in significant impacts to reptiles. Due to the wide dispersion of stressors and dynamic movement of many training and testing activities, it is unlikely that a sea turtle or sea snake would remain in the potential impact range of multiple sources or sequential exercises. Additionally, the majority of the proposed activities are unit-level training and small testing activities, which occur over a small spatial scale (one to a few square miles) and with few participants (usually one or two) or short duration (the order of a few hours or less). Likewise, training and testing activities are generally separated in space and time in such a way that it would be unlikely that any individual sea turtle or sea snake would be exposed to stressors from multiple activities within a short

timeframe. Furthermore, research and monitoring efforts have included before, during, and after-event observations and surveys, data collection through conducting long-term studies in areas of Navy activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of Navy activity, and tagging studies where animals are exposed to Navy stressors. To date, the findings from the research and monitoring and the regulatory conclusions from previous analyses by NMFS (National Marine Fisheries Service, 2015a; National Oceanic and Atmospheric Administration, 2013) are that the majority of impacts from Navy training and testing activities are not expected to have deleterious impacts on the fitness of any individuals or long-term consequences to populations of sea turtles.

4.4.8.5 Cumulative Impacts on Reptiles

The fact that all five species of sea turtles occurring in the Study Area are ESA-listed provides a clear indication that the current aggregate impacts of past human activities are significant for sea turtles. Bycatch, vessel strikes, coastal land development, and ocean pollution are the leading causes of mortality and population decline for sea turtles, and, although mitigated/avoided to the greatest extent practicable, the Proposed Action could result in stress, injury, and mortality to individuals of some sea turtle species from underwater explosions and vessel strikes. Implementation of mitigation measures discussed in Chapter 5 (Mitigation) would help avoid, but not absolutely eliminate, the risk for potential impacts, and any incidence of injury and mortality that might occur under the Proposed Action could be additive to injury and mortality associated with other actions in the region of influence.

Due to standard operating procedures and mitigation measures most impacts associated with the Proposed Action are not anticipated to interact with or increase similar stressors experienced throughout the region of influence. According to scientific studies, reptiles may rely primarily on senses other than hearing for interacting with their environment and appear to recover quickly from noise stressors (Section 3.8.3.1, Acoustic Stressors); thus, the acoustic stressors produced by Navy activities are anticipated to have minimal cumulative impact on sea turtles. The Proposed Action would not affect turtle nesting or sea snake habitat, and contaminants and debris discharged into the marine environment are expected to be negligible and not persistent (Section 4.4.1.2, Sediments and Water Quality). Affects from the Proposed Action to sea turtle food sources are avoided or insignificant (Section 4.4.4, Invertebrates and Section 4.4.3, Vegetation). Likewise, Navy actions generally would not overlap in space and time with other stressors as they occur as dispersed, infrequent, and isolated events that do not last for extended periods.

The potential exists for the impacts of ocean pollution (disease, malnourishment), injury, nesting habitat loss, starvation, and the composite increased underwater noise environment to contribute multiple stressors to an individual, and it is possible that the response of a previously stressed animal to impacts associated with the Proposed Action could be more severe than the response of an unstressed animal, or that impacts from the Proposed Action could make an individual more susceptible to other stressors. For example, if a Navy vessel were to strike an otherwise healthy sea turtle, exposure to multiple other stressors in the area may hinder the individual's recovery from any injury sustained in the accident. Likewise, depending on many factors, such as distance from and intensity of the stressor, a sea turtle near an underwater explosion or sonar activity may become stressed or disoriented, and the time to recover may be increased if that individual is likewise experiencing disease, malnutrition, or other strike injury that may increase its vulnerability to predation or decrease its ability to forage.

In summary, the aggregate impacts of past, present, and other reasonably foreseeable future actions continue to have significant impacts on all reptile species in the Study Area. The Proposed Action could

contribute incremental stressors to individuals, which would further compound effects on a given individual already experiencing stress. However, with the implementation of standard operating procedures reducing the likelihood of overlap in time and space with other stressors and the implementation of mitigation measures reducing the likelihood of impacts, the incremental stressors anticipated from the Proposed Action are not anticipated to be significant. Additionally, as with marine mammals, the NMFS regulatory process includes Stock Assessments and 5-year reviews for all ESA-listed species, which provides a backstop that informs decisions on take authorizations and Biological Opinions. Biological Opinions for federal and non-federal actions are grounded in status reviews and conditioned to avoid jeopardy and to allow continued progress toward recovery. This process helps to ensure that, through compliance with these regulatory requirements, the Navy's Proposed Actions will be imperceptible.

4.4.9 BIRDS

Although not uniformly distributed, the region of influence for birds includes shorelines, surface water, water column and shallow bottom habitats, and airspace throughout the Study Area. The majority of species encountered in the Study Area are water birds, including seabirds, wading birds, shorebirds, and waterfowl that use Study Area habitat for breeding, foraging, roosting, and migration. An estimated 15 million seabirds inhabit the Hawaiian Islands; 22 species of seabirds regularly nest in the Hawaiian Islands, and many more pass through during migration to and from their breeding grounds elsewhere in the Pacific (Birding Hawaii, 2004). More than 195 species of birds use coastal or offshore aquatic habitats in the Southern California Bight, and more than 300 bird species have been documented to use San Diego Bay (Anderson et al., 2007; Bearzi et al., 2009; Hunt & Butler, 1980).

All projects in the Study Area that affect ESA-listed species, species protected under the Migratory Bird Treaty Act, and U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern are subject to regulatory processes and permitting that give agencies a landscape management perspective of population trends and conservation measures. ESA-listed species are described in Table 3.9-1. Despite numerous protective laws and regulations, seabirds are some of the most threatened marine animals in the world, with 29 percent of species at risk of extinction and approximately half of the 346 species of seabirds that depend on ocean habitats in decline (Section 3.9.2.1.5, General Threats).

Birds are susceptible to multiple stressors, and the susceptibility of many species could be enhanced by additive or synergistic effects of multiple stressors. Section 3.9.2.1.5 (General Threats) includes an extensive discussion of the existing stressors to bird populations in the Study Area, and all activities listed in Table 4.2-1 and stressors described in Table 4.2-2 contribute one or more of these stressors. Other activities in the Study Area that could have direct impacts on birds include wind energy development (strike mortality and forage displacement); noise, light, and water pollution (direct impacts from major spills, indirect impacts from habitat loss and degradation, and marine debris); commercial fishing (loss of food source, strike, and entanglement); climate change; coastal land development (disturbance, collisions, and loss of breeding, nesting, or foraging habitat); and operation of ports and terminals or military training areas (disturbance). Commercial fisheries are considered the most serious threat to the world's seabirds. Most of the birds in the Study Area are relatively long-lived and wide-ranging seabirds, making it likely that individuals would be exposed to multiple activities and stressors over the course of their lifespans.

The analysis in Section 3.9 (Birds) indicates that birds could potentially be impacted by in-air and underwater acoustic stressors (sonar and other transducers, pile driving, air guns, weapons firing,

aircraft and vessel noise), explosives (shock wave, sound, fragments), energy stressors (electromagnetic devices, lasers), physical disturbance and strikes (aircraft, aerial targets, vessels and in-water devices, military expended materials, seafloor devices, pile driving), entanglement (fiber optic cables, guidance wires, vessel entanglement systems, and decelerators/parachutes), ingestion (military expended materials), and secondary stressors (explosives and explosion byproducts, unexploded munition, metals, chemicals, other materials, physical disturbance). Some stressors, including explosions, physical strikes, and ingestion of plastic military expended materials, could result in mortality. In general, however, the potential for training and testing activities to result in bird injury or mortality is considered low to discountable, depending on the specific training or testing activity being considered. The vast majority of impacts are expected to be nonlethal: the most likely responses to training and testing activities are short-term behavioral or physiological, such as alert response, startle response, cessation of feeding, fleeing the immediate area, and a temporary increase in heart rate. Recovery from the impacts of most stressor exposures that elicit such short-term behavioral or physiological responses would occur quickly. To further minimize the risk of potential impacts, the Navy has established mitigation measures for birds for explosive mine countermeasure and neutralization activities and explosive mine neutralization activities involving Navy divers (Chapter 5, Mitigation).

Impacts that elicit behavioral or physiological impacts can combine with other stressors experienced elsewhere and result in decreased fitness of the individual as it moves throughout the Study Area. However, most of the proposed activities would be widely dispersed in offshore areas where bird distribution is patchy and concentrations of individuals are often low; therefore, the potential for interactions between birds and training and testing activities is low. Likewise, for most stressors associated with the Proposed Action, impacts would be short term and localized, and physiological recovery would occur quickly for any individuals experiencing a stress response. It is unlikely that training and testing activities would influence nesting because most activities take place in water and away from nesting habitats on land.

Although other past, present, and reasonably foreseeable actions individually and collectively cause widespread disturbance and mortality of bird populations across the ocean landscape, the Proposed Action is not expected to substantially contribute to their diminishing abundance, induce widespread behavioral or physiological stress, or interfere with recovery from other stressors. It is anticipated that the incremental contribution of the Proposed Action, when added to the impacts of all other past, present and reasonably foreseeable future actions, would not result in measurable additional impacts on birds in the Study Area or beyond.

4.4.10 Cultural Resources

As discussed in Section 3.10 (Cultural Resources), stressors, including explosive and physical disturbance and strike stressors, associated with the Proposed Action would not affect submerged prehistoric sites and submerged historic resources in accordance with Section 106 of the National Historic Preservation Act because mitigation measures have been implemented to protect and avoid these resources (Chapter 5, Mitigation). Furthermore, programmatic agreements between the Navy and State Historic Preservation Offices exist to address the protection and management of cultural resources. The Proposed Action is not expected to result in impacts on cultural resources in the Study Area and likewise would not contribute incrementally to cumulative impacts on cultural resources. Therefore, further analysis of cumulative impacts on cultural resources is not warranted.

4.4.11 Socioeconomic Resources

The analysis in Section 3.11 (Socioeconomic Resources) indicates that the Proposed Action is not expected to result in long-term impacts to socioeconomic resources in the Study Area, including commercial transportation and shipping, commercial and recreational fishing, subsistence fishing, and tourism. Temporary and short-duration (hours) impacts may occur from limits on accessibility to marine areas used by the public (e.g., for fishing and tourism); however, most limitations on accessibility are temporary and would be lifted upon completion of training and testing activities. The public may intermittently hear airborne noise from transiting ships or aircraft overflights if they are in the general vicinity of a training or testing activity. These occurrences would be of short duration (seconds to minutes) and infrequent, and other than transiting vessels and aircraft, most Navy training and testing that generates airborne noise occurs farther from shore than most recreational and tourism activities. Similarly, impacts on socioeconomic resources from physical disturbances and strikes are unlikely, given that most training and testing activities that pose a risk of a physical disturbance or strike (e.g., activities using munitions or military expended materials) occur farther from shore than most fishing or tourism activities. The Navy's standard operating procedures also require that an area is clear of non-participating vessels and aircraft before an activity using munitions or expended materials occurs.

Secondary or indirect cumulative impacts on socioeconomic resources are dependent on the availability of other marine resources (e.g., target fish species). Population-level impacts on fishes, marine mammals, and invertebrates, which are the primary resources indirectly affecting socioeconomics in the Study Area, are not anticipated. No cumulative impacts on commercial transportation and shipping are anticipated because commercial vessels and aircraft are primarily transiting through the Study Area along well-established navigable routes or air traffic corridors that are avoided by Navy vessels and aircraft conducting training and testing activities.

Temporary limitations on accessibility to marine areas and the infrequent exposure to airborne noise would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience. Short-term impacts, should they occur, would not contribute incrementally to cumulative impacts on the socioeconomic resources in the Study Area. Therefore, further analysis of cumulative impacts on socioeconomic resources is not warranted.

4.4.12 Public Health and Safety

All Proposed Actions would be accomplished by technically qualified personnel and would be conducted in accordance with applicable Navy, state, and federal safety standards and requirements. The analysis presented in Section 3.12 (Public Health and Safety) indicates that the Proposed Action is not expected to result in impacts on public health and safety and thus would not contribute incrementally to or combine with other impacts on health and safety within the Study Area. Therefore, further analysis of cumulative impacts on public health and safety is not warranted.

4.5 Summary of Cumulative Impacts

The Proposed Action would contribute incremental effects on the ocean ecosystem, which is already experiencing and absorbing a multitude of stressors to a variety of receptors. In general, it is not anticipated that the implementation of the Proposed Action would have a meaningful contribution to the ongoing stress or cause significant collapse of any particular marine resource, but it would contribute minute impacts on resources that are already experiencing various degrees of interference and degradation. It is intended that the mitigation measures described in Chapter 5 (Mitigation) will

further reduce the potential impacts of the Proposed Action in such a way that they are avoided to the maximum extent practicable and to ensure that impacts do not become cumulatively significant to any marine resource.

Marine mammals and sea turtles are the primary resources of concern for cumulative impacts analysis, however, the incremental contributions of the Proposed Action are not anticipated to meaningfully contribute to the decline of these populations or affect the stabilization and recovery thereof. The Navy proposes to implement standard operating procedures that reduce the likelihood of overlap of Navy stressors in time and space with non-Navy stressors, and mitigation measures as described in Chapter 5 (Mitigation) reduce the risk of direct impacts of the Proposed Action to individual animals. The aggregate impacts of past, present, and other reasonably foreseeable future actions (Tables 4.2-1 and 4.2-2) have resulted in significant impacts on some marine mammal and all sea turtle species in the Study Area. However, the decline of these species is chiefly attributable to other stressors in the environment, including the synergistic effect of bycatch, entanglement, vessel traffic, ocean pollution, recreation and tourism, and coastal zone development. The analysis presented in this Chapter 4 (Cumulative Impacts) and Chapter 3 (Affected Environment and Environmental Consequences) indicates that the incremental contribution of the Proposed Action to cumulative impacts on air quality, sediments and water quality, vegetation, invertebrates, marine habitats, fishes, birds, cultural and socioeconomic resources, and public health and safety would not significantly contribute to cumulative stress on those resources.

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5 Mitigation

Final
Environmental Impact Statement/Overseas Environmental Impact Statement
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5 MITIGATION

5.1 INTRODUCTION

This chapter describes the mitigation measures that the United States (U.S.) Department of the Navy (Navy) will implement to avoid or reduce potential impacts from the Hawaii-Southern California Training and Testing (HSTT) Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) Proposed Action. The Navy has been mitigating impacts from military readiness activities throughout areas where it trains and tests for more than two decades. Past environmental documents applicable to the Study Area are discussed in Section 1.2 (The Navy's Environmental Compliance at At-Sea Policy).

The Navy will also implement standard operating procedures specific to training and testing activities conducted under the Proposed Action. In many cases, standard operating procedures provide a benefit to environmental and cultural resources, some of which have high socioeconomic value in the Study Area. Standard operating procedures differ from mitigation measures because standard operating procedures are designed to provide for safety and mission success, whereas mitigation measures are designed specifically to avoid or reduce potential environmental impacts. An example of a standard operating procedure is that ships operated by or for the Navy have personnel assigned to stand watch at all times when underway. Watch personnel monitor their assigned sectors for any indication of danger to the ship and the personnel on board, such as a floating or partially submerged object or piece of debris, periscope, surfaced submarine, wisp of smoke, flash of light, or surface disturbance. As a standard collision avoidance procedure, watch personnel also monitor for marine mammals that have the potential to be in the direct path of the ship. The standard operating procedures to avoid collision hazards are designed for safety of the ship and personnel on board. This is different from mitigation measures for vessel movement, which require vessels to maneuver to avoid marine mammals by specified distances to avoid or reduce the potential for physical disturbance and strike of marine mammals, as described in Section 5.3.4.1 (Vessel Movement). In this example, the benefit of the mitigation measure for vessel movement is additive to the benefit of the standard operating procedure for vessel safety. A full discussion of standard operating procedures is provided in Section 2.3.3 (Standard Operating Procedures).

In addition to the mitigation measures and standard operating procedures specific to the Proposed Action, the Navy has existing routine operating instructions (e.g., training manuals) and local installation instructions (e.g., Integrated Natural Resource Management Plans) that were developed to meet other safety and environmental compliance requirements or initiatives. For example, the Naval Air Training and Operating Procedures Standardization (NATOPS) General Flight and Operating Instructions Manual (CNAF M-3710.7) contains naval air training procedures pertaining to safe operations of aircraft, which includes requirements to minimize the disturbance of wildlife. Aviation units are required to avoid noise-sensitive areas, such as breeding farms, resorts, beaches, national parks, national monuments, and national recreational areas. They are also required to avoid disturbing wild fowl in their natural habitats and to avoid firing directly at large fish, whales, or other wildlife. These requirements are in addition to the measures identified for the Proposed Action. The Navy will continue complying with applicable operating instructions and local installation instructions within the Study Area, as appropriate.

5.1.1 BENEFITS OF MITIGATION

The Chapter 3 (Affected Environment and Environmental Consequences) environmental analyses indicate that certain acoustic, explosive, and physical disturbance and strike stressors have the potential

to impact certain biological or cultural resources. The Navy developed mitigation measures for those stressors and will implement the mitigation for either action alternative. The Navy considered the benefits of mitigation in the environmental analyses for both Alternative 1 and Alternative 2 of the Proposed Action in this Final EIS/OEIS. In addition to analyzing mitigation measures pursuant to the National Environmental Policy Act (NEPA), the Navy designed its mitigation measures to achieve one or more benefits, such as the following:

- Effect the least practicable adverse impact on marine mammal species or stocks and their habitat, and have a negligible impact on marine mammal species and stocks (as required under the Marine Mammal Protection Act [MMPA]);
- Ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat (as required under the Endangered Species Act [ESA]);
- Avoid or minimize adverse effects on essential fish habitat (as required under the Magnuson-Stevens Fishery Conservation and Management Act); and
- Avoid adversely impacting historic shipwrecks (as required under the Abandoned Shipwreck Act and National Historic Preservation Act).

The Navy coordinated its mitigation with the appropriate regulatory agencies, including the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS), through the consultation and permitting processes. The Navy and NMFS Records of Decision, MMPA Regulations and Letters of Authorization, and ESA Biological Opinion will document the mitigation measures that the Navy will implement under the Proposed Action. Should the Navy require a change in how it implements mitigation based on national security concerns, evolving readiness requirements, or other factors (e.g., significant changes in the best available science), the Navy will engage the appropriate agencies and reevaluate its mitigation through adaptive management or the appropriate consultations. The Navy's adaptive management approach is discussed in Section 5.1.2.2.1.1 (Adaptive Management). This approach was coordinated with NMFS during the consultation and permitting processes and will be included in the MMPA Regulations and Letters of Authorization.

5.1.2 COMPLIANCE INITIATIVES

To disseminate its mitigation requirements to the appropriate personnel and meet other compliance requirements for the MMPA and ESA, the Navy will continue using the Protective Measures Assessment Protocol and its ongoing monitoring and reporting initiatives, as described in the sections below.

5.1.2.1 Protective Measures Assessment Protocol

To disseminate requirements to the personnel who are required to implement mitigation during training and testing activities, the Navy will continue inputting its mitigation measures into the Protective Measures Assessment Protocol and appropriate governing instructions. The Protective Measures Assessment Protocol is a software tool that serves as the Navy's comprehensive data source for at-sea mitigation. The software tool provides personnel with notification of the required mitigation measures and a visual display of the planned training or testing activity location overlaid with relevant environmental data (e.g., mapped locations of shallow-water coral reefs). Navy policy requires applicable personnel to access the Protective Measures Assessment Protocol during the event planning process. This helps ensure that personnel receive mitigation instructions prior to the start of training and testing activities and that mitigation is implemented appropriately.

5.1.2.2 Monitoring, Research, and Reporting Initiatives

Many of the Navy's monitoring programs, research programs, and reporting initiatives have been ongoing for more than a decade and will continue as a compliance requirement for the MMPA, ESA, or both. The Navy and NMFS will use the information contained within monitoring, research, activity, and incident reports when evaluating the effectiveness and practicality of mitigation and determining if adaptive adjustments to mitigation may be appropriate. These reports also facilitate better understandings of the biological resources that inhabit the Study Area and the potential impacts of the Proposed Action on those resources.

5.1.2.2.1 Marine Species Research and Monitoring Programs

Through its marine species research and monitoring programs, the Navy is one of the nation's largest sponsors of scientific research on and monitoring of marine species. Detailed information on these programs is provided in Section 3.0.1.1 (Marine Species Monitoring and Research Programs). Navy research programs focus on investments in basic and applied research that increase fundamental knowledge and advance naval technological capabilities. Navy monitoring programs focus on the potential impacts of training and testing activities on biological resources. Monitoring reports are available to the public on the U.S. Navy Marine Species Monitoring webpage. The Navy will post future reports online as they become available. Specific details regarding the content of the reports were coordinated with the appropriate agencies through the consultation and permitting processes. Additional information about the U.S. Navy Marine Species Monitoring Program, including its adaptive management and strategic planning components, is provided in the sections below.

5.1.2.2.1.1 Adaptive Management

Adaptive management is an iterative process of decision-making that accounts for changes in the environment and scientific understanding over time through a system of monitoring and feedback. Within the natural resource management community, adaptive management involves ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself (Williams et al., 2009). Adaptive management focuses on learning and adapting, through partnerships of natural resource managers, scientists, and other stakeholders. Adaptive management helps managers maintain flexibility in their decisions and provides them the latitude to change direction to improve understanding of ecological systems and achieve management objectives. Working to improve progress toward desired outcomes is another function of adaptive management.

The Navy's adaptive management review process and reporting requirements serve as the basis for evaluating performance and compliance. The process involves technical review meetings and ongoing discussions between the Navy, NMFS, the Marine Mammal Commission, and other experts in the scientific community. An example of a revision to the compliance monitoring structure as a result of adaptive management is the development of the Strategic Planning Process, which is a planning tool for the selection and management of monitoring investments (U.S. Department of the Navy, 2013). Through adaptive management, the Strategic Planning Process has been incorporated into the Integrated Comprehensive Monitoring Program, which is described below.

5.1.2.2.1.2 Integrated Comprehensive Monitoring Program

The Navy developed an Integrated Comprehensive Monitoring Program to serve as the overarching framework for coordinating its marine species monitoring efforts and as a planning tool to focus its monitoring priorities pursuant to ESA and MMPA requirements (U.S. Department of the Navy, 2010). The purpose of the Integrated Comprehensive Monitoring Program is to coordinate monitoring efforts

across regions and to allocate the most appropriate level and type of monitoring effort for each range complex based on a set of standardized objectives, regional expertise, and resource availability. The Integrated Comprehensive Monitoring Program does not identify specific field work or individual projects. It is designed to provide a flexible, scalable, and adaptable framework using adaptive management and the Strategic Planning Process to periodically assess progress and reevaluate objectives.

The Integrated Comprehensive Monitoring Program is evaluated through the adaptive management review process to: (1) assess progress, (2) provide a matrix of goals and objectives, and (3) make recommendations for refinement and analysis of monitoring and mitigation techniques. This process includes conducting an annual adaptive management review meeting where the Navy and NMFS jointly consider the prior year's goals, monitoring results, and related scientific advances to determine if monitoring plan modifications are warranted to address program goals more effectively. Modifications to the Integrated Comprehensive Monitoring Program that result from annual adaptive management review discussions are incorporated by an addendum or revision to the Integrated Comprehensive Monitoring Program as needed. The Integrated Comprehensive Monitoring Program will be routinely updated as the program evolves and progresses.

The Strategic Planning Process serves to guide the investment of resources to most efficiently address Integrated Comprehensive Monitoring Program objectives and intermediate scientific objectives. Navy-funded monitoring projects relating to the impact of Navy training and testing activities on protected marine species are designed to accomplish one or more of the following top-level goals, as described in the Integrated Comprehensive Monitoring Program charter:

- Increase the understanding of the likely occurrence of marine mammals and ESA-listed marine species in the vicinity of the action (e.g., presence, abundance, distribution, density).
- Increase the understanding of the nature, scope, or context of the likely exposure of marine mammals and ESA-listed marine species to any of the potential stressors associated with the action (e.g., acoustics, explosives, physical disturbance and strike of military expended materials) through a better understanding of one or more of the following: (1) the nature of the action and its surrounding environment (e.g., sound-source characterization, propagation, ambient noise levels), (2) the affected species (e.g., life history, dive patterns), (3) the likely co-occurrence of marine mammals and ESA-listed marine species with the action (in whole or part), and (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving, or feeding areas).
- Increase the understanding of how individual marine mammals or ESA-listed marine species respond behaviorally or physiologically to the specific stressors associated with the action and in what context (e.g., at what distance or received level).
- Increase the understanding of how anticipated individual responses to individual stressors or anticipated combinations of stressors may impact either: (1) the long-term fitness and survival of an individual, or (2) the population, species, or stock (e.g., through impacts on annual rates of recruitment or survival).
- Increase the understanding of the effectiveness of mitigation and monitoring.
- Improve the understanding and record of the manner in which the Navy complies with its Incidental Take Authorizations and Incidental Take Statements.

- Increase the probability of detecting marine mammals through improved technology or methods within the mitigation zones (to improve mitigation effectiveness) and generally (to better achieve monitoring goals).

The Navy established a Scientific Advisory Group in 2011 with the initial task of evaluating current Navy monitoring approaches under the Integrated Comprehensive Monitoring Plan and existing MMPA Regulations and Letters of Authorization. The Scientific Advisory Group was also tasked with developing objective scientific recommendations that would form the basis for the Strategic Plan. While recommendations were fairly broad and not specifically prescriptive, the Scientific Advisory Group did provide specific programmatic recommendations that serve as guiding principles for the continued evolution of the Integrated Comprehensive Monitoring Program. Key recommendations included:

- Working within a conceptual framework of knowledge, from basic information on the occurrence of species within each range complex, to more specific matters of exposure, response, and consequences.
- Facilitating collaboration among researchers in each region, with the intent to develop a coherent and synergistic regional monitoring and research effort.
- Striving to move away from effort-based compliance metrics (e.g., completing a pre-determined amount of survey hours or days), with the intent to design and conduct monitoring projects according to scientific objectives rather than effort expended.
- Approaching the monitoring program holistically and selecting projects that offer the best opportunity to advance understanding of the issues, as opposed to establishing range-specific requirements.

5.1.2.2.1.3 Strategic Planning Process

The U.S. Navy Marine Species Monitoring Program has evolved and improved as a result of adaptive management review and the Strategic Planning Process through changes that include:

- Recognizing the limitations of effort-based compliance metrics;
- Developing a strategic approach to monitoring based on recommendations from the Scientific Advisory Group;
- Shifting focus to projects based on scientific objectives that facilitate generation of statistically meaningful results upon which natural resources management decisions may be based;
- Focusing on priority species or areas of interest as well as best opportunities to address specific monitoring objectives to maximize return on investment; and
- Increasing transparency of the program and management standards, improving collaboration among participating researchers, and improving accessibility to monitoring data and results.

As a result of the changes outlined above due to the implementation of the Strategic Planning Process, the U.S. Navy Marine Species Monitoring Program has undergone a transition. Intermediate scientific objectives now serve as the basis for developing and executing new monitoring projects across Navy training and testing areas in the Atlantic and Pacific Oceans. Implementation of the Strategic Planning Process involves coordination among fleets, system commands, Chief of Naval Operations Energy and Environmental Readiness Division, NMFS, and the Marine Mammal Commission with five primary steps:

- **Identify overarching intermediate scientific objectives.** Through the adaptive management process, the Navy coordinates with NMFS and the Marine Mammal Commission to review and revise the list of intermediate scientific objectives that guide development of individual

monitoring projects. Examples include addressing information gaps in species occurrence and density, evaluating behavioral responses of marine mammals to Navy training and testing activities, and developing tools and techniques for passive acoustic monitoring.

- **Develop individual monitoring project concepts.** This step generally takes the form of soliciting input from the scientific community in terms of potential monitoring projects that address one or more of the intermediate scientific objectives. This can be accomplished through a variety of forums, including professional societies, regional scientific advisory groups, and contractor support.
- **Evaluate, prioritize, and select monitoring projects.** Navy technical experts and program managers review and evaluate monitoring project concepts and develop a prioritized ranking. The goal of this step is to establish a suite of monitoring projects that address a cross-section of intermediate scientific objectives spread over a variety of range complexes.
- **Execute and manage selected monitoring projects.** Individual projects are initiated through appropriate funding mechanisms and include clearly defined objectives and deliverables, such as data, reports, or publications.
- **Report and evaluate progress and results.** Progress on individual monitoring projects is updated through the U.S. Navy Marine Species Monitoring Program website as well as annual monitoring reports submitted to NMFS. Both internal review and discussions with NMFS through the adaptive management process are used to evaluate progress toward addressing the primary objectives of the Integrated Comprehensive Monitoring Program and serve to periodically recalibrate the focus of the monitoring program.

These steps serve three primary purposes: (1) to facilitate the Navy in developing specific projects addressing one or more intermediate scientific objectives, (2) to establish a more structured and collaborative framework for developing, evaluating, and selecting monitoring projects across areas where the Navy conducts training and testing activities, and (3) to maximize the opportunity for input and involvement across the research community, academia, and industry. This process is designed to integrate various elements, including:

- Integrated Comprehensive Monitoring Program top-level goals,
- Scientific Advisory Group recommendations,
- Integration of regional scientific expert input,
- Ongoing adaptive management review dialog between NMFS and the Navy,
- Lessons learned from past and future monitoring of Navy training and testing, and
- Leveraging of research and lessons learned from other Navy-funded science programs.

The Strategic Planning Process will continue to shape the future of the U.S. Navy Marine Species Monitoring Program and serve as the primary decision-making tool for guiding investments. Information on monitoring projects currently underway in the Atlantic and Pacific oceans, as well as results, reports, and publications, can be accessed through the U.S. Navy Marine Species Monitoring Program website.

5.1.2.2.2 Training and Testing Activity Reports

The Navy developed a classified data repository known as the Sonar Positional Reporting System to maintain an internal record of underwater sound sources (e.g., active sonar) used during training and testing. The Sonar Positional Reporting System facilitates reporting pursuant to the Navy's MMPA Regulations and Letters of Authorization. Using data from the Sonar Positional Reporting System and other relevant sources, the Navy will continue to provide the NMFS Office of Protected Resources with

classified or unclassified (depending on the data) annual reports on the training and testing activities that use underwater sound sources. In its annual training and testing activity reports, the Navy will describe the level of training and testing conducted during the reporting period. For example, the Navy will report the location and total hours and counts of active sonar hours and in-water explosives used, and an assessment if activities conducted in the Study Area exceeded levels of training and testing analyzed in the MMPA authorization and ESA Biological Opinion. For major training exercises, the reports will also include information on each individual marine mammal sighting related to mitigation implementation. Unclassified annual training and testing activity reports that have been submitted to NMFS can be found on the NMFS Office of Protected Resources and U.S. Navy Marine Species Monitoring Program webpages.

5.1.2.2.3 Incident Reports

The Navy's mitigation measures and many of its standard operating procedures are designed to prevent incidents involving biological and cultural resources, such as aircraft strikes, vessel strikes, and impacts on submerged historic properties and seafloor resources. The Navy has been collecting data on such incidents (if they have occurred) for more than a decade and will continue doing so under the Proposed Action. To provide information on incidents involving biological or cultural resources, the Navy will submit reports to the appropriate management authorities, as described below:

- **Birds:** As described in Section 2.3.3.3 (Aircraft Safety), bird strikes present an aviation safety risk for aircrews and aircraft. The Navy will report all bird strikes per standard operating procedures.
- **Marine Mammals, Sea Turtles, and ESA-Listed Species:** The Navy will notify the appropriate regulatory agency, which may include NMFS or the USFWS, immediately or as soon as operational security considerations allow if it observes the following that is (or may be) attributable to Navy activities: (1) a vessel strike of a marine mammal or sea turtle during training or testing, (2) a stranded, injured, or dead marine mammal or sea turtle during training or testing, or (3) an injured or dead marine mammal, sea turtle or ESA-listed species during post-explosive event monitoring. The Navy will provide relevant information pertaining to the incident (e.g., vessel speed). Additional details on these incident reporting requirements will be included in the Notification and Reporting Plan. The Navy will continue to provide the appropriate personnel with training on marine species incidents and their associated reporting requirements to aid the data collection and reporting processes (see Section 5.3.1, Environmental Awareness and Education). Information on marine mammal strandings is included in the *Marine Mammal Strandings Associated with U.S. Navy Sonar Activities* technical report (U.S. Department of the Navy, 2017a).
- **Cultural Resources:** In the event the Navy impacts a submerged historic property (e.g., archaeological resource), it will commence consultation with the appropriate State Historic Preservation Officer or Tribal Historic Preservation Officer in accordance with 36 Code of Federal Regulations section 800.13(b)(3).

5.2 Mitigation Development Process

The Navy, in coordination with the appropriate regulatory agencies, developed its initial suite of mitigation measures for Phase I of environmental planning (2009–2014) and subsequently revised those mitigation measures for Phase II (2013–2018). For this Final EIS/OEIS (which represents Phase III of environmental planning), the Navy worked collaboratively with the appropriate regulatory agencies to develop and finalize its mitigation through the consultation and permitting processes. The mitigation development process involved reanalyzing existing Phase II measures and analyzing new mitigation

recommendations received from Navy and NMFS scientists, other governmental agencies, the public, and non-governmental organizations during the NEPA, consultation, and permitting processes. The Navy conducted a detailed review and assessment of each potential mitigation measure individually and then all potential mitigation measures collectively to determine if, as a whole, mitigation will effectively avoid or reduce potential impacts from the Proposed Action and will be practical to implement. The Navy operational community (i.e., leadership from the aviation, surface, subsurface, and special warfare communities; leadership from the research and acquisition community; and training and testing experts), environmental planners, and scientific experts provided input on the effectiveness and practicality of mitigation implementation. Navy Senior Leadership reviewed and approved the suite of mitigation measures included in this Final EIS/OEIS and determined it is the highest level of mitigation practical for the Navy to implement under the Proposed Action.

Mitigation measures that the Navy will implement under the Proposed Action are organized into two categories: procedural mitigation measures and mitigation areas. The sections below provide definitions of mitigation terminology, background information pertinent to the mitigation development process, and information about the mitigation effectiveness and practicality criteria. Additional activity or stressor-specific details, such as the level of effect to which a procedural mitigation measure is expected to mitigate and if a measure has been modified from Phase II is provided throughout Section 5.3 (Procedural Mitigation to be Implemented) and Section 5.4 (Mitigation Areas to be Implemented). Section 5.5 (Measures Considered but Eliminated) contains information on measures that did not meet the appropriate balance between being effective and practical to implement, and therefore will not be implemented under the Proposed Action.

5.2.1 Procedural Mitigation Development

Procedural mitigation is mitigation that the Navy will implement whenever and wherever training or testing activities involving applicable acoustic, explosive, and physical disturbance and strike stressors take place within the Study Area. Procedural mitigation generally involves: (1) the use of one or more trained Lookouts to observe for specific biological resources within a mitigation zone, (2) requirements for Lookouts to immediately communicate sightings of specific biological resources to the appropriate watch station for information dissemination, and (3) requirements for the watch station to implement mitigation until a pre-activity commencement or during-activity recommencement condition has been met.

Procedural mitigation primarily involves Lookouts observing for marine mammals and sea turtles. For some activities, Lookouts may also be required to observe for additional biological resources, such as marine birds, fish, jellyfish aggregations, or floating vegetation. In this chapter, the term “floating vegetation” refers specifically to floating concentrations of detached kelp paddies and *Sargassum*. Some biological resources, such as floating vegetation, can be indicators of potential marine mammal or sea turtle presence because marine mammals or sea turtles have been known to seek shelter in, feed on, or feed among them. For example, young sea turtles have been known to hide from predators and eat the algae associated with floating concentrations of *Sargassum*. The Navy observes for these additional biological resources prior to the initial start or during the conduct of certain activities to protect ESA-listed species or to offer an additional layer of protection for marine mammals and sea turtles.

To consider the benefits of procedural mitigation to marine mammals and sea turtles within the MMPA and ESA impact estimates, the Navy conservatively factored mitigation effectiveness into its quantitative analysis process, as described in the technical report titled *Quantifying Acoustic Impacts on Marine*

Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing (U.S. Department of the Navy, 2018). The Navy's quantitative analysis assumes that Lookouts will not be 100 percent effective at detecting all individual marine mammals and sea turtles within the mitigation zones for each activity. This is due to the inherent limitations of observing marine species and because the likelihood of sighting individual animals is largely dependent on observation conditions (e.g., time of day, sea state, mitigation zone size, observation platform) and animal behavior (e.g., the amount of time an animal spends at the surface of the water). This is particularly true for sea turtles, small marine mammals, and marine mammals that display cryptic behaviors (e.g., surfacing to breathe with only a small portion of their body visible from the surface). Throughout Section 5.3 (Procedural Mitigation to be Implemented), discussions about the likelihood that a Lookout would observe a marine mammal or sea turtle pertain specifically to animals that are available to be observed (i.e., on, above, or just below the water's surface). The benefits of procedural mitigation measures for species that were not included in the quantitative analysis process (e.g., birds, fish) are discussed qualitatively.

Data inputs for assessing and developing procedural mitigation included operational data as described in Section 5.2.3 (Practicality of Implementation), the best available science discussed in Chapter 3 (Affected Environment and Environmental Consequences), published literature, data on marine mammal and sea turtle impact ranges obtained through acoustic modeling, marine species monitoring and density data, and the most recent guidance from NMFS and the USFWS. Background information on the data that were used to develop the ranges to effect for marine mammals and sea turtles (such as hearing threshold metrics) is provided in Chapter 3.7 (Marine Mammals) and Chapter 3.8 (Reptiles).

5.2.1.1 Lookouts

Lookouts perform similar duties as standard watch personnel (e.g., personnel on the bridge watch team and personnel stationed for man-overboard precautions, as described in Section 2.3.3, Standard Operating Procedures), but are designated the responsibility of helping meet the Navy's mitigation requirements by visually observing mitigation zones. The number of Lookouts designated for each training or testing activity is dependent upon the number of personnel involved in the activity (i.e., manning restrictions) and the number and type of assets available (i.e., equipment and space restrictions).

Depending on the activity, a Lookout may be positioned on a ship (i.e., surface ships and surfaced submarines), on a small boat (e.g., rigid-hull inflatable boat), in an aircraft, on a pier, or on the shore. Certain platforms, such as aircraft and small boats, have manning or space restrictions; therefore, the Lookout on these platforms is typically an existing member of the aircraft or boat crew who is responsible for other essential tasks (e.g., a pilot who is also responsible for navigation). Some platforms (e.g., the Littoral Combat Ship) are minimally manned and are therefore either physically unable to accommodate more than one Lookout or divert personnel from mission-essential tasks, including safe and secure operation of propulsion, weapons, and damage control systems that ensure the safety of the ship and the personnel on board. The number of Lookouts specified for each activity in Section 5.3 (Procedural Mitigation to be Implemented) represents the maximum number of Lookouts that can be designated for those activities without requiring additional personnel or reassigning duties. The Navy is unable to position Lookouts on unmanned surface vehicles, unmanned aerial systems, unmanned underwater vehicles, and submerged submarines, or have Lookouts observe during activities that use systems deployed from or towed by unmanned platforms.

When Lookouts are positioned in a fixed-wing aircraft or rotary-wing aircraft (i.e., helicopter), mission requirements determine the flight parameters (altitude, flight path, and speed) for that aircraft. For example, most fixed-wing aircraft sorties occur above 3,000 feet (ft.), while most rotary-wing sorties associated with mine countermeasure activities occur at altitudes as low as 75–100 ft. Similarly, when Lookouts are positioned on a vessel, mission requirements determine the operational parameters (course and speed) for that vessel.

The Navy's passive acoustic devices (e.g., remote acoustic sensors, expendable sonobuoys, passive acoustic sensors on submarines) can complement visual observations for marine mammals when passive acoustic assets are already participating in an activity. The passive acoustic devices can detect vocalizing marine mammals within the frequency bands already being monitored by Navy personnel. Marine mammal detections from passive acoustic devices can alert Lookouts to possible marine mammal presence in the vicinity. Lookouts can use the information from passive acoustic detections to assist their visual observations of the mitigation zone. Based on the number and type of passive acoustic devices that are typically used, passive acoustic detections do not provide range or bearing to a detected animal in order to determine its location or confirm its presence in a mitigation zone. Therefore, it is not practical for the Navy to implement mitigation in response to passive acoustic detections alone (i.e., without a visual sighting of an animal within the mitigation zone). Additional information about passive acoustic devices is provided in Section 5.5.3 (Active and Passive Acoustic Monitoring Devices).

5.2.1.2 Mitigation Zones

Mitigation zones are areas at the surface of the water within which applicable training or testing activities will be ceased, powered down, or modified to protect specific biological resources from an auditory injury (permanent threshold shift [PTS]), non-auditory injury (from impulsive sources), or direct strike (e.g., vessel strike) to the maximum extent practicable. Mitigation zones are measured as the radius from a stressor. Implementation of procedural mitigation is most effective when mitigation zones are appropriately sized to be realistically observed during typical training and testing activity conditions.

The Navy customized its mitigation zone sizes and mitigation requirements for each applicable training and testing activity category or stressor. The Navy developed each mitigation zone to be the largest area that: (1) Lookouts can reasonably be expected to observe during typical activity conditions (i.e., the most environmentally protective), and (2) the Navy can commit to implementing mitigation without impacting safety, sustainability, and the ability to meet mission requirements. The Navy designed the mitigation zones for most acoustic and explosive stressors according to its source bins. As described in Section 3.0.3.3.1.1 (Sonar and Other Transducers), sonars and other transducers are grouped into classes that share an attribute, such as frequency range or purpose of use. Classes are further sorted by bins based on the frequency or bandwidth, source level, and when warranted, the application in which the source would be used. As described in Section 3.0.3.3.2.1 (Explosions in Water), explosives detonated in water are binned by net explosive weight. Mitigation does not pertain to stressors that do not have the potential to impact biological resources (e.g., *de minimis* acoustic and explosive sources that do not have the potential to impact marine mammals).

Discussions throughout Section 5.3 (Procedural Mitigation to be Implemented) about the level of effect that will likely be mitigated are based on a comparison of the mitigation zone size to the predicted impact ranges for the applicable source bins with the longest average ranges to PTS. These conservative discussions represent the worst-case scenario for each activity category or stressor. The mitigation zones will oftentimes cover all or a larger portion of the predicted average ranges to PTS for other

comparatively smaller sources with shorter impact ranges (e.g., sonar sources used at a lower source level, explosives in a smaller bin). The discussions are primarily focused on how the mitigation zone sizes compare to the ranges to PTS; however, depending on the activity category or stressor, the mitigation zones are oftentimes large enough to also mitigate within a portion of the ranges to temporary threshold shift (TTS). TTS is a threshold shift that is recoverable. Background information on PTS, TTS, and marine mammal and sea turtle hearing groups is presented in the U.S. Department of the Navy (2017b) technical report titled *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*.

5.2.1.3 Procedural Mitigation Implementation

The Navy takes several courses of action in response to a sighting of an applicable biological resource in a mitigation zone. First, a Lookout will communicate the sighting to the appropriate watch station. Next, the watch station will implement the prescribed mitigation, such as delaying the initial start of an activity, powering down sonar, ceasing an explosive detonation, or maneuvering a vessel. If floating vegetation is observed in the mitigation zone prior to the initial start of an activity, the activity will either be relocated to an area where floating vegetation is not observed in concentrations, or the initial start of the activity will be delayed until the mitigation zone is clear of floating vegetation concentrations. There are no requirements to cease activities if vegetation floats into the mitigation zone after activities commence. For sightings of marine mammals, sea turtles, and other specified biological resources within a mitigation zone prior to the initial start of or during applicable activities, the Navy will continue mitigating until one of the five conditions listed below has been met. The conditions are designed to allow a sighted animal to leave the mitigation zone before the initial start of an activity or before an activity resumes.

- The animal is observed exiting the mitigation zone;
- The animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the stressor source;
- The mitigation zone has been clear from any additional sightings for a specific wait period;
- For mobile activities, the stressor source has transited or has been relocated a distance equal to double the mitigation zone size beyond the location of the last sighting; or
- For activities using hull-mounted sonar, the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave and are therefore out of the main transmission axis of the sonar (and there are no other marine mammal sightings within the mitigation zone).

To supplement the implementation of procedural mitigation, the Navy has agreed to undertake reporting initiatives for certain activities or resources based on previous consultations with NMFS and the USFWS, as summarized in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives) and detailed where applicable in Section 5.3 (Procedural Mitigation to be Implemented). For some activities, the Navy also agreed during previous consultations with NMFS or the USFWS to adapt some of its procedural mitigation for particular resources at certain locations and plans to continue those mitigation measures for Phase III. For example, the Navy will continue implementing mitigation measures for ESA-listed scalloped hammerhead sharks within the Southern California Range Complex, as discussed in Section 5.3.3.8 (Explosive Mine Neutralization Activities Involving Navy Divers).

5.2.2 MITIGATION AREA DEVELOPMENT

Mitigation areas are geographic locations within the Study Area where the Navy will implement mitigation measures to: (1) avoid or reduce potential impacts on biological or cultural resources that are not observable by Lookouts from the water's surface (i.e., resources for which procedural mitigation cannot be implemented), (2) in combination with procedural mitigation, effect the least practicable adverse impact on marine mammal species or stocks and their habitat, or (3) in combination with procedural mitigation, ensure that the Proposed Action does not jeopardize the continued existence of endangered or threatened species, or result in destruction or adverse modification of critical habitat.

The Navy completed an extensive assessment of the Study Area to develop the mitigation areas included in this Final EIS/OEIS. The Navy reanalyzed existing Phase II mitigation areas; assessed additional habitat areas suggested by the public, NMFS, other governmental agencies, and non-governmental organizations; and considered other habitats identified internally by the Navy. Data inputs for mitigation area assessment and development included the operational information described in Section 5.2.3 (Practicality of Implementation), the best available science discussed in Chapter 3 (Affected Environment and Environmental Consequences), published literature, predicted activity impact footprints, and marine species monitoring and density data. The Navy considered a mitigation area to be effective if it met the following criteria:

- **The mitigation area is a key area of biological or ecological importance or contains cultural resources:** The best available science suggests that the mitigation area contains submerged cultural resources (e.g., shipwrecks) or is particularly important to one or more species or resources for a biologically important life process (i.e., foraging, migration, reproduction) or ecological function (e.g., shallow-water coral reefs that provide critical ecosystem functions); and
- **The mitigation will result in an avoidance or reduction of impacts:** Implementing the mitigation will likely avoid or reduce potential impacts on: (1) species, stocks, or populations of marine mammals based on data regarding their seasonality, density, and behavior; or (2) other biological or cultural resources based on their distribution and physical properties. Furthermore, implementing the mitigation will not shift or transfer adverse effects from one species to another (e.g., to a more vulnerable or sensitive species).

Potential impacts on environmental and cultural resources cannot occur unless there is an overlap between a resource and a stressor. During the mitigation assessment and development process, the Navy did not develop mitigation areas in locations where stressors are not used because doing so would not meet the basic definition of effective mitigation (i.e., the mitigation areas would not effectively avoid or reduce potential impacts). For example, some explosive activities cannot realistically be conducted in certain areas based on operational requirements relating to water depth; therefore, mitigation to avoid conducting explosives in these locations is not warranted.

The benefits of mitigation areas are discussed qualitatively and have not been factored into the quantitative analysis process or reductions in take for MMPA and ESA impact estimates. Marine mammal mitigation areas are designed to help avoid or reduce potential impacts during biologically important life processes within particularly important habitat areas. Therefore, the mitigation benefit is discussed in terms of the context of impact avoidance or reduction.

A full biological assessment and operational analysis of the mitigation areas that the Navy considered for marine mammals is provided in Appendix K (Geographic Mitigation Assessment). The appendix includes

background information and additional details for each of the areas considered, which include mitigation areas developed for Phase II, biologically important areas identified by Van Parijs et al. (2015), temporary litigation settlement measures resulting from a 2015 HSTT-related lawsuit, areas identified by the California Coastal Commission, and areas identified during the NEPA process. As described in Appendix K (Geographic Mitigation Assessment), following publication of the 2013 Hawaii-Southern California Final EIS/OEIS, a 2015 HSTT-related settlement agreement temporarily prohibited or restricted Navy activities within specific areas in the HSTT Study Area. The temporary settlement measures were derived pursuant to negotiations with plaintiffs and were not evaluated or selected based on the type of thorough examination of best available science that occurs through the consultation process under the MMPA, or through analysis conducted for NEPA purposes. The Navy's adoption of temporary restrictions on its activities as part of a short-term litigation settlement does not mean that those restrictions were supported by the best available science or practical to implement over a longer term. The temporary settlement and its terms were never intended to be a framework for how the Navy develops or implements future mitigation within the HSTT Study Area. Mitigation areas developed for the Proposed Action include a continuation of some settlement measures, the development of new mitigation areas, and the continuation or expansion of existing mitigation areas developed through previous MMPA or ESA consultations. A discussion of the mitigation areas developed for this Final EIS/OEIS is presented in Section 5.4 (Mitigation Areas to be Implemented).

5.2.3 Practicality of Implementation

Mitigation measures are expected to have some degree of impact on the training and testing activities that implement them (e.g., modifying where and when activities occur, ceasing an activity in response to a sighting). The Navy is willing to accept a certain level of impact on its military readiness activities because of the substantial benefit that mitigation measures provide for avoiding or reducing impacts on environmental and cultural resources. The Navy's focus during mitigation assessment and development was that mitigation measures must meet the appropriate balance between being effective and practical to implement. To evaluate practicality, the Navy operational community conducted an extensive and comprehensive assessment to determine how and to what degree potential mitigation measures would be compatible with planning, scheduling, and conducting training and testing activities under the Proposed Action in order to meet the Navy's Title 10 requirements.

5.2.3.1 Assessment Criteria

The purpose and need of the Proposed Action is to ensure that the Navy meets its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The Navy is statutorily mandated to protect U.S. national security by being ready, at all times, to effectively prosecute war and defend the nation by conducting operations at sea, as outlined in Title 10 section 5062 of the United States Code. The Navy's mission is achieved in part by conducting training and testing within the Study Area in accordance with established Navy military readiness requirements. Training requirements have been developed through many years of iteration and adaptation and are designed to ensure that Sailors achieve the levels of readiness needed to properly respond to the multitude of contingencies they may face during military missions and combat operations. Activities are planned and scheduled in accordance with the Optimized Fleet Response Plan, which details instructions on manning distribution, range scheduling, operational requirements, maintenance and modernization plans, quality of work and life for personnel, achieving training capabilities, and meeting strategic readiness objectives.

To achieve the highest skill proficiency and most accurate testing results possible, the Navy conducts activities in a variety of realistic tactical oceanographic and environmental conditions. Such conditions include variations in bathymetry, topography, surface fronts, and sea surface temperatures. Training activities must be as realistic as possible to provide the experiences vital to success and survival during military missions and combat operations. Degraded training would result in units being unqualified to conduct the range of military operations required by operational Commanders. The inability of such Commanders to meet security objectives would result in not only the increased risk to life, but also the degradation of national security. Testing activities must be as realistic as possible for the Navy to conduct accurate acoustic research to validate acoustic models; conduct accurate engineering tests of acoustic sources, signal processing algorithms, and acoustic interactions; and to effectively test systems and platforms (and components of these systems and platforms) to validate whether they perform as expected and determine whether they are operationally effective, suitable, survivable, and safe for their intended use by the fleet. Testing must be completed before full-scale production or delivery to the fleet to ensure functionality and accuracy in military mission and combat conditions.

As described in Chapter 2 (Description of Proposed Action and Alternatives), the Navy requires access to sea space and airspace throughout the Study Area within range complexes, pierside locations, nearshore areas, and large-scale open ocean areas of the high seas. Each area plays a critical role in the Navy's ability to plan, schedule, and effectively execute military readiness activities. The locations where training and testing occur must be situated in a way that allows the Navy to complete its activities without physical or logistical obstructions. The Navy requires extensive sea space so that individual training and testing activities can occur at sufficient distances so they do not interfere with one another. Some training and testing activities require continuous access to large and unobstructed areas, consisting potentially of tens or thousands of square miles. This provides personnel the ability to develop competence and confidence in their capabilities across multiple types of weapons and sensors, and the ability to train to communicate and operate in a coordinated fashion as required during military missions and combat operations. For example, major training exercises using integrated warfare components may require large areas of the littorals, open ocean, and nearshore areas for realistic and safe anti-submarine warfare training. The Navy also requires large areas of sea space because it trains in a manner to avoid observation by potential adversaries. Modern sensing technologies make training on a large scale without observation more difficult. A foreign military's continual observation of U.S. Navy training in predictable geographic areas and timeframes would enable foreign nations to gather intelligence and subsequently develop techniques, tactics, and procedures to potentially and effectively counter U.S. naval operations. Other activities may be conducted on a smaller and more localized scale, with training or testing at discrete locations that are critical to certain aspects of military readiness.

The locations for training and testing activities are selected to maximize efficiency while supporting specific mission and safety requirements, deconflict sea space and airspace, and minimize the time personnel must spend away from home. Training and testing locations are typically selected based on their proximity to homeports, home bases, associated training ranges, testing facilities, air squadrons, and existing infrastructure (e.g., instrumented underwater ranges) to reduce travel time and associated costs. Activities involving the use of rotary-wing aircraft typically occur in proximity to shore or refueling stations due to fuel restrictions and safety requirements. Testing areas are typically located near systems command support facilities, which provide critical infrastructure support and technical expertise necessary to conduct testing. Logistical support of range testing can only efficiently and effectively occur when the support is co-located with the testing activities. These same principles also apply to pierside and at-sea testing that must occur in proximity to naval shipyards and Navy contractor

shipyards. Testing event site locations and associated field activities were originally established to support specific Navy mission testing needs using a selection process that included testing requirements, cost of living, availability of personnel, and low level of crowding from industry and development.

During its assessment to determine how and to what degree the implementation of mitigation would be compatible with meeting the purpose and need of the Proposed Action, the Navy considered mitigation measures to be practical to implement if they met all criteria discussed below:

- **Implementing the mitigation is safe:** Mitigation measures must not increase safety risks to Navy personnel and equipment, or to the public. When assessing whether implementing a mitigation measure would be safe, the Navy factored in the potential for increased pilot fatigue; accelerated fatigue-life of aircraft; typical fuel restrictions of participating aircraft; locations of refueling stations; proximity to aircraft emergency landing fields, critical medical facilities, and search and rescue capabilities; space restrictions of the observation platforms; the ability to de-conflict platforms and activities to ensure that training and testing activities do not impact each other; and the ability to avoid interaction with non-Navy sea space and airspace uses, such as established commercial air traffic routes, commercial vessel shipping lanes, and areas used for energy exploration or alternative energy development. Other safety considerations included identifying if mitigation measures would reasonably allow Lookouts to safely and effectively maintain situational awareness while observing the mitigation zones during typical activity conditions, or if the mitigation would increase the safety risk for personnel. For example, the safety risk would increase if Lookouts were required to direct their attention away from essential mission requirements.
- **Implementing the mitigation is sustainable:** One of the primary factors that the Navy incorporates into the planning and scheduling of its training and testing activities is the amount and type of available resources, such as funding, personnel, and equipment. Mitigation measures must be sustainable over the life of the Proposed Action, meaning that they will not require the use of resources in excess of what is available. When assessing whether implementing a mitigation measure would be sustainable, the Navy considered if the measure would require excessive time on station or time away from homeport for Navy personnel, require the use of additional personnel (i.e., manpower) or equipment (e.g., adding a small boat to serve as an additional observation platform), or result in additional operational costs (e.g., increased fuel consumption, equipment maintenance, or acquisition of new equipment).
- **Implementing the mitigation allows the Navy to continue meeting its mission requirements:** The Navy considered if each individual measure and the iterative and cumulative impact of all potential measures would be within the Navy's legal authority to implement. The Navy also considered if mitigation would modify training or testing activities in a way that would prevent individual activities from meeting their mission objectives and if mitigation would prevent the Navy from meeting its national security requirements or statutorily-mandated Title 10 requirements, such as by:
    - Impacting training and testing realism or preventing ready access to ranges, operating areas, facilities, or range support structures (which would reduce realism and present sea space and airspace conflicts).
    - Impacting the ability for Sailors to train and become proficient in using sensors and weapon systems as would be required in areas analogous to where the military operates or causing an erosion of capabilities or reduction in perishable skills (which would result

in a significant risk to personnel or equipment safety during military missions and combat operations).

- Impacting the ability for units to meet their individual training and certification requirements (which would impact the ability to deploy with the required level of readiness necessary to accomplish any tasking by Combatant Commanders).
- Impacting the ability to certify forces to deploy to meet national security tasking (which would limit the flexibility of Combatant Commanders and warfighters to project power, engage in multi-national operations, and conduct the full range of naval warfighting capabilities in support of national security interests).
- Impacting the ability of researchers, program managers, and weapons system acquisition programs to conduct accurate acoustic research to meet research objectives, effectively test systems and platforms (and components of these systems and platforms) before full-scale production or delivery to the fleet, or complete shipboard maintenance, repairs, or pierside testing prior to at-sea operations (which would not allow the Navy to ensure safety, functionality, and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements).
- Requiring the Navy to provide advance notification of specific times and locations of Navy platforms, such as platforms using active sonar (which would present national security concerns).
- Reducing the Navy's ability to be ready, maintain deployment schedules, or respond to national emergencies or emerging national security challenges (which would present national security concerns).

5.2.3.2 Factors Affecting Practicality

Two of the factors that influenced whether procedural mitigation measures met the practicality criteria were the number of times mitigation measures would likely be implemented and the duration over which the activity would likely be ceased. The number of times mitigation would likely be implemented is largely dependent on the size of the mitigation zone. As a mitigation zone size increases, the area of observation increases by an order of magnitude. This is because mitigation zones are measured as the radius (r) from a stressor but apply to circular area (A) around that stressor ($A = \pi * r^2$, where π is a constant that is approximately equal to 3.14). For example, a 100-yard (yd.) mitigation zone is equivalent to an area of 31,416 square yd. A 200-yd. mitigation zone is equivalent to an area of 125,664 square yd. Therefore, increasing a mitigation zone from 100 yd. to 200 yd. (i.e., doubling the mitigation zone radius) would quadruple the mitigation zone area (the area over which mitigation must be implemented). Similarly, increasing a mitigation zone from 1,000 yd. to 4,000 yd. (i.e., quadrupling the mitigation zone radius) would increase the mitigation zone area by a factor of 16. Increasing the area over which mitigation must be implemented consequently increases the number of times mitigation would likely be implemented during that activity.

The duration over which mitigation is implemented can differ considerably depending on the mitigation zone size, number of animal sightings, behavioral state of animals sighted (e.g., travelling at a fast pace on course to exit the mitigation zone, milling slowly in the center of the mitigation zone), and which pre-activity commencement or during-activity recommencement condition is met before the activity can commence or resume after each sighting. The duration of mitigation implementation typically equates to the amount of time the training or testing activity will be extended. The impact that extending the

length of an activity has on safety, sustainability, and the Navy's ability to accomplish the activity's intended objectives varies by activity. This is one reason why the Navy tailors its mitigation zone sizes and mitigation requirements by activity category or stressor and the platforms involved.

As described in Section 5.2.1 (Procedural Mitigation Development), the Navy will mitigate for each applicable sighting and will continue mitigating until one of five conditions has been met. In some instances, such as if an animal dives underwater after a sighting, it may not be possible for a Lookout to visually verify if the animal has exited the mitigation zone. The Navy cannot delay or cease activities indefinitely for the purpose of mitigation due to impacts on safety, sustainability, and the Navy's ability to continue meeting its mission requirements. To account for this, one of the pre-activity commencement and during-activity recommencement conditions is an established post-sighting wait period of 30 minutes (min.) or 10 min., based on the platforms involved. Wait periods are designed to allow animals the maximum amount of time practical to resurface (i.e., become available to be observed by a Lookout) before activities resume. When developing the length of its wait periods, the Navy factored in the assumption that mitigation may need to be implemented more than once. For example, an activity may need to be delayed or ceased for more than one 30-min. or 10-min. period. Information on diving behaviors of marine mammals and sea turtles is presented in the U.S. Department of the Navy (2017c) technical report titled *Dive Distribution and Group Size Parameters for Marine Species Occurring in the U.S. Navy's Atlantic and Hawaii-Southern California Training and Testing Study Areas*.

The Navy assigns a 30-min. wait period to activities conducted from vessels and activities that involve aircraft that are not typically fuel constrained (e.g., maritime patrol aircraft). A 30-min. period covers the average dive times of most marine mammals and a portion of the dive times of sea turtles and deep-diving marine mammals (i.e., sperm whales, dwarf and pygmy sperm whales [Kogia whales], and beaked whales) (U.S. Department of the Navy, 2017c). The Navy determined that a 30-min. wait period is the maximum wait time that is practical to implement during activities involving vessels and aircraft that are not typically fuel constrained to allow the activities to continue meeting their intended objectives. For example, the typical duration of Maritime Security Operations – Anti-Swimmer Grenades (which involve the use of small boats) is 1 hour. These activities are scheduled to occur at specific locations within specific timeframes based on range scheduling and for sea space deconfliction. Implementing one wait period would result in the activity being extended by half of the typical activity duration. The Navy determined that, given the benefit of this mitigation, a 30-min. wait period would be practical to implement for this activity; however, implementing a longer wait period (such as extending the wait period to 45 min. or 60 min. to cover the average dive times of sea turtles and additional marine mammal species) would be impractical. Increasing the wait period, and consequently the amount of time the activity would need to be delayed or extended in order to accomplish its intended objective, would impact activity realism or cause sea space conflicts in a way that could impact the Navy's ability to continue meeting its mission requirements. For example, delaying an activity for multiple wait periods could result in personnel not being able to detonate an explosive before the participating platforms are required to depart the range due to range scheduling; therefore, the activity would not accomplish its intended objectives.

The Navy assigns a 10-min. wait period to activities involving aircraft that are typically fuel constrained (e.g., rotary-wing aircraft, fighter aircraft). A 10-min. period covers a portion, but not the average, dive times of marine mammals and sea turtles (U.S. Department of the Navy, 2017c). The Navy determined that a 10-min. wait period is the maximum wait time that is practical to implement during activities involving aircraft that are typically fuel constrained. Increasing the wait period, and consequently the

amount of time the training or testing activity would need to be extended in order to accomplish its intended objective, would require aircraft to depart the activity area to refuel in order to safely complete the event. If the wait period was implemented multiple times, the aircraft would be required to depart the activity area to refuel multiple times. Refueling events would vary in duration, depending on the activity location and proximity to the nearest refueling station. Multiple refueling events would generally be expected to extend the length of the activity by two to five times or more. This would impact activity realism, could cause air space or sea space conflicts in a way that could impact the Navy's ability to continue meeting its mission requirements, would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area, and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. For example, delaying a Kilo Dip activity for multiple wait periods could result in personnel not being able to conduct a functional check of the dipping sonar system before the rotary-wing aircraft is required to depart the range due to range scheduling; therefore, the activity would not accomplish its intended objectives.

Factors that influenced whether a mitigation area measure met the practicality criteria included the historical use and projected future use of geographic locations for training and testing activities under the Proposed Action, and the relative importance of each location. The frequency that an area is used for training or testing does not necessarily equate to that area's level of importance for meeting an individual activity objective, or collectively, the Navy's mission requirements. While frequently used areas can be essential to one or more types of military readiness activities, some infrequently used areas are critical for a particular training exercise, testing mission, or research project.

5.3 PROCEDURAL MITIGATION TO BE IMPLEMENTED

The first procedural mitigation measure (Section 5.3.1, Environmental Awareness and Education) is designed to aid Lookouts and other personnel with observation, environmental compliance, and reporting responsibilities. The remaining procedural mitigation measures are organized by stressor type and training or testing activity category.

5.3.1 ENVIRONMENTAL AWARENESS AND EDUCATION

The Navy will continue to implement procedural mitigation to provide environmental awareness and education to the appropriate personnel to aid visual observation, environmental compliance, and reporting responsibilities, as outlined in Table 5.3-1.

The Navy requires Lookouts and other personnel to complete their assigned environmental compliance responsibilities (e.g., mitigation, reporting requirements) before, during, and after training and testing activities. Marine Species Awareness Training was first developed in 2007 and has since undergone numerous updates to ensure that the content remains current. The most recent product was approved by NMFS and released by the Navy in 2014. In 2014, the Navy developed a series of educational training modules, known as the Afloat Environmental Compliance Training program, to ensure Navywide compliance with environmental requirements. The Afloat Environmental Compliance Training program, including the updated Marine Species Awareness Training, helps Navy personnel from the most junior Sailors to Commanding Officers gain a better understanding of their personal environmental compliance roles and responsibilities. Additional information on the Protective Measures Assessment Protocol is provided in Section 5.1.2.1 (Protective Measures Assessment Protocol), and additional information on training and testing activity and incident reports is provided in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives).

Table 5.3-1: Environmental Awareness and Education

Procedural Mitigation Description
Stressor or Activity • All training and testing activities, as applicable
Resource Protection Focus • Marine mammals • Sea turtles
Mitigation Requirements • Appropriate personnel (including civilian personnel) involved in mitigation and training or testing activity reporting under the Proposed Action will complete one or more modules of the U.S. Navy Afloat Environmental Compliance Training Series, as identified in their career path training plan. Modules include: – **Introduction to the U.S. Navy Afloat Environmental Compliance Training Series.** The introductory module provides information on environmental laws (e.g., ESA, MMPA) and the corresponding responsibilities that are relevant to Navy training and testing activities. The material explains why environmental compliance is important in supporting the Navy's commitment to environmental stewardship. – **Marine Species Awareness Training.** All bridge watch personnel, Commanding Officers, Executive Officers, maritime patrol aircraft aircrews, anti-submarine warfare and mine warfare rotary-wing aircrews, Lookouts, and equivalent civilian personnel must successfully complete the Marine Species Awareness Training prior to standing watch or serving as a Lookout. The Marine Species Awareness Training provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures. Navy biologists developed Marine Species Awareness Training to improve the effectiveness of visual observations for biological resources, focusing on marine mammals and sea turtles, and including floating vegetation, jellyfish aggregations, and flocks of seabirds. – **U.S. Navy Protective Measures Assessment Protocol.** This module provides the necessary instruction for accessing mitigation requirements during the event planning phase using the Protective Measures Assessment Protocol software tool. – **U.S. Navy Sonar Positional Reporting System and Marine Mammal Incident Reporting.** This module provides instruction on the procedures and activity reporting requirements for the Sonar Positional Reporting System and marine mammal incident reporting.

From an operational perspective, the interactive web-based format of the U.S. Navy Afloat Environmental Compliance Training Series is ideal for providing engaging and educational content that is cost effective and convenient to access by personnel who oftentimes face rotating job assignments. The U.S. Navy Afloat Environmental Compliance Training Series has resulted in an improvement in the quality and accuracy of training and testing activity reports, incident reports, and Sonar Positional Reporting System reports submitted by Navy operators. Improved reporting quality indicates that the U.S. Navy Afloat Environmental Compliance Training Series is helping to facilitate Navywide environmental compliance as intended.

Lookouts and members of the operational community have demonstrated enhanced knowledge and understanding of the Navy's environmental compliance responsibilities since the development of the U.S. Navy Afloat Environmental Compliance Training Series. From January 2007 through September 2018, the Navy reported four vessel strikes of whales during Navy activities in the Study Area (an average of 0.34 per year), with the last strike occurring in 2009. For the 10-year period (1997–2006) prior to the implementation of the original Marine Species Awareness Training in 2007, the Navy reported 15 vessel strikes of whales during Navy activities in the Study Area (an average of 1.5 per year). This is more than three times the amount reported for January 2007 through September 2018. It is likely that the implementation of the Marine Species Awareness Training starting in 2007, and the additional U.S. Navy Afloat Environmental Compliance Training Series modules starting in 2014, has contributed to this reduction in Navy vessel strikes of marine mammals. This indicates that the environmental awareness and education program is helping to improve the effectiveness of mitigation implementation. A more detailed analysis of marine mammal vessel strikes is presented in Section 3.7.3.4.1 (Impacts from Vessels and In-Water Devices).

5.3.2 ACOUSTIC STRESSORS

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the acoustic stressors or activities discussed in the sections below.

5.3.2.1 Active Sonar

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from active sonar, as outlined in Table 5.3-2. In addition to procedural mitigation, the Navy will implement mitigation for the use of active sonar within mitigation areas (see Section 5.4.2, Mitigation Areas for Marine Mammals in The Hawaii Range Complex and Section 5.4.3, Mitigation Areas for Marine Mammals in the Southern California Portion of the Study Area).

Table 5.3-2: Procedural Mitigation for Active Sonar

Procedural Mitigation Description
Stressor or Activity • Low-frequency active sonar, mid-frequency active sonar, high-frequency active sonar – For vessel-based activities, mitigation applies only to sources that are positively controlled and deployed from manned surface vessels (e.g., sonar sources towed from manned surface platforms). – For aircraft-based activities, mitigation applies only to sources that are positively controlled and deployed from manned aircraft that do not operate at high altitudes (e.g., rotary-wing aircraft). Mitigation does not apply to active sonar sources deployed from unmanned aircraft or aircraft operating at high altitudes (e.g., maritime patrol aircraft).
Resource Protection Focus • Marine mammals • Sea turtles (only for sources <2 kilohertz [kHz])
Number of Lookouts and Observation Platform • Hull-mounted sources: – 1 Lookout: Platforms with space or manning restrictions while underway (at the forward part of a small boat or ship) and platforms using active sonar while moored or at anchor (including pierside) – 2 Lookouts: Platforms without space or manning restrictions while underway (at the forward part of the ship) • Sources that are not hull-mounted: – 1 Lookout on the ship or aircraft conducting the activity
Mitigation Requirements • Mitigation zones: – 1,000 yd. power down, 500 yd. power down, and 200 yd. shut down for low-frequency active sonar ≥200 decibels (dB) and hull-mounted mid-frequency active sonar – 200 yd. shut down for low-frequency active sonar <200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of active sonar transmission. • During the activity: – Low-frequency active sonar ≥200 decibels (dB) and hull-mounted mid-frequency active sonar: Observe the mitigation zone for marine mammals and sea turtles (for sources <2 kHz); power down active sonar transmission by 6 dB if observed within 1,000 yd. of the sonar source; power down an additional 4 dB (10 dB total) within 500 yd.; cease transmission within 200 yd. – Low-frequency active sonar <200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar: Observe the mitigation zone for marine mammals and sea turtles (for sources <2 kHz); cease active sonar transmission if observed within 200 yd. of the sonar source.

Table 5.3-2: Procedural Mitigation for Active Sonar (continued)

Procedural Mitigation Description
• Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing or powering up active sonar transmission) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the sonar source; (3) the mitigation zone has been clear from any additional sightings for 10 min. for aircraft-deployed sonar sources or 30 min. for vessel-deployed sonar sources; (4) for mobile activities, the active sonar source has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting; or (5) for activities using hull-mounted sonar, the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave, and are therefore out of the main transmission axis of the sonar (and there are no other marine mammal sightings within the mitigation zone).

In Phase II, the Navy's active sonar mitigation zones were based on associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the sizes of these mitigation zones. The Navy determined that the current mitigation zones for active sonar are the largest areas within which it is practical to implement mitigation; therefore, it will continue implementing these same mitigation zones for Phase III. The Navy is clarifying in the table that the mitigation zone for low-frequency active sonar sources at or above 200 dB will be the same as the mitigation implemented for hull-mounted mid-frequency active sonar; whereas low-frequency active sonar sources below 200 dB will implement the same mitigation zone as high-frequency active sonar and mid-frequency active sonar sources that are not hull-mounted. The Navy is also clarifying that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting active sonar activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event.

The mitigation zone sizes and proximity to the observation platforms will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zones. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Section 3.7.3.1.2 (Impacts from Sonar and Other Transducers) provides a full analysis of the potential impacts of sonar on marine mammals and includes the predicted impact ranges for various source bins. For low-frequency active sonar at 200 dB or more and hull-mounted mid-frequency active sonar, bin MF1 has the longest predicted ranges to PTS. For the highest source level in bin MF1, the 1,000 yd. and 500 yd. power down mitigation zones and 200 yd. shut down mitigation zone extend beyond the average ranges to PTS for marine mammals. The ranges to PTS for the 200 yd. shut down mitigation zone were calculated based on full power transmissions and do not consider that the impact ranges would be reduced if the 1,000 yd. and 500 yd. power down mitigation measures are implemented in response to a marine mammal sighting in those mitigation zones. If an animal is first sighted in the 1,000 yd. or 500 yd. power down mitigation zone, the source level reduction would shorten the ranges to PTS, and the 200 yd. shut down mitigation would extend even further beyond the average ranges to PTS. For low-frequency active sonar below 200 dB, mid-frequency active sonar sources that are not hull-mounted, and high-frequency active sonar, bin HF4 has the longest predicted ranges to PTS. For the highest source level in bin HF4, the 200 yd. shut down mitigation zone extends beyond the average

ranges to PTS for marine mammals. The mitigation zones for active sonar will help avoid or reduce the potential for exposure to PTS for marine mammals.

The active sonar mitigation zones also extend into a portion of the average ranges to TTS for marine mammals; therefore, mitigation will help avoid or reduce the potential for some exposure to higher levels of TTS. Active sonar sources that fall within lower source bins or are used at lower source levels have shorter impact ranges than those discussed above; therefore, the mitigation zones will extend further beyond or into the average ranges to PTS and TTS for these sources. The analysis in Section 3.7.3.1.2 (Impacts from Sonar and Other Transducers) indicates that pygmy and dwarf sperm whales (Kogia whales) are the only deep-diving marine mammal species that could potentially experience PTS impacts from active sonar in the Study Area. The 30-min. wait period for vessel-deployed sources will cover the average dive times of marine mammal species that could experience PTS from sonar in the mitigation zone, except for Kogia whales. The 10-min. wait period for aircraft-deployed sources will cover a portion, but not the average, dive times of marine mammals.

Section 3.8.3.1.2 (Impacts from Sonar and Other Transducers) provides a full analysis of the potential impacts of sonar on sea turtles. Due to sea turtle hearing capabilities, the mitigation only applies to sea turtles during the use of sources below 2 kHz. The range to auditory effects for most active sonar sources in sea turtle hearing range (e.g., LF5) is zero meters. Impact ranges are longer (i.e., up to tens of meters) for active sonars with higher source levels. The mitigation zones for active sonar extend beyond the ranges to PTS and TTS for sea turtles; therefore, mitigation will help avoid or reduce the potential for exposure to these effects for sea turtles.

As described previously, the Phase III mitigation zones are based on the largest areas within which it is practical for the Navy to implement mitigation during training and testing. Training and testing with active sonar is essential to national security. Active sonar is the only reliable technology for detecting and tracking potential enemy diesel-electric submarines. For example, small diesel-electric submarines operate quietly and may hide in shallow coastal and littoral waters. The ability to effectively operate active sonar is a highly perishable skill that must be repeatedly practiced during realistic training. Naval forces must train in the same mode and manner in which they conduct military missions and combat operations. Anti-submarine warfare training typically involves the periodic use of active sonar to develop the “tactical picture,” or an understanding of the battle space (e.g., area searched or unsearched, identifying false contacts, and understanding the water conditions). This can take from several hours to multiple days and typically occurs over vast areas with varying physical and oceanographic conditions (e.g., bathymetry, topography, surface fronts, and variations in sea surface temperature). Sonar operators train to avoid or reduce interference and sound-reducing clutter from varying ocean floor topographies and environmental conditions, practice coordinating their efforts with other sonar operators in a strike group, develop skill proficiency in detecting and tracking submarines and other threats, and practice the focused endurance vital to effectively working as a team in shifts around the clock until the conclusion of the event.

Increasing the mitigation zone sizes would result in a larger area over which active sonar would need to be powered down or shut down in response to a sighting, and therefore would likely increase the number of times that these mitigation measures would be implemented. This would extend the length of the activity, significantly diminish event realism, and prevent activities from meeting their intended objectives. It would also create fundamental differences between how active sonar would be used in training and how active sonar should be used during military missions and combat operations. For example, additional active sonar power downs or shut downs would prevent sonar operators from

developing and maintaining awareness of the tactical picture during training events. Without realistic training in conditions analogous to military missions and combat operations, sonar operators cannot become proficient in effectively operating active sonar. Sonar operators, vessel crews, and aircrews would be expected to operate active sonar during military missions and combat operations in a manner inconsistent with how they were trained.

During integrated training, multiple vessels and aircraft may participate in an exercise using different warfare components simultaneously. Degrading the value of one training element results in a degradation of the training value of the other training elements. Degrading the value of training would cause a reduction in perishable skills and diminished operational capability, which would significantly impact military readiness. Each of these factors would ultimately impact the ability for units to meet their individual training and certification requirements and the Navy's ability to certify forces to safely deploy to meet national security tasking. Diminishing proficiency or eroding active sonar capabilities would present a significant risk to personnel safety during military missions and combat operations and would impact the ability to deploy with the required level of readiness necessary to accomplish any tasking by Combatant Commanders.

Increasing the number of times that the Navy must power down or shut down active sonar transmissions during testing activities would result in similar consequences to activity realism. For example, at-sea sonar testing activities are required in order to calibrate or document the functionality of sonar and torpedo systems while a ship or submarine is in an open ocean environment. Additional powering down or shutting down active sonar transmissions would prevent this activity from meeting its intended objective, such as verifying if the ship meets design acoustic specifications. These types of impacts would impede the ability of researchers, program managers, and weapons system acquisition programs to meet research objectives and testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements, and would impede shipboard maintenance, repairs, or pierside testing prior to at-sea operations.

For activities that involve aircraft (e.g., activities involving rotary-wing aircraft that use dipping sonar or sonobuoys to locate submarines or submarine targets), extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption. Increasing the mitigation zone sizes would not result in a substantial reduction of injurious impacts because, as described above, the mitigation zones extend beyond the average ranges to PTS for sea turtles and marine mammals.

In summary, the operational community determined that implementing procedural mitigation for active sonar beyond what is detailed in Table 5.3-2 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.2.2 Air Guns

The Navy developed new procedural mitigation for Phase III to avoid or reduce potential impacts on marine mammals and sea turtles from air guns, as outlined in Table 5.3-3. The Navy developed the new mitigation zone based on the largest area within which it is practical to implement mitigation for air gun activities. The Navy will implement procedural mitigation measures for this activity that are consistent

with procedural mitigation for other acoustic stressors. For example, the Navy will require observations of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event. The small mitigation zone size and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Table 5.3-3: Procedural Mitigation for Air Guns

Procedural Mitigation Description
Stressor or Activity • Air guns
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned on a ship or pierside
Mitigation Requirements • Mitigation zone: – 150 yd. around the air gun • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of air gun use. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease air gun use. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing air gun use) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the air gun; (3) the mitigation zone has been clear from any additional sightings for 30 min.; or (4) for mobile activities, the air gun has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

Section 3.7.3.1.3 (Impacts from Air Guns) and Section 3.8.3.1.3 (Impacts from Air Guns) provide a full analysis of the potential impacts of air guns on marine mammals and sea turtles, respectively, including the air gun impact ranges for the maximum number of pulses expected for air gun activities in the Study Area, which is 10 pulses. For 10 pulses, the mitigation zone extends beyond the average ranges to PTS and TTS for sea turtles and marine mammals. Therefore, mitigation will help avoid or reduce the potential for exposure to PTS and TTS. The 30-min. wait period will cover the average dive times of the marine mammal species that could be present in the mitigation zone.

When developing the new mitigation, the Navy analyzed a range of potential mitigation zone sizes. A larger mitigation zone would result in a larger area over which air gun activities would need to be ceased in response to a sighting, and therefore would likely increase the number of times air guns would be ceased. However, establishing a larger mitigation zone would not result in a substantial reduction of injurious impacts because the mitigation zone extends beyond the average ranges to PTS for sea turtles and marine mammals.

Due to the nature of how air gun testing is conducted (e.g., generated impulses with short durations), increasing the size of the mitigation zone would extend the length of the activity and significantly diminish realism in a way that would prevent the activity from meeting its intended objectives. During air gun testing events, the Navy determines the functionality of air gun equipment, tests sensors and system performance, and conduct bioacoustics research. These tests must be conducted in the same manner and under the same conditions in which they will be conducted during military readiness training exercises, military missions, and combat operations. Extending the length of the activity would decrease realism, increase time at sea for vessels, and increase fuel usage, particularly when air guns are deployed from small boats or small research vessels. Therefore, additional mitigation would prevent the Navy from validating whether air guns perform as expected, from meeting research program objectives, and from meeting testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements.

In summary, the operational community determined that implementing procedural mitigation beyond what is detailed in Table 5.3-3 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.2.3 Pile Driving

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from pile driving, as outlined in Table 5.3-4.

Table 5.3-4: Procedural Mitigation for Pile Driving

Procedural Mitigation Description
Stressor or Activity • Pile driving and pile extraction sound during Elevated Causeway System training
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned on the shore, the elevated causeway, or a small boat
Mitigation Requirements • Mitigation zone: – 100 yd. around the pile • Prior to the initial start of the activity (for 30 min.): – Observe the mitigation zone for floating vegetation; if observed, delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, delay the start of pile driving or vibratory pile extraction. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease impact pile driving or vibratory pile extraction. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing pile driving or pile extraction) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the pile driving location; or (3) the mitigation zone has been clear from any additional sightings for 30 min.

The Phase II pile driving mitigation zone was based on the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zone. The Navy identified an opportunity to increase the mitigation zone size for pile driving by 40 yd. to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-4. The mitigation zone for pile driving is now based on the largest area within which it is practical to implement mitigation. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting pile driving activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event.

The small mitigation zone size and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Section 3.7.3.1.4 (Impacts from Pile Driving) and Section 3.8.3.1.4 (Impacts from Pile Driving) provide a full analysis of the potential impacts of pile driving on marine mammals and sea turtles, respectively, and include the approximate impact ranges for impact pile driving and vibratory pile extraction. The ranges to effect from impact pile driving are longer than the ranges to effect for vibratory pile extraction. For impact pile driving, the 100 yd. mitigation zone extends beyond the average ranges to PTS for sea turtles and marine mammals. Therefore, mitigation will help avoid or reduce the potential for exposure to PTS. Depending on the hearing group, the mitigation zone also extends beyond or into the average range to TTS for impact pile driving for sea turtles and marine mammals; therefore, mitigation will help avoid or reduce the potential for exposure to all or a portion of TTS. Vibratory pile extraction has shorter predicted impact ranges than impact pile driving. The mitigation zone will extend further beyond the average ranges to PTS, and further beyond (or into, depending on hearing group) the average ranges to TTS during vibratory pile driving. The 30-min. wait period will cover the average dive times of the marine mammal species that could be present in the mitigation zone.

As described previously, the Phase III mitigation zone is based on the largest area within which it is practical for the Navy to implement mitigation for this activity. Increasing the mitigation zone would result in a larger area over which pile driving would need to be ceased in response to a sighting, and therefore would likely increase the number of times pile driving is ceased during Elevated Causeway System training. However, increasing the mitigation zone would not result in a substantial reduction of injurious impacts because the mitigation zone extends beyond the average ranges to PTS for sea turtles and marine mammals. The Navy also analyzed the potential for implementing additional types of mitigation employed by commercial construction projects, such as the use of bubble curtains and other sound attenuation devices. The Navy determined that these mitigation techniques would be impractical to use during Elevated Causeway System training due to impacts on event realism. The use of additional mitigation techniques would create fundamental differences between how pile driving would be conducted during training and how pile driving should be conducted during military missions and combat operations. This would present a significant risk to personnel safety during military missions and combat operations.

Elevated Causeway System training involves multiple steps, including driving support pilings into the sand, securing causeway platforms onto the piles, assembling causeway platforms into a pier, and

removing the pier and piles. The activity provides essential training for each component individually and for the logistical coordination of all components as a whole. In order for the Navy to effectively conduct this training exercise, all components must be completed on time and as they would during military missions and combat operations. Increasing the number of times that the Navy must cease pile driving would result in schedule delays to the first component of Elevated Causeway System training (i.e., installation of support pilings), which would diminish realism, put the activity timeline at risk, and impact the Navy's ability to become proficient in each component individually and the logistical coordination of the activity as a whole. These factors would prevent the activity from meeting its intended objective.

In summary, the operational community determined that implementing procedural mitigation beyond what is detailed in Table 5.3-4 would be incompatible with the practicality assessment criteria for safety and mission requirements.

5.3.2.4 Weapons Firing Noise

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from weapons firing noise, as outlined in Table 5.3-5.

Table 5.3-5: Procedural Mitigation for Weapons Firing Noise

Procedural Mitigation Description
Stressor or Activity • Weapons firing noise associated with large-caliber gunnery activities
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned on the ship conducting the firing – Depending on the activity, the Lookout could be the same one described in Section 5.3.3.3 (Explosive Medium-Caliber and Large-Caliber Projectiles) or Section 5.3.4.3 (Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions).
Mitigation Requirements • Mitigation zone: – 30° on either side of the firing line out to 70 yd. from the muzzle of the weapon being fired • Prior to the initial start of the activity: – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of weapons firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease weapons firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing weapons firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the firing ship; (3) the mitigation zone has been clear from any additional sightings for 30 min.; or (4) for mobile activities, the firing ship has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

In Phase II, the weapons firing noise mitigation zone was based on the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone for Phase III. The Navy is clarifying in the table that it will require observation of the

mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting weapons firing activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event.

The small mitigation zone size and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Section 3.7.3.1.7 (Impacts from Weapons Noise) and Section 3.8.3.1.7 (Impacts from Weapons Noise) provide a full analysis of the potential impacts of weapons noise on marine mammals and sea turtles, respectively. As described in Section 3.0.3.3.1.6 (Weapons Firing, Launch, and Inert Impact), underwater sounds would be strongest just below the surface and directly under the firing point. Any sound that enters the water only does so within a narrow cone below the firing point or path of the projectile. The mitigation zone extends beyond the distance to which marine mammals and sea turtles would likely experience PTS or TTS from weapons firing noise; therefore, mitigation will help avoid or reduce the potential for exposure to these impacts.

As described previously, the Phase III mitigation zone is based on the largest area within which it is practical for the Navy to implement mitigation for this activity. Increasing the mitigation zone would result in a larger area over which weapons firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times weapons firing would be ceased. However, increasing the mitigation zone size would not result in a substantial reduction of injurious impacts because the mitigation zone extends beyond the average ranges to PTS for sea turtles and marine mammals.

Large-caliber gunnery training activities may involve a single ship firing or may be conducted as part of a larger exercise involving multiple ships. Surface ship crews learn to track targets (e.g., with radar), engage targets, practice defensive marksmanship, and coordinate their efforts within the context of larger activities. Increasing the number of times that the Navy must cease weapons firing during training would decrease realism and impact the ability for Navy Sailors to train and become proficient in using large-caliber guns as required during military missions and combat operations. For example, additional ceasing of the activity would reduce the crew's ability to react to changes in the tactical situation or response to an incoming threat, which could result in a delay to the ship's training schedule. When training is undertaken in the context of a coordinated exercise involving multiple ships, degrading the value of one of the training element results in a degradation of the training value of the other training elements. These factors would ultimately impact the ability for units to meet their individual training and certification requirements, and the Navy's ability to certify forces to deploy to meet national security tasking.

Increasing the number of times that the Navy must cease weapons firing during testing activities would result in similar consequences to activity realism, which would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. This would impact the ability to effectively test large-caliber guns before full-scale production or delivery to the fleet to ensure functionality, safety, and accuracy in military mission and combat conditions.

In summary, the operational community determined that implementing procedural mitigation for weapons firing noise beyond what is detailed in Table 5.3-5 would be incompatible with the practicality assessment criteria for safety and mission requirements.

5.3.3 EXPLOSIVE STRESSORS

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the explosive stressors or activities discussed in the sections below. Section 3.7.3.2 (Explosive Stressors) and Section 3.8.3.2 (Explosive Stressors) provide a full analysis of potential impacts of explosives on marine mammals and sea turtles, respectively, including predicted impact ranges. In addition to procedural mitigation, the Navy will implement mitigation for some explosive activities within mitigation areas (see Section 5.4.1, Mitigation Areas for Seafloor Resources; Section 5.4.2, Mitigation Areas for Marine Mammals in The Hawaii Range Complex; and Section 5.4.3, Mitigation Areas for Marine Mammals in the Southern California Portion of the Study Area).

5.3.3.1 Explosive Sonobuoys

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive sonobuoys, as outlined in Table 5.3-6.

Table 5.3-6: Procedural Mitigation for Explosive Sonobuoys

Procedural Mitigation Description
Stressor or Activity • Explosive sonobuoys
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft or on small boat • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 600 yd. around an explosive sonobuoy • Prior to the initial start of the activity (e.g., during deployment of a sonobuoy field, which typically lasts 20–30 min.): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. – Visually observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of sonobuoy or source/receiver pair detonations. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease sonobuoy or source/receiver pair detonations. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the sonobuoy; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained.

Table 5.3-6: Procedural Mitigation for Explosive Sonobuoys (continued)

Procedural Mitigation Description
• After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, explosive sonobuoys had two mitigation zone sizes based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of these mitigation zones. The Navy identified an opportunity to increase the mitigation zone size by 250 yd. for sonobuoys using up to 2.5 lb. net explosive weight so that explosive sonobuoys will implement a 600 yd. mitigation zone, regardless of net explosive weight, to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-6. The mitigation zone for explosive sonobuoys is now based on the largest area within which it is practical to implement mitigation.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with Phase II consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. In developing mitigation for Phase III, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. There are typically multiple platforms in the vicinity of activities that use explosive sonobuoys (e.g., safety aircraft). When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Some activities that use explosive sonobuoys involve detonations of a single sonobuoy or sonobuoy pair, while other activities involve deployment of a field of sonobuoys that may be dispersed over a large distance. Lookouts will have a better likelihood of detecting marine mammals and sea turtles when observing the mitigation zone around a single sonobuoy, sonobuoy pair, or a smaller sonobuoy field than when observing a sonobuoy field dispersed over a large distance. When observing large sonobuoy fields, Lookouts will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

Bin E4 (e.g., Improved Extended Echo Ranging Sonobuoys) has the longest predicted impact ranges for explosive sonobuoys used in the Study Area. For the largest explosive in bin E4, the mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles

and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for high-frequency cetaceans, low-frequency cetaceans, and phocids. The mitigation zone also extends into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E4. Smaller explosives in bin E4 and explosives in smaller source bins (E1, E3) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zone is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be ineffective unless the Navy allocated additional platforms to observe for biological resources. This is particularly true when observations occur from a small boat or during observations of a large field of sonobuoys. The use of additional personnel and equipment (aircraft or small boats) would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of explosive sonobuoys or an explosive sonobuoy field.

Increasing the mitigation zone size would result in a larger area over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, during Sonobuoy Lot Acceptance Testing, additional ceasing of the activity would not allow the Navy to effectively verify the integrity and performance of a lot or group of sonobuoys before full-scale production or delivery to the fleet. Such testing is required to ensure functionality and accuracy in military mission and combat conditions. Extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the activity length would extend by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive sonobuoys beyond what is detailed in Table 5.3-6 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.2 Explosive Torpedoes

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive torpedoes, as outlined in Table 5.3-7.

Table 5.3-7: Procedural Mitigation for Explosive Torpedoes

Procedural Mitigation Description
Stressor or Activity • Explosive torpedoes
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 2,100 yd. around the intended impact location • Prior to the initial start of the activity (e.g., during deployment of the target): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. – Visually observe the mitigation zone for marine mammals, sea turtles, and jellyfish aggregations; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals, sea turtles, and jellyfish aggregations; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, the explosive torpedo mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone for Phase III. The post-activity observations for explosive torpedoes are a continuation from Phase II and will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy is adding a

requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive torpedoes, there are additional observation aircraft, support vessels (e.g., range craft for torpedo retrieval), or other safety aircraft in the vicinity. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources.

Explosive torpedo activities involve detonations at a target located down range of the firing platform. Due to the distance between the mitigation zone and the observation platform, Lookouts will have a better likelihood of detecting large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. As described in Chapter 3.8 (Reptiles), some species of sea turtles forage on jellyfish, and some of the locations where explosive torpedo activities could occur support high densities of jellyfish throughout parts of the year. Observing for indicators of marine mammal and sea turtle presence (including jellyfish aggregations) will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Bin E11 has the longest predicted impact ranges for explosive torpedoes used in the Study Area. For the largest explosive in bin E11, the mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for high-frequency cetaceans, low-frequency cetaceans, and phocids. The mitigation zone also extends into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E11. Explosive torpedoes in smaller source bins (e.g., E8) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zone is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase this mitigation zone because observations within the margin of increase would be ineffective unless the Navy allocated additional platforms to observe for biological resources. The use of additional personnel and observation platforms would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft participating in the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of explosive torpedoes.

Increasing the mitigation zone size would result in a larger area over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, the Navy conducts Torpedo (Explosive) Testing events to test the functionality of torpedoes and torpedo launch systems. These events often involve aircrews locating, approaching, and firing a torpedo on an artificial target. They require focused situational awareness of the activity area and continuous coordination between the participating platforms as required during military

missions and combat operations. Extending the length of the activity would require aircraft to depart the area to refuel. If the firing aircraft departed the activity location to refuel, the aircrew would lose the ability to maintain situational awareness and effectively coordinate with other participating platforms. If multiple refueling events were required, the activity length would extend by two to five times or more, which would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Therefore, an increase in mitigation would impede the Navy's ability to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive torpedoes beyond what is detailed in Table 5.3-7 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.3 Explosive Medium-Caliber and Large-Caliber Projectiles

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive gunnery activities, as outlined in Table 5.3-8.

Table 5.3-8: Procedural Mitigation for Explosive Medium-Caliber and Large-Caliber Projectiles

Procedural Mitigation Description
Stressor or Activity • Gunnery activities using explosive medium-caliber and large-caliber projectiles – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout on the vessel or aircraft conducting the activity – For activities using explosive large-caliber projectiles, depending on the activity, the Lookout could be the same as the one described in Section 5.3.2.4 (Weapons Firing Noise). • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 200 yd. around the intended impact location for air-to-surface activities using explosive medium-caliber projectiles – 600 yd. around the intended impact location for surface-to-surface activities using explosive medium-caliber projectiles – 1,000 yd. around the intended impact location for surface-to-surface activities using explosive large-caliber projectiles • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing.

Table 5.3-8: Procedural Mitigation for Explosive Medium-Caliber and Large-Caliber Projectiles (continued)

Procedural Mitigation Description
• Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; (3) the mitigation zone has been clear from any additional sightings for 10 min. for aircraft-based firing or 30 min. for vessel-based firing; or (4) for activities using mobile targets, the intended impact location has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, explosive gunnery activity mitigation zones were based on net explosive weight and the associate average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of these mitigation zones. The Navy identified an opportunity to increase the mitigation zone size by 400 yd. for surface-to-surface activities to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-8. The mitigation zones for explosive medium-caliber and large-caliber projectiles are now based on the largest areas within which it is practical to implement mitigation.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with Phase II consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. In developing mitigation for Phase III, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive munitions there are additional observation aircraft, multiple aircraft firing munitions, or other safety aircraft in the vicinity. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Large-caliber gunnery activities involve vessels firing projectiles at targets located up to 6 NM down range. Medium-caliber gunnery activities involve vessels or aircraft firing projectiles at targets located up to 4,000 yd. down range, although typically much closer. As described in Section 5.2.1 (Procedural Mitigation Development), certain platforms, such as the small boats and aircraft used during explosive medium-caliber gunnery exercises, have manning or space restrictions; therefore, the Lookout for these

activities is typically an existing member of the aircraft or boat crew who is responsible for other essential tasks (e.g., navigation). Due to their relatively lower vantage point, Lookouts on vessels (during medium-caliber or large-caliber gunnery exercises) will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles when observing around targets located at the furthest firing distances. The Navy will implement larger mitigation zones for large-caliber gunnery activities than for medium-caliber gunnery activities due to the nature of how the activities are conducted. For example, large-caliber gunnery activities are conducted from surface combatants, so Lookouts can observe a larger mitigation zone because they typically have access to high-powered binoculars mounted on the ship deck. This will enable observation of the distant mitigation zone in combination with hand-held binoculars and naked-eye scanning. Lookouts in aircraft (during medium-caliber gunnery exercises), have a relatively higher vantage point for observing the mitigation zones but will still be more likely to detect individual marine mammals and sea turtles when observing mitigation zones located close to the firing platform than at the furthest firing distances. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

The mitigation applies only to activities using surface targets. Most airborne targets are recoverable aerial drones that are not intended to be hit by ordnance. Given the speed of the projectiles and mobile target, and the long ranges that projectiles typically travel, it is not possible to definitively predict or to effectively observe where the projectile fragments will fall. For gunnery activities using explosive medium-caliber and large-caliber projectiles, the potential military expended material fall zone can only be predicted within thousands of yards, which can be up to 6 NM from the firing location. These areas are too large to be effectively observed for marine mammals and sea turtles with the number of personnel and platforms available for this activity. The potential risk to marine mammals and sea turtles during events using airborne targets is limited to the animal being directly struck by falling military expended materials. There is no potential for direct impact from the explosives because the detonations occur in air. Based on the extremely low potential for projectile fragments to co-occur in space and time with a marine mammal or sea turtle at or near the surface of the water, the potential for a direct strike is negligible; therefore, mitigation for gunnery activities using airborne targets would not be effective at avoiding or reducing potential impacts. Additional information on military expended materials is provided in Appendix F (Military Expended Material and Direct Strike Impact Analysis).

Bin E5 (e.g., 5-in. projectiles) has the longest predicted impact ranges for explosive projectiles that apply to the 1,000-yd. mitigation zone. Bin E2 (e.g., 40-millimeter [mm] projectiles) has the longest predicted impact ranges for explosive projectiles that apply to the 600-yd. and 200-yd. mitigation zones. The 1,000-yd., 600-yd., and 200-yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The 1,000-yd. mitigation zone extends beyond the average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for high-frequency cetaceans, low-frequency cetaceans, and phocids. The 600-yd. and 200-yd. mitigation zones extend beyond the respective average ranges to PTS for sea turtles, mid-frequency cetaceans, low-frequency cetaceans, otariids, and phocids, and into a portion of the average range to PTS for high-frequency cetaceans. The mitigation zones also extend into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E5 and bin E2. Explosives in smaller source bins (e.g., E1) have shorter predicted impact ranges;

therefore, the mitigation zones will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zones are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective. One of the mission-essential safety protocols for explosive gunnery activities is a requirement for event participants (including Lookouts) to maintain focus on the activity area to ensure safety of Navy personnel and equipment, and the public. For example, when air-to-surface medium-caliber gunnery exercises involve fighter aircraft descending on a target, or rotary-wing aircraft flying a racetrack pattern and descending on a target using a forward-tilted firing angle, maintaining attention on the activity area is paramount to aircraft safety. The typical activity areas for medium-caliber and large-caliber gunnery activities coincide with the applicable mitigation zones developed for Phase III; therefore, Lookouts can safely and effectively observe the mitigation zones for biological resources while simultaneously maintaining focus on the activity areas. However, if the mitigation zone sizes increased, Lookouts would need to redirect their attention to observe beyond the activity area. This would not meet the safety criteria since personnel would be required to direct attention away from mission requirements. Alternatively, the Navy would need to add personnel to serve as additional Lookouts on the existing observation platforms or allocate additional platforms to the activity to observe for biological resources. These actions would not be safe or sustainable due to an exceedance of manpower, resource, and space restrictions for these activities. Similarly, positioning platforms closer to the intended impact location would increase safety risks related to proximity to the detonation location and path of the explosive projectile.

Increasing the mitigation zone sizes would result in larger areas over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times firing would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent activities from meeting their intended objectives. For example, the Navy must train its gun crews to coordinate with other participating platforms (e.g., small boats launching a target, other firing platforms), locate and engage surface targets (e.g., high speed maneuverable surface targets), and practice precise defensive marksmanship to disable threats. The Navy must test the functionality of its guns in advance of delivery to the fleet for operational use.

Depending on the type of target being used, additional stopping of the activity could result in the target needing to be recovered and relaunched, which would cause a significant loss of training or testing time. For activities that involve aircraft, extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. These types of impacts would reduce the number of opportunities that gun crews have to fire on the target and cause significant delays to the training or testing schedule. Therefore, an increase in mitigation would impede the ability for gun crews to train and become proficient in using their weapons as required during military missions and combat operations, would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions), and would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to

meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive medium-caliber and large-caliber projectiles beyond what is detailed in Table 5.3-8 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.4 Explosive Missiles and Rockets

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive missiles and rockets, as outlined in Table 5.3-9.

Table 5.3-9: Procedural Mitigation for Explosive Missiles and Rockets

Procedural Mitigation Description
Stressor or Activity • Aircraft-deployed explosive missiles and rockets – Mitigation applies to activities using a surface target
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 900 yd. around the intended impact location for missiles or rockets with 0.6–20 lb. net explosive weight – 2,000 yd. around the intended impact location for missiles with 21–500 lb. net explosive weight • Prior to the initial start of the activity (e.g., during a fly-over of the mitigation zone): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, explosive missile and rocket mitigation zones were based on net explosive weight and the associate average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the mitigation zone sizes. The Navy identified an opportunity to increase the mitigation zone by 1,100 yd. for missiles and rockets using 21–250 lb. net explosive weight to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-9. The mitigation zones are now based on the largest areas within which it is practical to implement mitigation.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with Phase II consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. In developing mitigation for Phase III, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive munitions there are additional observation aircraft, multiple aircraft firing munitions, or other safety aircraft in the vicinity. For example, during typical explosive missile exercises, two aircraft circle the activity location, one aircraft clears the intended impact location while the other fires, and vice versa. A third aircraft is typically present for safety or proficiency inspections. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Missile and rocket exercises involve firing munitions at a target typically located up to 15 NM down range, and infrequently up to 75 NM down range. Due to the distance between the mitigation zone and the observation platform, Lookouts will have a better likelihood of detecting marine mammals and sea turtles during close-range observations and are less likely to detect these resources once positioned at the firing location, particularly individual marine mammals, cryptic marine mammal species, and sea turtles. There is a chance that animals could enter the mitigation zone after the aircraft conducts its close-range mitigation zone observations and before firing begins (once the aircraft has transited to its firing position). Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones.

The Navy will implement larger mitigation zones for missiles using 21–500 lb. net explosive weight than for missiles and rockets using 0.6–20 lb. net explosive weight due to the nature of how these activities are conducted. During activities using missiles in the larger net explosive weight category, the firing aircraft (e.g., maritime patrol aircraft) have the capability of mitigating a larger area due to their larger fuel capacity. During activities using missiles or rockets in the smaller net explosive weight category, the firing aircraft (e.g., rotary-wing aircraft) are typically constrained by their fuel capacity.

The mitigation applies to aircraft-deployed missiles and rockets because aircraft can fly over the intended impact area prior to commencing firing. Mitigation would be ineffective for vessel-deployed missiles and rockets because of the inability for a Lookout to detect marine mammals or sea turtles from a vessel from the distant firing position. It would not be effective or practical to have a vessel conduct

close-range observations of the mitigation zone prior to firing due to the length of time it would take to complete observations and transit back to the firing position, and the costs associated with increased fuel consumption.

The mitigation applies to activities using surface targets. Most airborne targets are recoverable aerial drones that are not intended to be hit by ordnance. For example, telemetry-configured anti-air missiles used in training are designed to detonate or simulate a detonation near a target, but not as a result of a direct strike on a target. Given the speed of missiles and mobile targets, the high altitudes involved, and the long ranges that missiles typically travel, it is not possible to definitively predict or to effectively observe where the missile fragments will fall. The potential expended material fall zone can only be predicted within tens of miles for long range events, which can be 75 NM from the firing location; and thousands of yards for short range events, which can occur 15 NM from the firing location. These areas are too large to be effectively observed for marine mammals and sea turtles with the number of personnel and platforms available for this activity. The potential risk to marine mammals and sea turtles during events using airborne targets is limited to the animal being directly struck by falling military expended materials. There is no potential for direct impact from the explosives because the detonations occur in air. Based on the extremely low potential for military expended materials to co-occur in space and time with a marine mammal or sea turtle at or near the surface of the water, the potential for a direct strike is negligible; therefore, mitigation would not be effective at avoiding or reducing impacts. Additional information on military expended materials is provided in Appendix F (Military Expended Material and Direct Strike Impact Analysis).

Bin E10 (e.g., Harpoon missiles) has the longest predicted impact ranges for explosive missiles that apply to the 2,000-yd. mitigation zone. Bin E6 (e.g., Hellfire missiles) has the longest predicted impact ranges for explosive missiles and rockets that apply to the 900-yd. mitigation zone. The 2,000-yd. and 900-yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zones extend beyond the respective average ranges to PTS for sea turtles and all marine mammal hearing groups except high-frequency cetaceans (the mitigation zones extend into a portion of the respective average ranges to PTS for this hearing group). The mitigation zones also extend into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E10 and bin E6. Explosives in smaller source bins (e.g., missiles in bin E9, rockets in bin E3) have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zones are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and equipment (e.g., aircraft) would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Similarly, positioning platforms closer to the intended impact location (as would be required if mitigation applied to vessel-deployed missiles and rockets) would

increase safety risks related to proximity to the detonation location and path of the explosive missile or rocket.

Increasing the mitigation zone sizes would result in larger areas over which firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. Explosive missile and rocket events require focused situational awareness of the activity area and continuous coordination between the participating platforms as required during military missions and combat operations. For activities using missiles in the larger net explosive weight category, the flyover distance between the mitigation zone and the firing location can extend upwards of 75 NM; therefore, even aircraft with larger fuel capacities would need to depart the activity area to refuel if the length of the activity was extended. If the firing aircraft departed the activity location to refuel, the aircrew would lose the ability to maintain situational awareness of the activity area and effectively coordinate with other participating platforms. If multiple refueling events were required, the activity length would extend by two to five times or more, which would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. These types of impacts would cause a significant loss of training or testing time, reduce the number of opportunities that aircrews have to fire on the target, and cause a significant delay to the training or testing schedule. Therefore, an increase in mitigation would impede the ability for aircrews to train and become proficient in using their weapons as required during military missions and combat operations, would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions), and would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive missiles and rockets beyond what is detailed in Table 5.3-9 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.5 Explosive Bombs

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from explosive bombs, as outlined in Table 5.3-10.

In Phase II, the explosive bombing mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of this mitigation zone. The Navy determined that the current mitigation zone for explosive bombs is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone for Phase III.

Table 5.3-10: Procedural Mitigation for Explosive Bombs

Procedural Mitigation Description
Stressor or Activity • Explosive bombs
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in the aircraft conducting the activity • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 2,500 yd. around the intended target • Prior to the initial start of the activity (e.g., when arriving on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of bomb deployment. • During the activity (e.g., during target approach): – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease bomb deployment. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing bomb deployment) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended target; (3) the mitigation zone has been clear from any additional sightings for 10 min.; or (4) for activities using mobile targets, the intended target has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of this activity. In accordance with Phase II consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. In developing mitigation for Phase III, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Typically, when aircraft are firing explosive munitions there are additional observation aircraft, multiple aircraft firing munitions, or other safety aircraft in the vicinity. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of

detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

Bombing exercises involve an aircraft deploying munitions at a surface target located beneath the firing platform. During target approach, aircraft maintain a relatively steady altitude of approximately 1,500 ft. Lookouts, by necessity for safety and mission success, primarily focus their attention on the water surface surrounding the intended detonation location (i.e., the mitigation zone). Being positioned in an aircraft gives the Lookout a good vantage point for observing marine mammals and sea turtles throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Bin E12 (e.g., 2,000-lb. bombs) has the longest predicted impact ranges for explosive bombs used in the Study Area. The 2,500-yd. mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles and all marine mammal hearing groups except high-frequency cetaceans (the mitigation zones extend into a portion of the respective average ranges to PTS for this hearing group). The mitigation zone also extends into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest bombs in bin E12. Smaller bombs (e.g., 250-lb. bombs, 500-lb. bombs) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zone is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase this mitigation zone because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and aircraft would be unsustainable due to increased operational costs and an exceedance of the available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft participating in the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence of observation vessels within the vicinity of the intended explosive bomb detonation location.

Increasing the mitigation zone would result in a larger area over which explosive bomb deployment would need to be ceased in response to a sighting, and therefore would likely increase the number of times explosive bombing activities would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. For example, critical components of a Bombing Exercise Air-to-Surface training activity are the assembly, loading, delivery, and assessment of an explosive bomb. The activity requires focused situational awareness of the activity area and continuous coordination between multiple training components. The training exercise starts with ground personnel, who must practice the building and loading of explosive munitions. Training includes the safe handling of explosive material, configuring munitions to precise specifications, and loading munitions onto aircraft. Aircrew must then identify a target and safely deliver fused munitions, discern if the bomb was assembled correctly, and determine

bomb damage assessments based on how and where the explosive detonated. Extending the length of the activity would require aircraft to depart the area to refuel. If the firing aircraft departed the activity area to refuel, aircrew would lose the ability to maintain situational awareness of the activity area, effectively coordinate with other participating platforms, and complete all training components as required during military missions and combat operations. If multiple refueling events were required, the activity length would be extended by two to five times or more, which would cause a significant loss of training or testing time and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. This would reduce the number of opportunities that aircrews have to approach targets and deploy bombs and reduce the Navy's ability to evaluate the bomb, the bomb carry and delivery system, and any associated systems that may have been newly developed or enhanced, which would cause a significant delay to the training or testing schedule. Therefore, an increase in mitigation would impede the ability for aircrews to train and become proficient in using their weapons, would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions), and would impede the ability of program managers and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive bombs beyond what is detailed in Table 5.3-10 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.6 Sinking Exercises

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles during sinking exercises, as outlined in Table 5.3-11.

Table 5.3-11: Procedural Mitigation for Sinking Exercises

Procedural Mitigation Description
Stressor or Activity • Sinking exercises
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 2 Lookouts (one positioned in an aircraft and one on a vessel) • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 2.5 NM around the target ship hulk • Prior to the initial start of the activity (90 min. prior to the first firing): – Conduct aerial observations of the mitigation zone for floating vegetation; delay the start until the mitigation zone is clear. – Conduct aerial observations of the mitigation zone for marine mammals, sea turtles, and jellyfish aggregations; if observed, delay the start of firing.

Table 5.3-11: Procedural Mitigation for Sinking Exercises (continued)

Procedural Mitigation Description
• During the activity: – Conduct passive acoustic monitoring for marine mammals; use information from detections to assist visual observations. – Visually observe the mitigation zone for marine mammals and sea turtles from the vessel; if observed, cease firing. – Immediately after any planned or unplanned breaks in weapons firing of longer than 2 hours, observe the mitigation zone for marine mammals and sea turtles from the aircraft and vessel; if observed, delay recommencement of firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the target ship hulk; or (3) the mitigation zone has been clear from any additional sightings for 30 min. • After completion of the activity (for 2 hours after sinking the vessel or until sunset, whichever comes first): – Observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, the mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zone. The Navy determined that the current mitigation zone for sinking exercises is the largest area within which it is practical to implement mitigation; therefore, it will continue implementing this same mitigation zone for Phase III. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. Sinking exercises typically involved multiple participating platforms. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The 2-hour post-activity observations for sinking exercises are a continuation from Phase II and will help the Navy determine if any resources were injured during the activity. Sinking exercises are scheduled to ensure they are conducted only in daylight hours. The Navy will be able to complete the full 2-hours of post-activity observation during typical activity conditions and it is unlikely that observations will be shortened due to nightfall. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

There is a chance that animals could enter the mitigation zone after the aircraft conducts its close-range mitigation zone observations and before firing begins (once the aircraft has transited to its distant firing position). The Lookout positioned on the vessel will have a higher likelihood of detecting individual marine mammals and sea turtles that are in the central portion of the mitigation zone near the target ship hulk. Near the perimeter of the mitigation zone, the Lookout will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. The Lookout positioned in the aircraft will be able to assist the vessel-based Lookout by observing the entire mitigation zone, including near the perimeter, because the aircraft will be able to transit a larger area more quickly (e.g., during range clearance), and will offer a

better vantage point. As described in Chapter 3.8 (Reptiles), some species of sea turtles forage on jellyfish in the region where this activity occurs. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Bin E12 has the longest predicted impact ranges for the types of explosives used during sinking exercises in the Study Area. For the largest explosive in bin E12, the mitigation zone extends beyond the ranges to 50 percent non-auditory injury, 50 percent mortality, and average ranges to PTS for sea turtles and marine mammals. The mitigation zone also extends beyond or into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E12. Smaller explosives in bin E12 and explosives in smaller source bins (e.g., E5) have shorter predicted impact ranges; therefore, the mitigation zone will extend further beyond or cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zone is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase this mitigation zone because observations within the margin of increase would be ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel, aircraft, or vessels would be unsustainable due to increased operational costs and an exceedance of available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft participating in the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding additional platforms to observe the mitigation zone would increase safety risks due to the presence of additional vessels or aircraft within the vicinity of the intended impact location or in the path of explosive projectiles.

Increasing the mitigation zone size would result in a larger area over which firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times that the sinking exercise would be ceased and would extend the length of the activity. These impacts would significantly diminish event realism in a way that would prevent the activity from meeting its intended objectives. Sinking exercises require focused situational awareness of the activity area and continuous coordination of tactics between ship, submarine, and aircraft crews using multiple weapon systems to deliver explosive ordnance to deliberately sink a deactivated vessel. Extending the length of the activity would require aircraft to depart the area to refuel, which would disrupt the ability for platforms to maintain continuous coordination of tactics. If multiple refueling events were required, the length of the activity would be extended by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. These types of impacts would reduce the frequency at which participants would be able to fire on the deactivated vessel. Because the activity ends when the ship sinks, firing at a decreased frequency would ultimately extend the amount of time it takes for the deactivated vessel to sink. Sinking exercises only take place during daylight hours; therefore, the training exercise would likely be delayed into the next day or next several days, which would significantly impact the schedules of the multiple participants. An increase in mitigation would impede the ability for the participants to become proficient in using their weapons as required during military missions and combat operations and would prevent units from meeting their individual training

and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions). Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for sinking exercises beyond what is detailed in Table 5.3-11 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.7 Explosive Mine Countermeasure and Neutralization Activities

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, sea turtles, and ESA-listed birds from explosive mine countermeasure and neutralization activities, as outlined in Table 5.3-12. The mitigation applies to explosive mine countermeasure and neutralization activities except those that involve the use of Navy divers, which are discussed in Section 5.3.3.8 (Explosive Mine Neutralization Activities Involving Navy Divers).

Table 5.3-12: Procedural Mitigation for Explosive Mine Countermeasure and Neutralization Activities

Procedural Mitigation Description
Stressor or Activity • Explosive mine countermeasure and neutralization activities
Resource Protection Focus • Marine mammals • Sea turtles • Birds
Number of Lookouts and Observation Platform • 1 Lookout positioned on a vessel or in an aircraft when implementing the smaller mitigation zone • 2 Lookouts (one positioned in an aircraft and one on a small boat) when implementing the larger mitigation zone • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 600 yd. around the detonation site for activities using 0.1–5-lb. net explosive weight – 2,100 yd. around the detonation site for activities using 6–650 lb. net explosive weight (including high explosive target mines) • Prior to the initial start of the activity (e.g., when maneuvering on station; typically, 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of detonations. • During the activity: – Observe the mitigation zone for marine mammals, sea turtles, concentrations of seabirds, and individual foraging seabirds; if observed, cease detonations. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity or a sighting of seabird concentrations or individual foraging seabirds during the activity: – The Navy will allow a sighted animal to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to detonation site; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained.

Table 5.3-12: Procedural Mitigation for Explosive Mine Countermeasure and Neutralization Activities (continued)

Procedural Mitigation Description
• After completion of the activity (typically 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained): – Observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

The types of charges used in these activities are positively controlled, which means the detonation is controlled by the personnel conducting the activity and is not authorized until the mitigation zone is clear at the time of detonation. In Phase II, explosive mine countermeasure and neutralization activity mitigation zones were based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zones. The Navy identified an opportunity to increase the mitigation zone sizes for bins E5 through E10 to enhance protections to the maximum extent practicable. This increase is reflected in Table 5.3-12. The mitigation zones for explosive mine countermeasure and neutralization activities are now based on the largest areas within which it is practical to implement mitigation. The post-activity observations are a continuation from Phase II and will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources.

For the 600-yd. mitigation zone, the small observation area and proximity to the observation platform will result in a high likelihood that the Lookout will be able to detect marine mammals and sea turtles throughout the mitigation zone (regardless of the type of observation platform used). For the 2,100-yd. mitigation zone, the Lookout on a small boat will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) or splashes of individual marine mammals than cryptic marine mammal species and sea turtles near the mitigation zone perimeter, while the Lookout positioned in an aircraft will help increase the chance that marine mammals and sea turtles will be detected throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones. The mitigation for birds will help the Navy avoid or reduce impacts on ESA-listed least terns and other seabirds while foraging underwater.

Bin E11 (e.g., 650-lb. high explosive target mines) has the longest predicted impact ranges for explosives that apply to the 2,100-yd. mitigation zone. Bin E4 (e.g., 5-lb. net explosive weight charges) has the longest predicted impact ranges for explosives that apply to the 600-yd. mitigation zone. The 2,100-yd.

and 600-yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zones extend beyond the respective average ranges to PTS for sea turtles, mid-frequency cetaceans, and otariids, and into a portion of the average ranges to PTS for high-frequency cetaceans, low-frequency cetaceans, and phocids. The mitigation zones also extend into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E11 and bin E4. Smaller explosives within bin E11 and bin E4 and explosives in smaller source bins (e.g., E2) have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zones are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. The use of additional personnel and equipment (e.g., small boats, aircraft) would be unsustainable due to increased operational costs and an exceedance of available manpower and resources for this activity. Adding aircraft to observe the mitigation zone could result in airspace conflicts with the event participants. This would either require the aircraft conducting the activity to modify their flights plans (which would reduce activity realism) or force the observing aircraft to position itself a safe distance away from the activity area (which would decrease observation effectiveness). Adding vessels to observe the mitigation zone would increase safety risks due to the presence observation vessels within the vicinity of detonations.

Increasing the mitigation zone sizes would result in larger areas over which firing would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased and would extend the length of the activity. These impacts would significantly diminish realism in a way that would prevent the activity from meeting its intended objectives. For example, Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicle training exercises require focused situational awareness of the activity area and continuous coordination of tactics between ship, small boat, and rotary-wing aircraft crews to locate and neutralize mines. During Airborne Mine Neutralization Systems Test events, personnel evaluate the system's ability to detect and destroy mines from an airborne mine countermeasures-capable rotary-wing aircraft in advance of delivery to the fleet for operational use. Extending the length of these activities would require aircraft to depart the activity area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more. This would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and would increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft.

These types of impacts would result in a significant loss of training or testing time (which would reduce the number of opportunities that platforms have to locate and neutralize mines and reduce the Navy's ability to validate whether mine neutralization systems perform as expected) and cause a significant delay to the training or testing schedule. Therefore, an increase in mitigation would impede the ability for the Navy to train and become proficient in using mine neutralization systems as required during military missions and combat operations, would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions), and would impede the ability of program managers

and weapons system acquisition programs to meet testing requirements per required acquisition milestones or on an as-needed basis to meet operational requirements. Extending the length of the activities would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive mine countermeasure and neutralization activities beyond what is detailed in Table 5.3-12 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.8 Explosive Mine Neutralization Activities Involving Navy Divers

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals, sea turtles, birds, and scalloped hammerhead sharks from explosive mine neutralization activities involving Navy divers, as outlined in Table 5.3-13. Navy divers participating in these activities may be explosive ordnance disposal personnel.

Table 5.3-13: Procedural Mitigation for Explosive Mine Neutralization Activities Involving Navy Divers

Procedural Mitigation Description
Stressor or Activity • Explosive mine neutralization activities involving Navy divers
Resource Protection Focus • Marine mammals • Sea turtles • Birds • Fish (scalloped hammerhead sharks)
Number of Lookouts and Observation Platform • 2 Lookouts (two small boats with one Lookout each, or one Lookout on a small boat and one in a rotary-wing aircraft) when implementing the smaller mitigation zone • 4 Lookouts (two small boats with two Lookouts each), and a pilot or member of an aircrew will serve as an additional Lookout if aircraft are used during the activity, when implementing the larger mitigation zone • All divers placing the charges on mines will support the Lookouts while performing their regular duties and will report applicable sightings to their supporting small boat or Range Safety Officer. • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zones: – 500 yd. around the detonation site during activities under positive control using 0.1–20 lb. net explosive weight – 1,000 yd. around the detonation site during activities using time-delay fuses (0.1–29 lb. net explosive weight) and during activities under positive control using 21–60 lb. net explosive weight charges • Prior to the initial start of the activity (e.g., when maneuvering on station for activities under positive control; 30 min. for activities using time-delay firing devices): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of detonations or fuse initiation.

Table 5.3-13: Procedural Mitigation for Explosive Mine Neutralization Activities Involving Navy Divers (continued)

Procedural Mitigation Description
• During the activity: – Observe the mitigation zone for marine mammals, sea turtles, concentrations of seabirds, and individual foraging seabirds (in the water and not on shore); if observed, cease detonations or fuse initiation. – Within the Southern California Range Complex, divers will notify their supporting small boat or Range Safety Officer of hammerhead shark sightings (of any hammerhead species, due to the difficulty of differentiating species). Detonations will cease if divers sight a hammerhead shark when setting the charge and will recommence when the shark is no longer observed. – To the maximum extent practicable depending on mission requirements, safety, and environmental conditions, boats will position themselves near the mid-point of the mitigation zone radius (but outside of the detonation plume and human safety zone), will position themselves on opposite sides of the detonation location (when two boats are used), and will travel in a circular pattern around the detonation location with one Lookout observing inward toward the detonation site and the other observing outward toward the perimeter of the mitigation zone. – If used, aircraft will travel in a circular pattern around the detonation location to the maximum extent practicable. – The Navy will not set time-delay firing devices (0.1–29 lb. net explosive weight) to exceed 10 min. – During activities conducted in shallow water, a shore-based observer will survey the mitigation zone with binoculars for birds before and after each detonation. If training involves multiple detonations, the second (or third, etc.) detonation will occur either immediately after the preceding detonation (i.e., within 10 seconds) or after 30 min. to avoid potential impacts on birds foraging underwater. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity or a sighting of seabird concentrations or individual foraging seabirds during the activity: – The Navy will allow a sighted animal to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the detonation site; or (3) the mitigation zone has been clear from any additional sightings for 10 min. during activities under positive control with aircraft that have fuel constraints, or 30 min. during activities under positive control with aircraft that are not typically fuel constrained and during activities using time-delay firing devices. • After completion of an activity (for 30 min): – Observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, the mitigation zones for explosive mine neutralization activities involving Navy divers were based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zones. The Navy identified an opportunity to increase the mitigation zone size for positive control charges in bin E4 or below and bin E7 to enhance protections to the maximum extent practicable and for consistency across activities. These increases are reflected in Table 5.3-13. The mitigation zones for explosive mine neutralization activities involving the use of Navy divers are now based on the largest areas within which it is practical to implement mitigation.

The post-activity observations are a continuation from Phase II and will help the Navy determine if any resources were injured during the activity. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the

activity while performing their regular duties. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources.

The charges used during explosive mine neutralization activities involving Navy divers are either positively controlled or initiated using a time-delay fuse. Positive control means the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation. Time-delay means the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated but cannot be terminated once the fuse is initiated due to human safety concerns. For activities using a time-delay fuse, there is a remote chance that animals could swim into the mitigation zone after the fuse has been initiated. The Navy established a mitigation measure to set time-delay firing devices not to exceed 10-min. to limit the potential time that animals have to swim into the mitigation zone after fuse initiation. During activities under positive control, the Navy can cease detonations at any time in response to a sighting of a marine mammal or sea turtle. For this reason, all activities using a time-delay fuse will implement the 1,000-yd. mitigation zone, while activities that are under positive control will implement either the 500-yd. or 1,000-yd. mitigation zone, depending on the size of the charge. Time-delay charges have a maximum charge size of 29-lb. net explosive weight.

For the 500-yd. mitigation zone, the small observation area and proximity to observation platforms will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zone. For the 1,000-yd. mitigation zone, the use of two additional Lookouts increases the likelihood that Lookouts will be able to detect marine mammals and sea turtles across the larger observation area. Due to their low vantage point on the water, Lookouts in small boats will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) or the splashes of individual marine mammals than cryptic marine mammal species and sea turtles near the perimeter of the 1,000-yd. mitigation zone. When rotary-wing aircraft are used, Lookouts positioned in an aircraft will have a good vantage point for observing out to the perimeter of the 500-yd. and 1,000-yd. mitigation zones. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zones. The additional mitigation within the Southern California Range Complex will help the Navy avoid or reduce potential impacts on hammerhead sharks, least terns, and other seabirds while foraging underwater.

Bin E7 (e.g., 60-lb. net explosive weight charges) has the longest predicted impact ranges for explosives that apply to the 1,000-yd. mitigation zone. Bin E6 (e.g., 20-lb. net explosive weight) has the longest predicted impact ranges for the positive control explosives that apply to the 500-yd. mitigation zone. The 1,000-yd. and 500-yd. mitigation zones extend beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zones extend beyond the average ranges to PTS for sea turtles and marine mammals that could potentially occur in the locations where this activity takes place except low-frequency cetaceans (the mitigation zones extend into a portion of the average ranges to PTS for this hearing group). The mitigation zones also extend into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E7 and bin E6. Smaller explosives within bin E7 and bin E6 and explosives in smaller source bins (e.g., E5) have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

As described previously, the Phase III mitigation zones are based on the largest areas within which it is practical for the Navy to implement mitigation. It is not practical to increase these mitigation zones because observations within the margin of increase would be unsafe and ineffective unless the Navy allocated additional platforms to the activity to observe for biological resources. Because mine neutralization activities involve training Navy divers in the safe handling of explosive charges, one of the mission-essential safety protocols required of all event participants, including Lookouts, is to maintain focus on the activity area to ensure safety of personnel and equipment. The typical mine neutralization activity areas coincide with the mitigation zone sizes developed for Phase III; therefore, Lookouts can safely and effectively observe the mitigation zones for biological resources while simultaneously maintaining focus on the activity areas. However, if the mitigation zone sizes increased, Lookouts would need to redirect their attention beyond the activity areas. This would not meet the safety criteria since personnel would be required to direct their attention away from mission requirements. Alternatively, the Navy would need to add personnel to serve as additional Lookouts on the existing observation platforms or allocate additional platforms to the activity to observe for biological resources. These actions would not be safe or sustainable due to an exceedance of manpower, resource, and space restrictions for these activities.

Increasing the mitigation zone sizes would result in larger areas over which detonations would need to be ceased in response to a sighting, and therefore would likely increase the number of times detonations would be ceased. This would extend the length of the activities and cause significant safety risks for Navy divers and loss of training time. Ceasing an activity (e.g., fuse initiation) with divers in the water would have safety implications for diver air consumption and bottom time. It would also impede the ability for Navy divers to complete the training exercise with the focused endurance as required during military missions and combat operations. These impacts would significantly diminish event realism in a way that would prevent activities from meeting their intended objectives. For example, the number of opportunities that divers would have to locate and neutralize mines would be reduced. Divers would then not be able to gain skill proficiency in precise identification and evaluation of a threat mine, safe handling of explosive material during charge placement, and effective charge detonation or fuse initiation. Mine neutralization activities involving the use of Navy divers only take place during daylight hours for safety reasons; therefore, extending the length of the activity could delay the activity into the next day or next several days, which would significantly impact training schedules for all participating platforms. Therefore, an increase in mitigation would impede the ability for Navy divers to train and become proficient in mine neutralization and would prevent units from meeting their individual training and certification requirements (which would prevent them from deploying with the required level of readiness necessary to accomplish their missions).

For activities that involve aircraft, extending the length of the activity would require aircraft to depart the area to refuel. If multiple refueling events were required, the length of the activity would be extended by two to five times or more, which would decrease the ability for Lookouts to safely and effectively maintain situational awareness of the activity area and increase safety risks due to increased pilot fatigue and accelerated fatigue-life of aircraft. Extending the length of the activity would also result in additional operational costs due to increased fuel consumption.

In summary, the operational community determined that implementing procedural mitigation for explosive mine neutralization activities involving Navy divers beyond what is detailed in Table 5.3-13 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.3.9 Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading exercises, as outlined in Table 5.3-14.

Table 5.3-14: Procedural Mitigation for Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading

Procedural Mitigation Description
Stressor or Activity • Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading exercises
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 2 Lookouts (one on a small boat and one on shore from an elevated platform) • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 700 yd. around the detonation location • Prior to the initial start of the activity: – For 30 min. prior to the first detonation, the Lookout positioned on a small boat will observe the mitigation zone for floating vegetation, marine mammals, and sea turtles; if observed, delay the start of detonations. – For 10 min. prior to the first detonation, the Lookout positioned on shore will use binoculars to observe the mitigation zone for marine mammals and sea turtles; if observed, delay the start of detonations until the mitigation zone has been clear of any additional sightings for a minimum of 10 min. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease detonations. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the detonation location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. (as determined by the shore observer). • After completion of the activity (for 30 min.): – The Lookout positioned on a small boat will observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, the Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone for Phase III.

The Navy is continuing its mitigation to observe the mitigation zone prior to the initial start of the activity to ensure the area is clear of applicable biological resources and after completion of the activity

to help determine if any resources were injured the event. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

The activity's proximity to shore and the use of two Lookouts from different observation platforms will result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zone. The Navy will implement a 10-min. recommencement wait period because this activity is conducted in the shallow waters of San Clemente Island (e.g., Northwest Harbor) where marine mammals would not be expected to undergo deep or prolonged dives. Shore-based Lookouts will have an enhanced vantage point for observing the mitigation zone to help determine that it is clear of marine mammals and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce impacts on these resources within the mitigation zone.

Bin E13 has the longest predicted impact ranges for explosives used in this activity. The mitigation zone extends beyond the respective ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the average ranges to PTS for sea turtles and marine mammals that could potentially occur in the locations where this activity takes place except phocids (the mitigation zone extends into a portion of the average ranges to PTS for this hearing group). The mitigation zone also extends into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, depending on the species, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E13. Smaller explosives within bin E13 and explosives in smaller source bins (e.g., E10) have shorter predicted impact ranges; therefore, the mitigation zones will cover a greater portion of the impact ranges for these explosives.

During this activity, military personnel train to use explosive charges to destroy barriers or obstacles to amphibious vehicle access to beach areas. Because this activity involves training Navy divers in the safe handling of explosive charges, one of the mission-essential tasks required of all personnel (including Lookouts) is to maintain attention on the activity area as a safety protocol to ensure safety of personnel and equipment. The typical activity area coincides with the mitigation zone size presented in Table 5.3-14; therefore, Lookouts will be able to safely and effectively observe the mitigation zone for biological resources while simultaneously maintaining focus on the activity area. However, if the mitigation zone size was to increase, the Lookout would need to redirect attention to observe a larger area that extends beyond the activity area (which would not meet the safety criteria since personnel would be required to direct their attention away from mission requirements). Alternatively, the Navy would need to add personnel to serve as additional Lookouts, which would cause an exceedance of manpower available for this activity. Additional delays to the exercise would reduce the personnel's abilities to construct, place, and safely detonate multiple charges laid in a pattern for underwater obstacle clearance as would be required in military missions and combat operations, which would modify the activity in a way that prevents it from meeting its intended objectives.

In summary, the operational community determined that implementing procedural mitigation for Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading beyond what is detailed in

Table 5.3-14 would be incompatible with the practicality assessment criteria for safety, sustainability and mission requirements.

5.3.3.10 Maritime Security Operations – Anti-Swimmer Grenades

The Navy will continue to implement procedural mitigation to avoid or reduce potential impacts on marine mammals and sea turtles from anti-swimmer grenades during Maritime Security Operations, as outlined in Table 5.3-15.

Table 5.3-15: Procedural Mitigation for Maritime Security Operations – Anti-Swimmer Grenades

Procedural Mitigation Description
Stressor or Activity • Maritime Security Operations – Anti-Swimmer Grenades
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned on the small boat conducting the activity • If additional platforms are participating in the activity, personnel positioned in those assets (e.g., safety observers, evaluators) will support observing the mitigation zone for applicable biological resources while performing their regular duties.
Mitigation Requirements • Mitigation zone: – 200 yd. around the intended detonation location • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of detonations. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease detonations. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing detonations) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended detonation location; (3) the mitigation zone has been clear from any additional sightings for 30 min.; or (4) the intended detonation location has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting. • After completion of the activity (e.g., prior to maneuvering off station): – When practical (e.g., when platforms are not constrained by fuel restrictions or mission-essential follow-on commitments), observe the vicinity of where detonations occurred; if any injured or dead marine mammals or ESA-listed species are observed, follow established incident reporting procedures. – If additional platforms are supporting this activity (e.g., providing range clearance), these assets will assist in the visual observation of the area where detonations occurred.

In Phase II, the Maritime Security Operations – Anti-Swimmer Grenade mitigation zone was based on net explosive weight and the associated average ranges to PTS. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zone. The Navy determined that the current mitigation zone is the largest area within which it is practical to implement mitigation for this activity; therefore, it will continue implementing this same mitigation zone for Phase III. The Navy is clarifying in the table that it will require observation of the mitigation zone prior to the initial start of the

activity to ensure the area is clear of applicable biological resources. The Navy has always verified that the mitigation zone is visually clear prior to conducting explosive activities and is more clearly capturing this current practice in the mitigation measures for Phase III. The Navy developed a new mitigation measure requiring the Lookout to observe the mitigation zone after completion of the activity. In accordance with Phase II consultation requirements, the Navy currently conducts post-activity observations for some, but not all explosive activities. In developing mitigation for Phase III, the Navy determined that it could expand this requirement to other explosive activities for enhanced consistency and to help determine if any resources were injured during explosive events, when practical. The Navy is adding a requirement that additional platforms already participating in the activity will support observing the mitigation zone before, during, and after the activity while performing their regular duties. When available, having additional personnel support observations of the mitigation zone will help increase the likelihood of detecting biological resources. The Navy will follow the incident reporting procedures outlined in Section 5.1.2.2.3 (Incident Reports) if an incident is detected at any time during the event, including during the post-activity observations.

The small mitigation zone size and proximity to the observation platform result in a high likelihood that Lookouts will be able to detect marine mammals and sea turtles throughout the mitigation zone. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

Explosives used during Maritime Security Operations – Anti-Swimmer Grenades exercises are in bin E2 (e.g., 0.5-lb. net explosive weight). The mitigation zone extends beyond the ranges to 50 percent non-auditory injury and 50 percent mortality for sea turtles and marine mammals. The mitigation zone extends beyond the respective average ranges to PTS for sea turtles all marine mammal hearing groups that could potentially occur in the locations where this activity takes place (high-frequency cetaceans are unlikely to occur in the areas where this activity takes place). The mitigation zone also extends into a portion of the average ranges to TTS for sea turtles and marine mammals. Therefore, mitigation will help avoid or reduce all or a portion of the potential for exposure to mortality, non-auditory injury, PTS, and higher levels of TTS for the largest explosives in bin E2.

As described previously, the Phase III mitigation zone is based on the largest area within which it is practical for the Navy to implement mitigation. It is not practical to increase the mitigation zone because observations within the margin of increase would be unsafe and ineffective. Because this activity involves training crews in the safe handling of explosive hand grenades, one of the mission-essential safety protocols required of all event participants, including the Lookout, is to maintain focus on the activity area to ensure safety of personnel and equipment. The typical activity area coincides with the mitigation zone that will be implemented for Phase III; therefore, the Lookout can safely and effectively observe the mitigation zone for biological resources while simultaneously maintaining focus on the activity area. However, if the mitigation zone size increased, the Lookout would need to redirect attention to observe beyond the activity area. This would not meet the safety criteria since personnel would be required to direct their attention away from mission requirements. Alternatively, the Navy would need to either add personnel to serve as additional Lookouts on the existing observation platform or allocate additional platforms to the activity to observe for biological resources. These actions would not be safe or sustainable due an exceedance of manpower, resource, and space restrictions for this activity.

In summary, the operational community determined that implementing procedural mitigation for Maritime Security Operations – Anti-Swimmer Grenades beyond what is detailed in Table 5.3-15 would be incompatible with the practicality assessment criteria for safety and sustainability.

5.3.4 Physical Disturbance and Strike Stressors

The Navy will implement procedural mitigation to avoid or reduce potential impacts on biological resources from the physical disturbance and strike stressors or activities discussed in the sections below. Section 3.7.3.4 (Physical Disturbance and Strike Stressors) and Section 3.8.3.4 (Physical Disturbance and Strike Stressors) provide a full analysis of the potential impacts of physical disturbance and strikes on marine mammals and sea turtles, respectively. Appendix F (Military Expended Material and Direct Strike Impact Analysis) presents the impact footprints and direct strike calculations. In addition to procedural mitigation, the Navy will implement mitigation for physical disturbance and strike stressors within mitigation areas (see Section 5.4.1, Mitigation Areas for Seafloor Resources; Section 5.4.2, Mitigation Areas for Marine Mammals in The Hawaii Range Complex; and Section 5.4.3, Mitigation Areas for Marine Mammals in the Southern California Portion of the Study Area).

5.3.4.1 Vessel Movement

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for vessel strikes of marine mammals and sea turtles, as outlined in Table 5.3-16.

Table 5.3-16: Procedural Mitigation for Vessel Movement

Procedural Mitigation Description
Stressor or Activity • Vessel movement – The mitigation will not be applied if: (1) the vessel's safety is threatened, (2) the vessel is restricted in its ability to maneuver (e.g., during launching and recovery of aircraft or landing craft, during towing activities, when mooring, etc.), (3) the vessel is operated autonomously, or (4) when impractical based on mission requirements (e.g., during Amphibious Assault – Battalion Landing exercises)
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout on the vessel that is underway
Mitigation Requirements • Mitigation zones: – 500 yd. around whales – 200 yd. around other marine mammals (except bow-riding dolphins and pinnipeds hauled out on man-made navigational structures, port structures, and vessels) – Within the vicinity of sea turtles • During the activity: – When underway, observe the mitigation zone for marine mammals and sea turtles; if observed, maneuver to maintain distance. • Additional requirements: – If a marine mammal or sea turtle vessel strike occurs, the Navy will follow the established incident reporting procedures.

The procedural mitigation measures for vessel movement are based on guidance from NMFS for vessel strike avoidance. Although the Navy is unable to position Lookouts on unmanned vessels, some vessels that operate autonomously have embedded sensors that aid in avoidance of large objects. The embedded sensors may help those unmanned vessels avoid marine mammal vessel strikes.

As discussed in Section 5.3.1 (Environmental Awareness and Education), it is likely that the implementation of the Marine Species Awareness Training starting in 2007, and the additional U.S. Navy Afloat Environmental Compliance Training Series modules starting in 2014, has contributed to a reduction in marine mammal vessel strikes. The Navy is able to detect if a whale is struck due to the diligence of standard watch personnel and Lookouts stationed specifically to observe for marine mammals while a vessel is underway. In the unlikely event that a marine mammal vessel strike occurs, the Navy will notify the appropriate regulatory agency immediately or as soon as operational security considerations allow per the established incident reporting procedures described in Section 5.1.2.2.3 (Incident Reports). The Navy's incident reports include relevant information pertaining to the incident, including but not limited to vessel speed.

The small mitigation zone sizes and close proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zones while vessels are underway. A mitigation zone size is not specified for sea turtles to allow flexibility based on vessel type and mission requirements (e.g., small boats operating in a narrow harbor).

As described in Section 2.3.3.2 (Vessel Safety), Navy vessels are required to operate in accordance with applicable navigation rules, including Inland Navigation Rules (33 Code of Federal Regulations 83) and International Regulations for Preventing Collisions at Sea (72 COLREGS), which were formalized in the Convention on the International Regulations for Preventing Collisions at Sea, 1972. These rules require that vessels proceed at a safe speed so proper and effective action can be taken to avoid collision and so vessels can be stopped within a distance appropriate to the prevailing circumstances and conditions. In addition to complying with navigation requirements, Navy ships transit at speeds that are optimal for fuel conservation, to maintain ship schedules, and to meet mission requirements. Vessel captains use the totality of the circumstances to ensure the vessel is traveling at appropriate speeds in accordance with navigation rules. Depending on the circumstances, this may involve adjusting speeds during periods of reduced visibility or in certain locations.

As discussed in Section 3.0.3.3.4.1 (Vessels and In-Water Devices), large Navy ships typically operate at average speeds of between 10 and 15 knots, which for reference is slower than large commercial vessels, such as container ships that steam at approximately 24 knots during normal operations (Maloni et al., 2013). Operating vessels at speeds that are not optimal for fuel conservation or mission requirements would be unsustainable due to increased time on station and increased fuel consumption. Each ship has a limited amount of time that it can be underway based on target service requirements and ship schedules. Ship schedules are driven largely by training cycles, scheduled maintenance periods, certification schedules, and deployment requirements. Because of the complex logistical considerations involved with maintaining ship schedules, the Navy does not have the flexibility to extend the amount of time that ships are underway, which would result from vessel speed restriction mitigation.

Navy vessel operators need to train to proficiently operate vessels as they would during military missions and combat operations, including being able to react to changing tactical situations and evaluate system capabilities. For example, during training activities involving flight operations from an aircraft carrier, the vessel must maintain a certain wind speed over the deck to launch or recover aircraft. Depending on wind conditions, the aircraft carrier itself must travel at a certain speed to generate the wind required to launch or recover aircraft. Implementing vessel speed restrictions would increase safety risks for Navy personnel and equipment and the public during the training event and would reduce skill proficiency in a way that would increase safety risks during military missions and

combat operations. Furthermore, vessel speed restrictions would not allow the Navy to continue meeting its training requirements due to diminished realism of training exercises.

The Navy needs to test the full range of its vessel and system capabilities to ensure safety and functionality in conditions analogous to military missions and combat operations. For example, during non-explosive torpedo testing activities, the Navy must operate its vessels using speeds typical of military missions and combat operations to accurately test the functionality of its acoustic countermeasures and torpedo systems during firing on submarine and vessel targets. The Navy conducts some activities specifically to test the functionality of vessel propulsion systems, including maneuvering, full-power runs, and endurance runs. During these events, ships must operate across the full spectrum of capable speeds to accomplish the primary testing objectives. Vessel speed restrictions would not allow the Navy to continue meeting its testing program requirements due to diminished realism of testing events. Researchers, program managers, and weapons system acquisition programs would be unable to conduct accurate acoustic research to meet research objectives and effectively test vessels and vessel-deployed systems and platforms before full-scale production or delivery to the fleet. Such testing is required to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

In summary, the operational community determined that implementing procedural mitigation for vessel movements beyond what is detailed in Table 5.3-16 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

5.3.4.2 Towed In-Water Devices

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from towed in-water devices, as outlined in Table 5.3-17. Vessels involved in towing in-water devices will implement the mitigation described in Section 5.3.4.1 (Vessel Movement), in addition to the mitigation outlined in Table 5.3-17.

Table 5.3-17: Procedural Mitigation for Towed In-Water Devices

Procedural Mitigation Description
Stressor or Activity • Towed in-water devices – Mitigation applies to devices that are towed from a manned surface platform or manned aircraft – The mitigation will not be applied if the safety of the towing platform or in-water device is threatened
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned on the manned towing platform
Mitigation Requirements • Mitigation zones: – 250 yd. around marine mammals – Within the vicinity of sea turtles • During the activity (i.e., when towing an in-water device): – Observe the mitigation zone for marine mammals and sea turtles; if observed, maneuver to maintain distance.

The small mitigation zone size and proximity to the observation platform will result in a high likelihood that Lookouts will be able to detect marine mammals throughout the mitigation zone when manned vessels or manned aircraft are towing in-water devices. A mitigation zone size is not specified for sea

turtles to allow flexibility based on towing platform type and mission requirements (e.g., small boats operating in a narrow harbor).

The mitigation zones for towed in-water devices are based on the largest areas within which it is practical for the Navy to implement mitigation. When developing Phase III mitigation, the Navy analyzed the potential for increasing the size of the mitigation zones. Mission and safety requirements determine the operational parameters (e.g., course) for in-water device towing platforms. Towed in-water devices must be towed at certain speeds and water depths for stability, which are controlled in part by the towing platform's speed and directional movements. Because these devices are towed and not self-propelled, they generally have limited maneuverability and are not able to make immediate course corrections. For example, during a Mine Countermeasure – Towed Mine Neutralization activity using rotary-wing aircraft, towed devices are used to trigger mines and perform various other functions, such as detaching floating moored mines. A high degree of pilot skill is required in deploying devices, safely towing them at relatively low speeds and altitudes, and then recovering devices. The aircraft can safely alter course to shift the route of the towed device in response to a sighted marine mammal or sea turtle up to a certain extent (i.e., up to the size of the mitigation zone) while still maintaining the parameters needed for stable towing. However, the aircraft would be unable to further alter its course to more drastically course-correct the towed device without decreasing towing stability, which would have implications for safety of personnel and equipment.

In summary, the operational community determined that implementing procedural mitigation for towed in-water devices beyond what is detailed in Table 5.3-17 would be incompatible with the practicality assessment criteria for safety.

5.3.4.3 Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from small-, medium-, and large-caliber non-explosive practice munitions, as outlined in Table 5.3-18.

Table 5.3-18: Procedural Mitigation for Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions

Procedural Mitigation Description
Stressor or Activity
• Gunnery activities using small-, medium-, and large-caliber non-explosive practice munitions – Mitigation applies to activities using a surface target
Resource Protection Focus
• Marine mammals • Sea turtles
Number of Lookouts and Observation Platform
• 1 Lookout positioned on the platform conducting the activity – Depending on the activity, the Lookout could be the same as the one described in Section 5.3.2.4 (Weapons Firing Noise).
Mitigation Requirements
• Mitigation zone: – 200 yd. around the intended impact location • Prior to the initial start of the activity (e.g., when maneuvering on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing.

Table 5.3-18: Procedural Mitigation for Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions (continued)

Procedural Mitigation Description
• During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting before or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; (3) the mitigation zone has been clear from any additional sightings for 10 min. for aircraft-based firing or 30 min. for vessel-based firing; or (4) for activities using a mobile target, the intended impact location has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

The mitigation zone is conservatively designed to be several times larger than the impact footprint for large-caliber non-explosive practice munitions, which are the largest projectiles based on the military expended material impact footprints calculated in Appendix F (Military Expended Material and Direct Strike Impact Analysis). Small-caliber and medium-caliber non-explosive practice munitions have smaller impact footprints than large-caliber non-explosive practice munitions; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller projectiles.

Large-caliber gunnery activities involve vessels firing projectiles at a target located up to 6 NM down range. Small- and medium-caliber gunnery activities involve vessels or aircraft firing projectiles at targets located up to 4,000 yd. down range, although typically much closer. Lookouts will have a better likelihood of detecting marine mammals and sea turtles when observing mitigation zones around targets located close to the firing platform. When observing activities that use a target located far from the firing platform, Lookouts will be more likely to detect large visual cues (e.g., whale blows or large pods of dolphins) than individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone. Positioning additional observers closer to the targets would increase safety risks because these platforms would be located in the vicinity of an intended impact location or in the path of a projectile.

5.3.4.4 Non-Explosive Missiles and Rockets

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from non-explosive missiles and rockets, as outlined in Table 5.3-19.

Table 5.3-19: Procedural Mitigation for Non-Explosive Missiles and Rockets

Procedural Mitigation Description
Stressor or Activity
• Aircraft-deployed non-explosive missiles and rockets – Mitigation applies to activities using a surface target
Resource Protection Focus
• Marine mammals • Sea turtles
Number of Lookouts and Observation Platform
• 1 Lookout positioned in an aircraft

Table 5.3-19: Procedural Mitigation for Non-Explosive Missiles and Rockets (continued)

Procedural Mitigation Description
Mitigation Requirements • Mitigation zone: – 900 yd. around the intended impact location • Prior to the initial start of the activity (e.g., during a fly-over of the mitigation zone): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of firing. • During the activity: – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease firing. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting prior to or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing firing) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended impact location; or (3) the mitigation zone has been clear from any additional sightings for 10 min. when the activity involves aircraft that have fuel constraints, or 30 min. when the activity involves aircraft that are not typically fuel constrained.

The mitigation zone for non-explosive missiles and rockets is conservatively designed to be several times larger than the impact footprint for the largest non-explosive missile based on the military expended material impact footprints calculated in Appendix F (Military Expended Material and Direct Strike Impact Analysis). Smaller non-explosive missiles and non-explosive rockets have smaller impact footprints than the largest non-explosive missile used for these activities; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller projectiles.

Mitigation applies to activities using non-explosive missiles or rockets fired from aircraft at targets that are typically located up to 15 NM down range, and infrequently up to 75 NM down range. There is a chance that animals could enter the mitigation zone after the aircraft conducts its close-range mitigation zone observations and before firing begins (once the aircraft has transited to its firing position). Due to the distance between the mitigation zone and the observation platform, Lookouts will have a better likelihood of detecting marine mammals and sea turtles during the close-range observations and are less likely to detect these resources once positioned at the firing location, particularly individual marine mammals, cryptic marine mammal species, and sea turtles. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone during the close-range observations. The mitigation only applies to aircraft-deployed missiles and rockets for the reasons discussed in Section 5.3.3.4 (Explosive Missiles and Rockets). Positioning additional observers closer to the targets would increase safety risks because these platforms would be located in the vicinity of an intended impact location or in the path of a projectile.

5.3.4.5 Non-Explosive Bombs and Mine Shapes

The Navy will continue to implement procedural mitigation to avoid or reduce the potential for strike of marine mammals and sea turtles from non-explosive bombs and mine shapes, as outlined in Table 5.3-20.

Table 5.3-20: Procedural Mitigation for Non-Explosive Bombs and Mine Shapes

Procedural Mitigation Description
Stressor or Activity • Non-explosive bombs • Non-explosive mine shapes during mine laying activities
Resource Protection Focus • Marine mammals • Sea turtles
Number of Lookouts and Observation Platform • 1 Lookout positioned in an aircraft
Mitigation Requirements • Mitigation zone: – 1,000 yd. around the intended target • Prior to the start of the activity (e.g., when arriving on station): – Observe the mitigation zone for floating vegetation; if observed, relocate or delay the start until the mitigation zone is clear. – Observe the mitigation zone for marine mammals and sea turtles; if observed, relocate or delay the start of bomb deployment or mine laying. • During the activity (e.g., during approach of the target or intended minefield location): – Observe the mitigation zone for marine mammals and sea turtles; if observed, cease bomb deployment or mine laying. • Commencement/recommencement conditions after a marine mammal or sea turtle sighting prior to or during the activity: – The Navy will allow a sighted marine mammal or sea turtle to leave the mitigation zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing bomb deployment or mine laying) until one of the following conditions has been met: (1) the animal is observed exiting the mitigation zone; (2) the animal is thought to have exited the mitigation zone based on a determination of its course, speed, and movement relative to the intended target or minefield location; (3) the mitigation zone has been clear from any additional sightings for 10 min.; or (4) for activities using mobile targets, the intended target has transited a distance equal to double that of the mitigation zone size beyond the location of the last sighting.

The mitigation zone for non-explosive bombs and mine shapes is conservatively designed to be several times larger than the impact footprint for the largest non-explosive bomb based on the military expended material impact footprints calculated in Appendix F (Military Expended Material and Direct Strike Impact Analysis). Smaller non-explosive bombs and mine shapes have smaller impact footprints than the largest non-explosive bomb used for these activities; therefore, the mitigation zone will extend even further beyond the impact footprints for these smaller military expended materials.

Activities involving non-explosive bombing and mine laying involve aircraft deploying munitions or mine shapes from a relatively steady altitude of approximately 1,500 ft. at a surface target or in an intended minefield located beneath the aircraft. Due to the mitigation zone size, proximity to the observation platform, and the good vantage point from an aircraft, Lookouts will be able to observe the entire mitigation zone during approach of the target or intended minefield location. Observing for indicators of marine mammal and sea turtle presence will further help avoid or reduce potential impacts on these resources within the mitigation zone.

5.4 MITIGATION AREAS TO BE IMPLEMENTED

The first section (Section 5.4.1, Mitigation Areas for Seafloor Resources) describes mitigation areas that are designed to avoid or reduce potential impacts on seafloor resources throughout the Study Area. The remaining sections are specific to marine mammals and are organized by geographic region.

5.4.1 MITIGATION AREAS FOR SEAFLOOR RESOURCES

As outlined in Table 5.4-1 and shown in Figure 5.4-1 and

Figure 5.4-2, the Navy will implement mitigation to avoid or reduce potential impacts on biological or cultural resources that are not observable by Lookouts from the water's surface (i.e., resources for which procedural mitigation cannot be implemented).

Table 5.4-1: Mitigation Areas for Seafloor Resources

Mitigation Area Description
Stressor or Activity • Explosives • Physical disturbance and strikes
Resource Protection Focus • Shallow-water coral reefs • Precious coral beds • Live hard bottom • Artificial reefs • Shipwrecks
Mitigation Area Requirements (year-round) • **Within the anchor swing circle of shallow-water coral reefs, precious coral beds, live hard bottom, artificial reefs, and shipwrecks:** – The Navy will not conduct precision anchoring (except in designated anchorages in the Hawaii Range Complex and Southern California portion of the Action Area, such as areas adjoining the boat lanes off Silver Strand Training Complex and Naval Amphibious Base Coronado). • **Within a 350-yd. radius of live hard bottom, artificial reefs, and shipwrecks:** – The Navy will not conduct explosive mine countermeasure and neutralization activities or explosive mine neutralization activities involving Navy divers (except in designated areas in the Hawaii Range Complex and Southern California portion of the Action Area, such as the nearshore areas of San Clemente Island and in the Silver Strand Training Complex, where these features will be avoided to the maximum extent practicable). – The Navy will not place mine shapes, anchors, or mooring devices on the seafloor (except in designated areas in the Hawaii Range Complex and Southern California portion of the Action Area, such as the nearshore areas of San Clemente Island and in the Silver Strand Training Complex, where these features will be avoided to the maximum extent practicable). • **Within a 350-yd. radius of shallow-water coral reefs and precious coral beds:** – The Navy will not conduct explosive or non-explosive small-, medium-, and large-caliber gunnery activities using a surface target; explosive or non-explosive missile and rocket activities using a surface target; explosive or non-explosive bombing and mine laying activities; explosive or non-explosive mine countermeasure and neutralization activities; and explosive or non-explosive mine neutralization activities involving Navy divers (except in designated areas in the Hawaii Range Complex and Southern California portion of the Action Area, such as the nearshore areas of San Clemente Island and in the Silver Strand Training Complex, where these features will be avoided to the maximum extent practicable). – The Navy will not place mine shapes, anchors, or mooring devices on the seafloor (except in designated areas in the Hawaii Range Complex and Southern California portion of the Action Area, such as the nearshore areas of San Clemente Island and in the Silver Strand Training Complex, where these features will be avoided to the maximum extent practicable).

5.4.1.1 Resource Description

Seafloor resources fulfill important ecosystem functions. Live hard bottom habitats and artificial structures (e.g., artificial reefs, shipwrecks) provide attachment substrate for aquatic vegetation and invertebrates, such as corals, seaweed, seagrass, macroalgae, and sponges. These habitats in turn support a community of organisms, such as fish, shrimp, crabs, barnacles, worms, and sea cucumbers. Shallow-water coral reefs provide substrate, shelter, and food for hundreds of invertebrate species, sea turtles, fishes, and other biological resources. They are one of the most productive and diverse assemblages on Earth.

Dive sites occur throughout nearshore areas of the Study Area where there are shipwrecks, artificial reefs, and shallow-water coral reefs, making these resources highly valuable from a socioeconomic standpoint. Historic shipwrecks are classified as archaeological resources and are an important part of maritime history. For additional information on the biological, cultural, and socioeconomic importance of seafloor resources and their associated ecosystem components, refer to Chapter 3.3 (Vegetation), Chapter 3.4 (Invertebrates), Chapter 3.5 (Habitats), Chapter 3.6 (Fishes), Chapter 3.7 (Marine Mammals), Chapter 3.8 (Reptiles), Chapter 3.10 (Cultural Resources), and Chapter 3.11 (Socioeconomic Resources).

5.4.1.2 Mitigation Area Assessment

Without mitigation, explosives and physical disturbance and strike stressors could potentially impact shallow-water coral reefs, live hard bottom, artificial reefs, shipwrecks, and their associated ecosystem components during certain training and testing activities in the Study Area. Figure 5.4-1 and

Figure 5.4-2 show the relevant seafloor resources and the Navy training or testing locations that overlap them. The Navy developed mitigation areas as either the anchor swing circle diameter or a 350-yd. radius around a seafloor resource, as indicated by the best available georeferenced data. Mitigating within the anchor swing circle will protect seafloor resources during precision anchoring activities when factoring in environmental conditions that could affect anchoring position and swing circle size, such as winds, currents, and water depth. For other activities applicable to the mitigation, a 350-yd. radius around a seafloor resource is a conservatively sized mitigation area that will provide protection well beyond the maximum expected impact footprint (e.g., crater and expelled material radius) of the explosives and non-explosive practice munitions used in the Study Area. As described in Appendix F (Military Expended Material and Direct Strike Impact Analysis), the military expended material with the largest footprint that applies to the mitigation is an explosive mine with 650-lb. net explosive weight, which has an estimated impact footprint of approximately 14,800 square ft. and associated radius of 22.7 yd. The 350-yd. mitigation zone is well beyond the maximum expected direct impact footprint for the activities listed in Table 5.4-1, and further mitigates some level of indirect impact from explosive disturbances. Other applicable explosive activities and non-explosive practice munitions have a smaller impact footprint; therefore, the mitigation area will result in additional protection during those activities.

The seafloor resource mitigation areas will help the Navy avoid or reduce potential impacts from explosives and physical disturbance and strike stressors on sensitive seafloor resources and to any biological or cultural resources that inhabit, shelter, rest, feed, or occur in the mitigation areas. As described in Chapter 3.5 (Habitats), other habitats, such as soft bottom, are expected to recover relatively quickly from potential disturbances; therefore, there would be a limited benefit of mitigation for other habitat types.

To facilitate mitigation implementation, the Navy will include maps of the best available georeferenced data for shallow-water coral reefs, precious coral beds, artificial reefs, live hard bottom, and shipwrecks in its Protective Measures Assessment Protocol. The Navy will include data that most accurately represent the natural boundaries of seafloor resources, as described in *Building and Maintaining a Comprehensive Database and Prioritization Scheme for Overlapping Habitat Data* (U.S. Department of the Navy, 2016). Data presented in Section 3.3 (Vegetation), Section 3.4 (Invertebrates), Section 3.5 (Habitats), and Section 3.10 (Cultural Resources) will serve as the baseline of best available georeferenced data for seafloor resource mitigation areas. The Navy will also include additional seafloor resource data (such as data that the Navy has acquired access to but that is not publicly available), if applicable. Mitigation areas apply to georeferenced resources because the Navy requires accurate resource identification and mapping for mitigation to be effective and practical to implement.

Input from the operational community indicates that the mitigation detailed in Table 5.4-1 is practical to implement. Implementing additional mitigation for other activities or types of seafloor resources would not allow the Navy to continue meeting its mission requirements to successfully accomplish military readiness objectives. Expanding the mitigation to protect additional seafloor features where marine species are known to occur (e.g., soft bottom, which provides habitat for resources such as seagrass, worms, and clams) would essentially result in the Navy not conducting training and testing activities throughout a significant portion of the Study Area. This would prohibit the Navy from accessing a majority of its ranges and operating areas and conducting the Proposed Action in environments that are analogous to where the military operates, or may need to operate in the future, which would prevent it from meeting its mission requirements. This would also push training and testing activities farther offshore, which would have implications for safety and sustainability. Moving activities farther offshore would increase the distance from aircraft emergency landing fields, critical medical facilities, and search and rescue capabilities; would require excessive time on station or time away from homeport for Navy personnel; and would result in significant increases to operational costs.

In summary, the operational community determined that implementing mitigation for seafloor resources beyond what is detailed in Table 5.4-1 would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements.

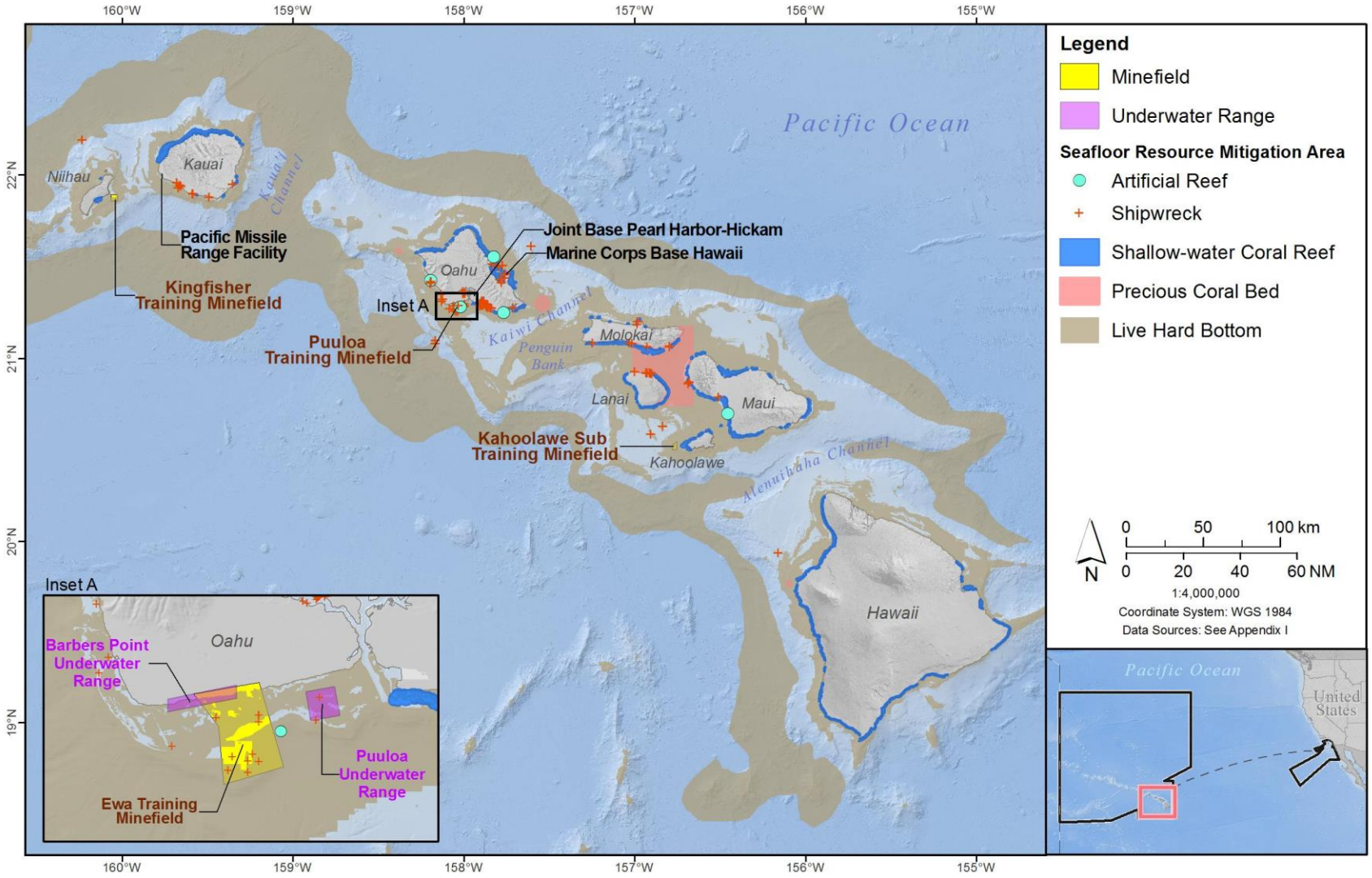


Figure 5.4-1: Seafloor Resource Mitigation Areas off Hawaii

Notes: MCB = Marine Corps Base; SOCAL = Southern California

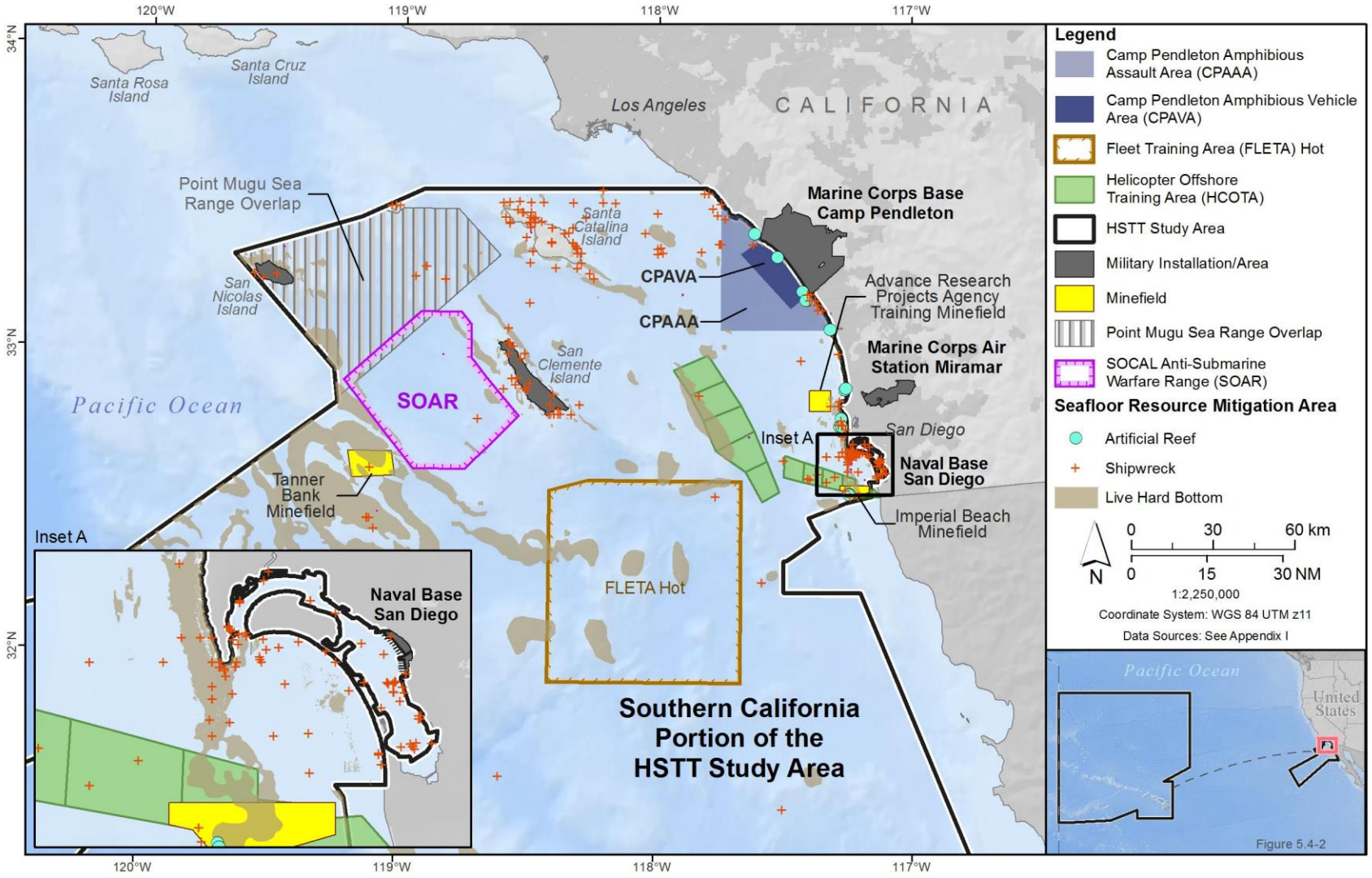


Figure 5.4-2: Seafloor Resource Mitigation Areas off Southern California

Notes: HSTT = Hawaii-Southern California Training and Testing; MCAS = Marine Corps Air Station; MCB = Marine Corps Base; NB = Naval Base; SOCAL = Southern California

5.4.2 Mitigation Areas for Marine Mammals in The Hawaii Range Complex

As described in Table 5.4-2 and shown in Figure 5.4-3, the Navy will implement mitigation within mitigation areas in the Hawaii Range Complex to, in combination with procedural mitigation, effect the least practicable adverse impact on marine mammal species or stocks and their habitat and to provide additional mitigation for ESA-listed marine mammal species. A description, biological assessment, and map of each area the Navy assessed is provided in Appendix K (Geographic Mitigation Assessment). This section presents a summary of the mitigation that will be implemented within mitigation areas in the Hawaii Range Complex based on the biological and operational assessment in the appendix.

Table 5.4-2: Mitigation Areas in the Hawaii Range Complex

Mitigation Area Description
Stressor or Activity • Sonar • Explosives • Vessel strikes
Resource Protection Focus • Marine mammals
Mitigation Area Requirements • **Hawaii Island Mitigation Area (year-round):** – The Navy will not conduct more than 300 hours of MF1 surface ship hull-mounted mid-frequency active sonar or 20 hours of MF4 dipping sonar, or use explosives that could potentially result in takes of marine mammals during training and testing. Should national security present a requirement to conduct more than 300 hours of MF1 surface ship hull-mounted mid-frequency active sonar or 20 hours of MF4 dipping sonar, or use explosives that could potentially result in the take of marine mammals during training or testing, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., sonar hours or explosives usage) in its annual activity reports submitted to NMFS. • **4-Islands Region Mitigation Area (November 15 – April 15 for active sonar; year-round for explosives):** – The Navy will not use MF1 surface ship hull-mounted mid-frequency active sonar or explosives that could potentially result in takes of marine mammals during training and testing. Should national security present a requirement to use MF1 surface ship hull-mounted mid-frequency active sonar or explosives that could potentially result in the take of marine mammals during training or testing, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., sonar hours or explosives usage) in its annual activity reports submitted to NMFS. • **Humpback Whale Special Reporting Areas (December 15 – April 15):** – The Navy will report the total hours of surface ship hull-mounted mid-frequency active sonar used in the special reporting areas in its annual training and testing activity reports submitted to NMFS. • **Humpback Whale Awareness Notification Message Area (November – April):** – The Navy will issue a seasonal awareness notification message to alert ships and aircraft operating in the area to the possible presence of concentrations of large whales, including humpback whales. – To maintain safety of navigation and to avoid interactions with large whales during transits, the Navy will instruct vessels to remain vigilant to the presence of large whale species (including humpback whales), that when concentrated seasonally, may become vulnerable to vessel strikes. – Platforms will use the information from the awareness notification message to assist their visual observation of applicable mitigation zones during training and testing activities and to aid in the implementation of procedural mitigation.

5.4.2.1 Summary of Mitigation Area Assessment

The Navy developed the mitigation areas identified in Table 5.4-2 to help avoid or reduce impacts from the Proposed Action on marine mammals in areas that the best available science suggests are important to one or more species of marine mammals for reproduction (seasonally) or occurrence as a small or resident population (year-round). As described in Appendix K (Geographic Mitigation Assessment), implementing additional mitigation in the Hawaii Range Complex beyond what is described in Table 5.4-2 would be impractical due to implications for safety, sustainability, and the Navy's ability to continue meeting its mission requirements. The appendix presents details on how each area was developed (e.g., known high-use areas of Main Hawaiian Islands insular false killer whales, habitat for the small and resident population of the Kohala resident stock of melon-headed whales) and the mitigation benefits they provide. In summary, the mitigation areas in the Hawaii Range Complex will help the Navy avoid or reduce potential impacts on one or more marine mammal species or stocks and their habitat (as well as other species that occur within the areas, such as sea turtles), such as:

- **Hawaii Island Mitigation Area**. This new mitigation will avoid or reduce potential impacts from mid-frequency active sonar and explosives on marine mammals within the mitigation area, which the best available science suggests contains important habitat for numerous small and resident populations (including Blainville's beaked whales, bottlenose dolphins, Cuvier's beaked whales, dwarf sperm whales, false killer whales, melon-headed whales, pantropical spotted dolphins, pygmy killer whales, rough-toothed dolphins, short-finned pilot whales, and spinner dolphins), important seasonal reproductive habitat for humpback whales, and critical habitat for Hawaiian monk seals.
- **4-Islands Region Mitigation Area and Humpback Whale Special Reporting Areas.** By expanding the boundaries and season of the existing mitigation area (which was known in Phase II as the Humpback Whale Cautionary Area), the Navy will further enhance protections for humpback whales from mid-frequency active sonar in the mitigation area. In particular, new data indicates that the area north of Maui and Molokai is associated with high humpback whale densities. Expanding this mitigation area will also help the Navy avoid or reduce impacts on Main Hawaiian Islands insular false killer whales, which are listed as endangered under the ESA and have been shown to have high occurrence in this area. By adding new requirements pertaining to explosives, the Navy will further avoid or reduce potential impacts on marine mammals from explosives year-round. Overall, the mitigation will avoid or reduce potential impacts from mid-frequency active sonar and explosives within the mitigation area on humpback whales (which the best available science suggests contains important seasonal reproductive habitat), numerous small and resident marine mammal populations (including bottlenose dolphins, false killer whales, pantropical spotted dolphins, and spinner dolphins), and Hawaiian monk seals. Continuing to report the total hours of surface ship hull-mounted mid-frequency active sonar used in the Humpback Whale Special Reporting Areas from December 15 through April 15 will aid the Navy and NMFS in analyzing the effectiveness of mitigation in these areas during the adaptive management process. The Humpback Whale Special Reporting Areas contain the Humpback Whale National Marine Sanctuary plus a 5-km buffer around the sanctuary, excluding the Pacific Missile Range Facility.
- **Humpback Whale Awareness Notification Message Area.** This mitigation will further help avoid or reduce potential impacts from vessel strikes and training and testing activities on humpback whales within the Hawaii Range Complex, which contains important seasonal reproductive habitat.

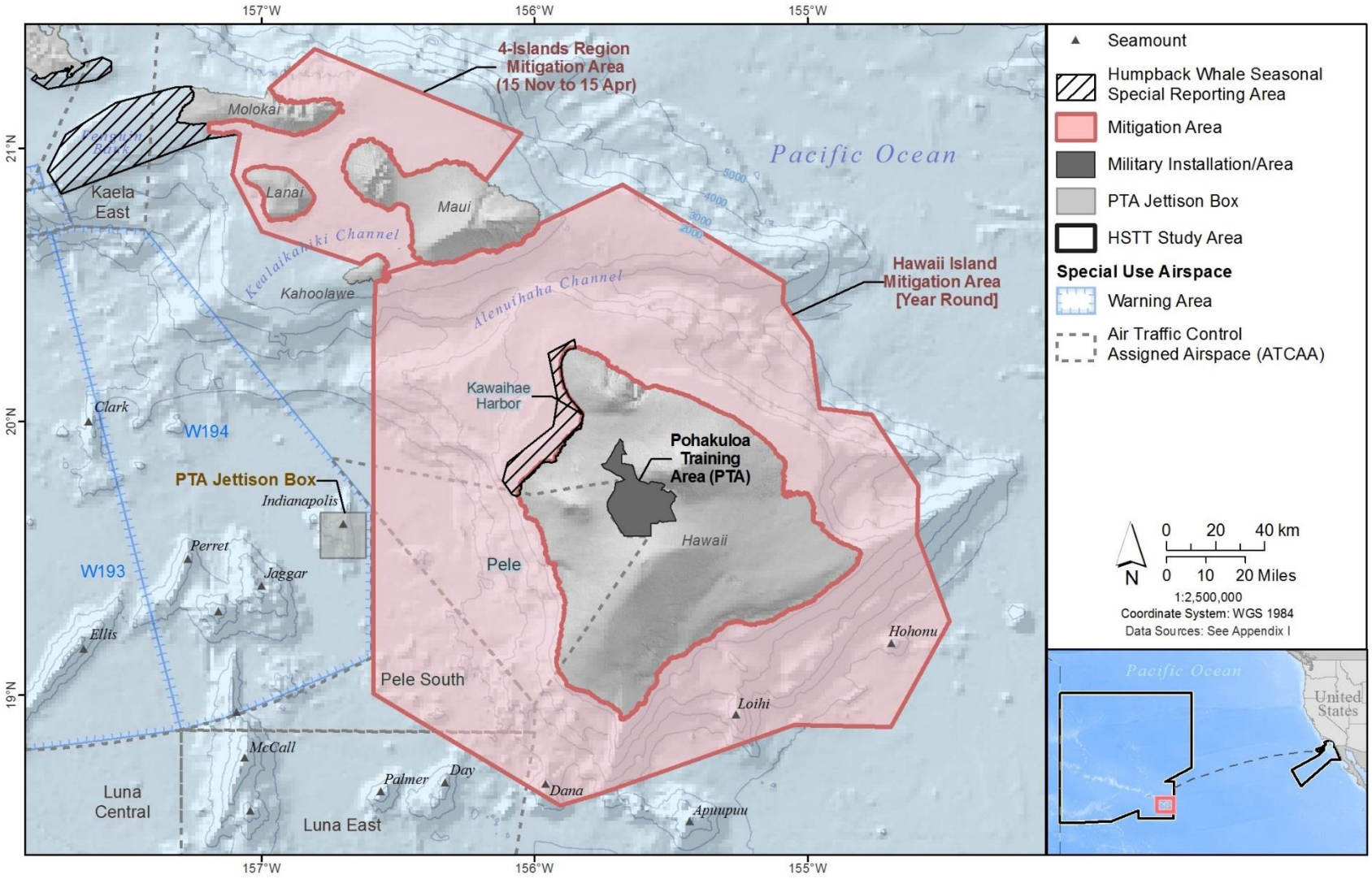


Figure 5.4-3: Marine Mammal Mitigation Areas in the Hawaii Range Complex

Notes: HSTT = Hawaii-Southern California Training and Testing

5.4.3 Mitigation Areas for Marine Mammals in the Southern California Portion of the Study Area

As described in Table 5.4-3 and shown in

Figure 5.4-4, the Navy will implement mitigation within mitigation areas in the Southern California portion of the Study Area to, in combination with procedural mitigation, effect the least practicable adverse impact on marine mammal species or stocks and their habitat and to provide additional mitigation for ESA-listed marine mammal species. A description, biological assessment, and map of each area the Navy assessed is provided in Appendix K (Geographic Mitigation Assessment). This section presents a summary of the mitigation that will be implemented within mitigation areas in the Southern California portion of the Study Area based on the biological and operational assessment in the appendix.

Table 5.4-3: Mitigation Areas in the Southern California Portion of the Study Area

Mitigation Area Description
Stressor or Activity • Sonar • Explosives • Vessel strikes
Resource Protection Focus • Marine mammals
Mitigation Area Requirements • **San Diego Arc, San Nicolas Island, and Santa Monica/Long Beach Mitigation Areas (June 1 – October 31):** – The Navy will not conduct more than a total of 200 hours of MF1 surface ship hull-mounted mid-frequency active sonar in the combined areas, excluding normal maintenance and systems checks, during training and testing. Should national security present a requirement to conduct more than 200 hours of MF1 surface ship hull-mounted mid-frequency active sonar in the combined areas during training and testing (excluding normal maintenance and systems checks), naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., sonar hours) in its annual activity reports submitted to NMFS. – Within the San Diego Arc Mitigation Area, the Navy will not use explosives that could potentially result in the take of marine mammals during large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training and testing. Should national security present a requirement to use explosives that could potentially result in the take of marine mammals during large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training or testing, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., explosives usage) in its annual activity reports submitted to NMFS. – Within the San Nicolas Island Mitigation Area, the Navy will not use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training. Should national security present a requirement to use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., explosives usage) in its annual activity reports submitted to NMFS. – Within the Santa Monica/Long Beach Mitigation Area, the Navy will not use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training and testing. Should national security present a requirement to use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training or testing, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., explosives usage) in its annual activity reports submitted to NMFS.

Table 5.4-3: Mitigation Areas in the Southern California Portion of the Study Area (continued)

Mitigation Area Description
• **Santa Barbara Island Mitigation Area (year-round):** – The Navy will not use MF1 surface ship hull-mounted mid-frequency active sonar during training or testing, or explosives that could potentially result in the take of marine mammals during medium-caliber or large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training. Should national security present a requirement to use MF1 surface ship hull-mounted mid-frequency active sonar during training or testing, or explosives that could potentially result in the take of marine mammals during medium-caliber or large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., sonar hours or explosives usage) in its annual activity reports submitted to NMFS. • **Blue Whale (June – October), Gray Whale (November – March), and Fin Whale (November – May) Awareness Notification Message Areas:** – The Navy will issue a seasonal awareness notification message to alert ships and aircraft operating in the area to the possible presence of concentrations of large whales, including blue, gray, or fin whales. – To maintain safety of navigation and to avoid interactions with large whales during transits, the Navy will instruct vessels to remain vigilant to the presence of large whale species, that when concentrated seasonally, may become vulnerable to vessel strikes. – Platforms will use the information from the awareness notification messages to assist their visual observation of applicable mitigation zones during training and testing activities and to aid in the implementation of procedural mitigation.

5.4.3.1 Summary of Mitigation Area Assessment

The Navy developed the mitigation areas identified in Table 5.4-3 to help avoid or reduce impacts from the Proposed Action on marine mammals in areas that the best available science suggests are important to one or more species of marine mammals for foraging, migrating, or other biologically important life processes either year-round or for part of the year (depending on the species). As described in Appendix K (Geographic Mitigation Assessment), implementing additional mitigation in the Southern California portion of the Study Area beyond what is described in Table 5.4-3 would be impractical due to implications for safety, sustainability, and the Navy's ability to continue meeting its mission requirements. The appendix presents details on how each area was developed (e.g., known high-use foraging areas) and the mitigation benefit they provide. In summary, the mitigation areas in the Southern California portion of the Study Area will help the Navy avoid or reduce potential impacts on one or more marine mammal species or stocks and their habitat (as well as other species, such as sea turtles that occur within the areas), such as:

- **San Diego Arc, San Nicolas Island, and Santa Monica/Long Beach Mitigation Areas**. This new mitigation will avoid or reduce potential impacts from mid-frequency active sonar and some explosive activities on blue whales within the mitigation areas, which the best available science suggests contain important seasonal foraging habitat.
- **Santa Barbara Island Mitigation Area**. This new mitigation will avoid or reduce potential impacts from mid-frequency active sonar and some explosive activities on numerous marine mammal species (including blue whales and gray whales) within the mitigation area, which the best available science suggest is important foraging or migration habitat. The mitigation area overlaps a portion of the Channel Islands National Marine Sanctuary.
- **Blue Whale, Gray Whale, and Fin Whale Awareness Notification Message Areas**. This new mitigation will further help avoid or reduce potential impacts from vessel strikes and training and testing activities on blue whales, gray whales, and fin whales within the Southern California portion of the Study Area, which the best available science suggests contains important seasonal foraging or migration habitat for these species.

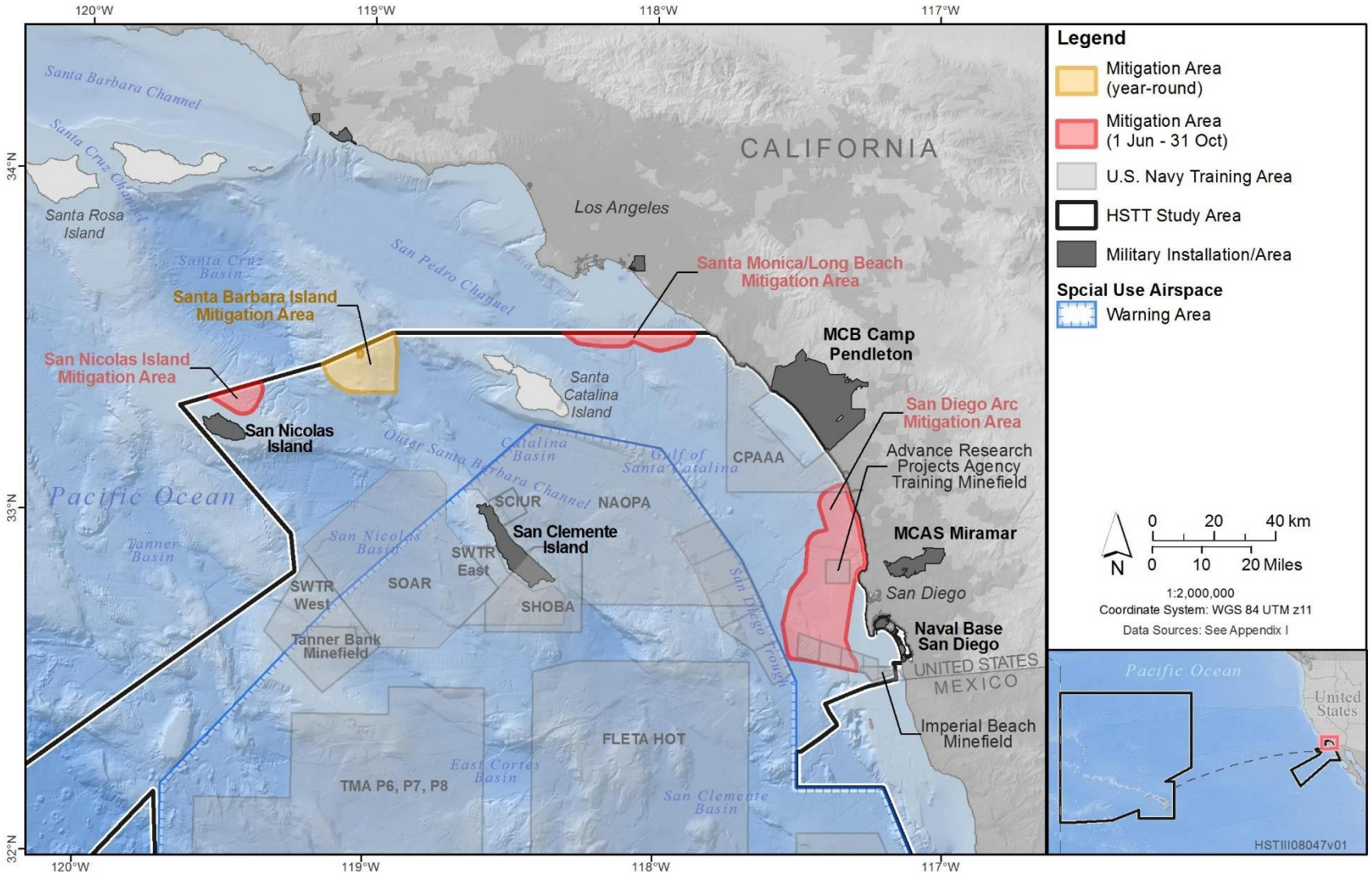


Figure 5.4-4: Marine Mammal Mitigation Areas in the Southern California Portion of the Study Area

Notes: MCAS = Marine Corps Air Station; MCB = Marine Corps Base; NWS = Naval Weapons Station

5.5 MEASURES CONSIDERED BUT ELIMINATED

As described in Section 5.2 (Mitigation Development Process), the Navy conducted a detailed review and assessment of each potential mitigation measure individually and then all potential mitigation measures collectively to determine if, as a whole, the mitigation will be effective at avoiding or reducing impacts and practical to implement. The assessment included consideration of mitigation recommendations received during scoping, through public comments, and during consultations for Phase III and past environmental compliance documents applicable to the Study Area. The operational community determined that implementing mitigation beyond what is detailed in Section 5.3 (Procedural Mitigation to be Implemented) and Section 5.4 (Mitigation Areas to be Implemented) would be incompatible with the practicality assessment criteria for safety, sustainability, and mission requirements. Information about why implementing additional mitigation measures for active sonar, explosives, active and passive acoustic monitoring devices, thermal detection systems, third-party observers, foreign navy mitigation, and reporting requirements would be impractical is provided in the sections below. Information about why implementing additional geographic mitigation would be impractical is provided in Section 5.4 (Mitigation Areas to be Implemented).

When analyzing all potential mitigation measures collectively, the operational community determined that adopting the additional mitigation measures beyond what is included in this Final EIS/OEIS would essentially result in the Navy losing access to the significant majority of its required sea space and airspace. Additional measures would restrict or prohibit Navy training and testing in the Hawaii Range Complex and Southern California portion of the Study Area except in very narrow circumstances. For example, blanket limitations or restrictions on the level, number, or timing (seasonal or time of day) of training and testing activities within discrete or broad-scale areas of water (e.g., embayments and large swaths of the littorals and open ocean), or other areas vital to mission requirements would prevent the Navy from accessing its ranges, operating areas, facilities, or range support structures necessary to meet the purpose and need of the Proposed Action. As described in Section 5.2.3 (Practicality of Implementation), the Navy requires extensive sea space so that individual training and testing activities can occur at sufficient distances so they do not interfere with one another, and so that Navy units can train to communicate and operate in a coordinated fashion over tens or hundreds of square miles, as required during military missions and combat operations. The Navy also needs to maintain access to sea space with the unique, challenging, and diverse environmental and oceanographic features (e.g., bathymetry, topography, surface fronts, and variations in sea surface temperature) analogous to military mission and combat conditions to achieve the highest skill proficiency and most accurate testing results possible.

Threats to national security are constantly evolving. The Navy requires the ability to adapt training and testing to meet these emerging threats. Restricting access to broad-scale areas of water would impact the ability for Navy training and testing to evolve as the threat evolves. Eliminating opportunities for the Navy to train and test in a myriad of at-sea conditions would put U.S. forces at a tactical disadvantage during military missions and combat operations. This would also present a risk to national security if adversaries were to be alerted to the environmental conditions within which the U.S. Navy is prohibited from training and testing. Restricting large areas of ocean or other smaller areas at sea that are critical to Navy training and testing would make training and concealment much more difficult and would adversely impact the Navy's ability to perform its statutory mission.

5.5.1 ACTIVE SONAR

When assessing and developing mitigation, the Navy considered reducing active sonar training and testing hours, modifying active sonar sound sources, implementing time-of-day restrictions and restrictions during surface ducting conditions, replacing active sonar training and testing with synthetic activities (e.g., computer simulated training), and implementing active sonar ramp-up procedures. As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Section 5.2.3 (Practicality of Implementation), Appendix K (Geographic Mitigation Assessment), and Appendix A (Navy Activity Descriptions), training and testing activities are planned and scheduled based on numerous factors and data inputs, such as compliance with the Optimized Fleet Response Plan. Information on why training and testing with active sonar is essential to national security is presented in Section 5.3.2.1 (Active Sonar). The Navy uses active sonar during military readiness activities only when it is essential to training missions or testing program requirements since active sonar has the potential to alert opposing forces to the operating platform's presence. Passive sonar and other available sensors are used in association with active sonar to the maximum extent practicable.

The Navy currently uses, and will continue to use, computer simulation to augment training and testing whenever possible. As discussed in Section 1.4.1 (Why the Navy Trains), simulators and synthetic training are critical elements that provide early skill repetition and enhance teamwork; however, they cannot duplicate the complexity faced by Sailors during military missions and combat operations for the types of active sonar used under the Proposed Action (e.g., hull-mounted mid-frequency active sonar). Just as a pilot would not be ready to fly solo after simulator training, a Navy Commander cannot allow military personnel to engage in military missions and combat operations based merely on simulator training. Similarly, in testing a system that is being developed, simulation can be used during the initial stages of development, but ultimately the system must be tested under conditions analogous to those faced during military missions and combat operations. Systems that have undergone maintenance need to be tested, and not simulated, to ensure that the system is operating correctly.

Sonar operators must train to effectively handle bottom bounce and sound passing through changing currents, eddies, and across changes in ocean temperature, pressure, salinity, depth, and in surface ducting conditions. Sonar systems must be tested in these conditions to ensure functionality and accuracy in military mission and combat conditions. The Navy tests its active sonar systems in areas analogous to where the Navy trains and operates. This includes a nighttime testing requirement for some active sonar systems, and a requirement to test in a variety of locations and environmental conditions depending on the testing program objectives. Training and testing in good visibility (e.g., daylight, favorable weather conditions) and low visibility (e.g., nighttime, inclement weather conditions) is vital because environmental differences between day and night and varying weather conditions affect sound propagation and the detection capabilities of sonar. Temperature layers that move up and down in the water column and ambient noise levels can vary significantly between night and day. This affects sound propagation and how sonar systems function and are operated.

Submarines may hide in the higher ambient noise levels of shallow coastal waters and surface ducts. Surface ducting occurs when water conditions, such as temperature layers and lack of wave action, result in little sound energy penetrating beyond a narrow layer near the surface of the water. Avoiding surface ducting conditions would be impractical because ocean conditions contributing to surface ducting change frequently and surface ducts can be of varying duration. Surface ducting can also lack uniformity and may or may not extend over a large geographic area, making it difficult to determine where to reduce power and for what periods. Submarines have long been known to take advantage of

the phenomena associated with surface ducting to avoid being detected by sonar. When surface ducting occurs, active sonar becomes more useful near the surface but less useful at greater depths. As noted by the U.S. Supreme Court in *Winter v. Natural Resources Defense Council, Inc.*, 555 U.S. 7 (2008), because surface ducting conditions occur relatively rarely and are unpredictable, it is especially important for the Navy to be able to train under these conditions when they occur. Training with active sonar in these conditions is a critical component of military readiness because sonar operators need to learn how sonar transmissions are altered due to surface ducting, how submarines may take advantage of them, and how to operate sonar effectively under these conditions. Reducing power or shutting down active sonar based on environmental conditions as a mitigation would affect a Commander's ability to develop the tactical picture. It would also prevent sonar operators from training in conditions analogous to those faced during military missions and combat operations, such as during periods of low visibility.

Active sonar signals are designed explicitly to provide optimum performance at detecting underwater objects (e.g., submarines) in a variety of acoustic environments. The Navy assessed the potential for implementing active sonar signal modification as mitigation. At this time, the science on the differences in potential impacts of up or down sweeps of the sonar signal (e.g., different behavioral reactions) is extremely limited and requires further development. If future studies indicate that modifying active sonar signals (i.e., up or down sweeps) could be an effective mitigation approach, then the Navy will investigate if and how the mitigation would affect the sonar's performance.

Active sonar equipment power levels are set consistent with mission requirements. Active sonar ramp-up procedures are used during seismic surveys and some foreign navy sonar activities. Ramping up involves slowly increasing sound levels over a certain length of time until the optimal source level is reached. The intent of ramping up a sound source is to alert marine mammals with a low sound level to deter them from the area and avoid higher levels of sound exposure. The best available science does not suggest that ramp-up would be an effective mitigation tool for U.S. Navy active sonar training and testing activities under the Proposed Action. Wensveen et al. (2017) found that active sonar ramp-up was not an effective method for reducing impacts on humpback whales because most whales did not display strong behavioral avoidance to the sonar signals. The study suggested that sonar ramp-up could potentially be more effective for other more behaviorally responsive species but would likely also depend on the context of exposure. For example, ramp-up would be less effective if animals have a strong motivation not to move away from their current location, such as when foraging. Dunlop et al. (2016) and von Benda-Beckmann et al. (2014) found that implementing ramp-up as mitigation may be effective for some activities in some situations. Additionally, von Benda-Beckmann et al. (2014) found that the main factors limiting ramp-up effectiveness for a typical anti-submarine warfare activity are a high source level, a moving sonar source, and long silences between consecutive sonar transmissions. Based on the source levels, vessel speeds, and sonar transmission intervals that will be used during typical active sonar activities under the Proposed Action, the Navy has determined that ramp-up would be an ineffective mitigation measure for the active sonar activities analyzed in this document.

Implementing active sonar ramp-up procedures during training or testing under the Proposed Action would not be representative of military mission and combat conditions and would significantly impact training and testing realism. For example, during an anti-submarine warfare exercise using active sonar, ramp-ups have the potential to alert opponents (e.g., target submarines) to the transmitting vessel's presence. This would defeat the purpose of the training by allowing the target submarine to detect the searching unit and take evasive measures, thereby denying the sonar operator the opportunity to learn how to locate the submarine. Similarly, testing program requirements determine test parameters to

accurately determine whether a system is meeting its operational and performance requirements; therefore, implementing ramp-up during testing activities would impede the Navy's ability to collect essential data for evaluation of a system's capabilities.

Reducing realism in training impedes the ability for Navy Sailors to train and become proficient in using active sonar, erodes capabilities, and reduces perishable skills. These impacts would result in a significant risk to personnel safety during military missions and combat operations and would prevent units from meeting their individual training and certification requirements. Therefore, implementing additional mitigation that would reduce training realism would ultimately prevent units from deploying with the required level of readiness necessary to accomplish their missions and impede the Navy's ability to certify forces to deploy to meet national security tasking. Reducing realism in testing would impact the ability of researchers, program managers, and weapons system acquisition programs to conduct accurate acoustic research and effectively test systems and platforms (and components of these systems and platforms) before full-scale production or delivery to the fleet. These tests are required to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

5.5.2 EXPLOSIVES

When assessing and developing mitigation, the Navy considered reducing the number and size of explosives and limiting the locations and time of day of explosive training and testing in the Study Area. As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Section 5.2.3 (Practicality of Implementation), Appendix K (Geographic Mitigation Assessment), and Appendix A (Navy Activity Descriptions), the locations and timing of the training and testing activities that use explosives vary throughout the Study Area based on range scheduling, mission requirements, testing program requirements, and standard operating procedures for safety and mission success. The Navy's suite of mitigation includes mitigation areas for explosives, including avoiding seafloor resource areas throughout the Study Area and important marine mammal habitats in the Hawaii Range Complex and Southern California portion of the Study Area. The Navy determined that, beyond what is described in Section 5.4 (Mitigation Areas to be Implemented), it would be impractical to develop additional mitigation areas to limit the locations of explosive training and testing activities.

Activities that involve explosive ordnance are inherently different from those that involve non-explosive practice munitions. For example, critical components of an explosive Bombing Exercise Air-to-Surface include the assembly, loading, delivery, and assessment of the explosive bomb. The explosive bombing training exercise starts with ground personnel, who must practice the building and loading of explosive munitions. Training includes the safe handling of explosive material, configuring munitions to precise specifications, and the loading of munitions onto aircraft. Aircrew must then identify a target and safely deliver fused munitions, discern if the bomb was assembled correctly, and determine bomb damage assessments based on how and where the explosive detonated. An air-to-surface bombing exercise using non-explosive practice munitions can train aircrews on valuable skills to locate and accurately deliver munitions on a target; however, it cannot effectively replicate the critical components of an explosive activity in terms of assembly, loading, delivery, and assessment of an explosive bomb. Reducing the number and size of explosives or diminishing activity realism by implementing time of day or geographic restrictions for additional explosive training exercises would impede the ability for Navy Sailors to train and become proficient in using explosive weapon systems (which would result in a significant risk to personnel safety during military missions and combat operations), and would ultimately prevent units from meeting their individual training and certification requirements (which

would prevent them from deploying with the required level of readiness necessary to accomplish their missions) and impede the Navy's ability to certify forces to deploy to meet national security tasking.

Similar to training, the Navy is required to test its explosives to quantify the compatibility of weapons with the platform from which they will be launched or released in military missions and combat operations. Such testing requires the use of the actual explosive ordnance that will be used during training exercises, military missions, and combat operations. Reducing the number and size of explosives or diminishing activity realism by implementing time of day or geographic restrictions for additional explosive testing events would impact the ability of researchers, program managers, and weapons system acquisition programs to effectively test systems and platforms (and components of these systems and platforms). Such testing must be conducted before full-scale production or delivery to the fleet to ensure functionality and accuracy in military mission and combat conditions per required acquisition milestones or on an as-needed basis to meet operational requirements.

5.5.3 Active and Passive Acoustic Monitoring Devices

When assessing and developing mitigation, the Navy considered using active and passive acoustic monitoring devices as procedural mitigation. During Surveillance Towed Array Sensor System low-frequency active sonar (which is not part of the Proposed Action), the Navy uses a specially-designed adjunct high-frequency marine mammal monitoring active sonar known as "HF/M3" to mitigate potential impacts. HF/M3 can only be towed at slow speeds and operates like a fish finder used by commercial and recreational fishermen. Installing the HF/M3 adjunct system on the tactical sonar ships used under the Proposed Action would have implications for safety and mission requirements due to impacts on speed and maneuverability. Furthermore, installing the system would significantly increase costs associated with designing, building, installing, maintaining, and manning the equipment. The Navy will not install the HF/M3 system or other adjunct marine mammal monitoring devices as mitigation under the Proposed Action. However, Navy assets with passive acoustic monitoring capabilities that are already participating in an activity will continue to monitor for marine mammals, as described in Section 5.2.1 (Procedural Mitigation Development) and Section 5.3 (Procedural Mitigation to be Implemented). Significant manpower and logistical constraints make constructing and maintaining additional passive acoustic monitoring systems for each training and testing activity under the Proposed Action impractical. Diverting platforms with passive acoustic monitoring capabilities to monitor training and testing events would impact their ability to meet their mission requirements and would reduce the service life of those systems.

The Navy is continuing to improve its capabilities to use range instrumentation to aid in the passive acoustic detection of marine mammals. For example, at the Southern California Offshore Range, the Pacific Missile Range Facility off Kauai, Hawaii, and the Atlantic Undersea Test and Evaluation Center in the Bahamas, the Navy can monitor instrumented ranges in real-time or through data recorded by hydrophones. The Navy has sponsored numerous studies that have produced meaningful results on marine mammal occurrence, distribution, and behavior on these ranges through the U.S. Navy Marine Species Monitoring Program. For information on the U.S. Navy Marine Species Monitoring Program, see Section 3.0.1.1 (Marine Species Monitoring and Research Programs) and Section 5.1.2.2.1 (Marine Species Research and Monitoring Programs).

The Navy's instrumented ranges are helping to facilitate a better understanding of the species that are present in those areas. However, instrumented ranges do not have the capabilities to be used effectively for mitigation. Although the Navy's instrumented ranges are helping to facilitate a better understanding

of the species that are present in those areas, instrumented ranges were not developed for the purpose of mitigation, and therefore do not have the capabilities to be used effectively for mitigation. To develop an estimated position for an individual marine mammal, the animal's vocalizations must be detected on at least three hydrophones. The vocalizations must be loud enough to provide the required signal to noise ratio on those hydrophones. The hydrophones must have the required bandwidth and dynamic range to capture that signal. Detection capabilities are generally degraded under noisy conditions (such as high sea state) that affect signal to noise ratio.

The ability to detect and develop an estimated position for marine mammals on the Navy's instrumented ranges depends of numerous factors, such as behavioral state (e.g., only vocalizing animals can be detected), species (e.g., species vocalize at varying rates, call types, and source levels), animal location relative to the passive acoustic receivers (hydrophones), and location on the range. For example, the majority of hydrophones within the Pacific Missile Range Facility are located within the Shallow Water Test Range, which is the smallest area within that instrumented range. The hydrophones at this location are grouped relatively close together. The Shallow Water Test Range has some capabilities to localize odontocete whistles, but is unable to localize vocalizations of other species, such as large baleen whales due to hydrophone frequency detection limitations. Small odontocetes, such as beaked whales, produce highly directed echolocation clicks that are difficult to simultaneously detect on multiple hydrophones on this instrumented range; therefore, there is a high probability that a vocalizing animal would be assigned a false location on the range (i.e., the Navy would not be able to verify its presence in a mitigation zone). Beaked whales vocalize only during deep foraging dives which occur at a rate of approximately 10 per day. The Navy's hydrophones cannot track the real-time locations of individuals with such dispersed and directional vocalizations with the level of precision needed for effective mitigation.

The most expansive area within the Pacific Missile Range Facility instrumented range is the Barking Sands Underwater Range Expansion area, which is numerous times larger than Shallow Water Test Range, but has less than half the number of hydrophones. Because hydrophone spacing is designed to be a function of water depth, the hydrophone spacing at the Barking Sands Underwater Range Expansion area ranges from approximately 2 NM to over 3.8 NM. The Barking Sands Underwater Range Expansion area has some limited capabilities to localize large baleen whale vocalizations using a few broadband hydrophones with low-frequency capabilities; however, these hydrophones are limited in number and are widely spaced, which makes localization difficult. Other factors, such as animal behavior, compound this difficulty. For example, minke whales produce periodic "boings," and it takes approximately 30–45 minutes of vocalizing (e.g., detection of 8 or more boings) to have good confidence in the vocalizing animal's location. Furthermore, even minke whales that have been vocalizing for extended periods of time have been known to stop vocalizing for hours at a time, which would prevent the Navy from obtaining or maintaining an accurate estimate of animal location. Additional species have also been known to display extended gaps in vocalizing, such as fin whales, sei whales, and Bryde's whales. The process for localizing humpback whales during past monitoring and research projects on this instrumented range has been performed in a laboratory with MATLAB algorithms. The Navy does not currently have the capability to perform the data processing for large baleen whales in real-time. Furthermore, determining if an animal was located within a mitigation zone within the timeframes required for mitigation would be prohibited by the amount of time it takes to process the data. The Navy is unable to localize odontocetes in Barking Sands Underwater Range Expansion area due to low hydrophone density and deep waters that result in high propagation loss.

If a vocalizing animal is detected on only one or two hydrophones, estimating its location is not possible, and the location of the animal would be assigned generally within the detection radius around each hydrophone. The detection radius of a hydrophone is typically much larger than the mitigation zone for the activities conducted on instrumented ranges. The Navy does not have a way to verify if that vocalizing animal is located within the mitigation zone or at a location down range. Mitigating for passive acoustic detections based on unknown animal locations would essentially increase the mitigation zone sizes for each activity to that of the hydrophone detection radius. Increasing the mitigation zone sizes beyond what is described for each activity is impractical for the reasons described throughout Section 5.3 (Procedural Mitigation to be Implemented).

In summary, although the Navy is continuing to improve its capabilities to use range instrumentation to aid in the passive acoustic detection of marine mammals, at this time it would not be effective or practical for the Navy to monitor instrumented ranges for real-time mitigation or to construct additional instrumented ranges as a tool to aid in the implementation of mitigation.

5.5.4 THERMAL DETECTION SYSTEMS

Thermal detection technology is designed to allow observers to detect the difference in temperature between a surfaced marine mammal (i.e., the body or blow of a whale) and the environment (i.e., the water and air). Although thermal detection may be reliable in some applications and environments, current technologies are limited by their: (1) reduced performance in certain environmental conditions, (2) inability to detect certain animal characteristics and behaviors, (3) low sensor resolution and narrow fields of view, and (4) high cost and low lifecycle (Boebel, 2017; Zitterbart et al., 2013).

Thermal detection systems can be effective at detecting some types of marine mammals in a limited range of marine environmental conditions. Current thermal detection systems have proven more effective at detecting large whale blows than the bodies of small animals, particularly at a distance (Zitterbart et al., 2013). The effectiveness of current technologies has not been demonstrated for small marine mammals. Thermal detection systems exhibit varying degrees of false positive detections (i.e., incorrect notifications) due in part to their low sensor resolution and reduced performance in certain environmental conditions. False positive detections may incorrectly identify other features (e.g., birds, waves, boats) as marine mammals. In one study, Zitterbart et al. (2013) reported a false positive rate approaching one incorrect notification per 4 min. of observation.

Thermal detection systems are generally thought to be most effective in cold environments, which have a large temperature differential between an animal's temperature and the environment. Two studies that examined the effectiveness of thermal detection systems for marine mammal observations are Zitterbart et al. (2013), which tested a thermal detection system and automatic algorithm in polar waters between 34–50 degrees Fahrenheit, and a Navy-funded study in subtropical and tropical waters. Zitterbart et al. (2013) found that current technologies have limitations regarding temperature and survey conditions (e.g., rain, fog, sea state, glare, ambient brightness), for which further effectiveness studies are required. The Office of Naval Research Marine Mammals and Biology program funded a project (2013-2018) to test the thermal limits of infrared-based automatic whale detection technology. This project is focused on capturing whale spouts at two different locations featuring subtropical and tropical water temperatures, optimizing detector/classifier performance on the collected data, and testing system performance by comparing system detections with concurrent visual observations.

The Navy has also been investigating the use of thermal detection systems with automated marine mammal detection algorithms for future mitigation during training and testing, including on

autonomous platforms. For example, the Defense Advanced Research Projects Agency funded six initial studies to test and evaluate infrared-based thermal detection technologies and algorithms to automatically detect marine mammals on an unmanned surface vehicle. Based on the outcome of these initial studies, follow-on efforts and testing are planned for 2018-2019.

Thermal detection systems are currently used by some specialized U.S. Air Force aircraft for marine mammal mitigation. These systems are specifically designed for and integrated into Air Force aircraft and cannot be added to Navy aircraft. Only certain Navy aircraft have specialized infrared capabilities, and these capabilities are only for fine-scale targeting within a narrow field of view. The only thermal imagery sensors aboard Navy surface ships are associated with specific weapons systems, and these sensors are not available on all vessels. These sensors are typically used only in select training events, have a limited lifespan before requiring expensive replacement, and are not optimized for marine mammal observations within the Navy's mitigation zones. For example, as described in Section 5.3.3.3 (Explosive Medium-Caliber and Large-Caliber Projectiles), Lookouts are required to observe a 1,000-yd. mitigation zone around the intended impact location during explosive large-caliber gunnery activities. In addition to observing for marine mammals, one of the activity's mission-essential requirements is for event participants, including Lookouts, to maintain focus on the mitigation zone to ensure the safety of Navy personnel and equipment and the public. Lookouts would not be able to observe the 1,000-yd. mitigation zone using the Navy's thermal imagery sensors due to their narrow fields of view and technological design specific to fine-scale targeting. Such observations would be ineffective for marine mammals and would prevent Lookouts from effectively maintaining focus on the activity area and implementing mission-essential safety protocols.

The effectiveness of even the most advanced commercially available thermal detection systems with technological designs specific to marine mammal observations is highly dependent on environmental conditions, animal characteristics, and animal behaviors (Zitterbart et al., 2013). Considering the range of environmental conditions and diversity of marine mammal species found throughout the Study Area, the use of thermal detection systems would be less effective than the traditional techniques currently employed by the Navy, such as naked-eye scanning, hand-held binoculars, and high-powered binoculars mounted on a ship deck. Furthermore, high false positive rates of thermal detection systems could result in the Navy implementing mitigation for features incorrectly identified as marine mammals. Increasing the instances of mitigation implementation based on incorrectly-identified features would have significant impacts on the ability for training and testing activities to accomplish their intended objectives, without providing any mitigation benefit to the species. In addition, thermal detection systems are designed to detect marine mammals and do not have the capability to detect other resources for which the Navy is required to implement mitigation. Requiring Lookouts to use thermal detection systems would prevent them from detecting and mitigating for sea turtles and other biological resources (e.g., floating vegetation, jellyfish aggregations, large schools of fish).

As discussed in Section 5.3 (Procedural Mitigation to be Implemented), the Navy's procedural mitigation measures include the maximum number of Lookouts the Navy can assign to each activity based on available manpower and resources. It would be impractical to add personnel to serve as additional Lookouts for the sole purpose of thermal detection system use. For example, the Navy does not have available manpower to add Lookouts to use thermal detection systems in tandem with existing Lookouts who are using traditional observation techniques.

In summary, thermal detection systems have not been sufficiently studied both in terms of their effectiveness within the environmental conditions found in the Study Area and their compatibility with

Navy training and testing. The Navy plans to continue researching thermal detection systems to determine their effectiveness and compatibility with Navy applications. If the technology matures to the state where thermal detection is determined to be an effective mitigation tool during training and testing, the Navy will assess the practicality of using the technology during training and testing events and retrofitting its observation platforms with thermal detection devices. The assessment will include an evaluation of the budget and acquisition process (including costs associated with designing, building, installing, maintaining, and manning equipment that is expensive and has a relatively short lifecycle before key system components need replacing); logistical and physical considerations for device installment, repair, and replacement (e.g., conducting engineering studies to ensure there is no electronic or power interference with existing shipboard systems); manpower and resource considerations for training personnel to effectively operate the equipment; and considerations of potential security and classification issues. New system integration on Navy assets can entail up to 5 to 10 years of effort to account for acquisition, engineering studies, and development and execution of systems training. The Navy will provide information to NMFS about the status and findings of Navy-funded thermal detection studies and any associated practicality assessments at the annual adaptive management meetings. Information about the Navy's adaptive management program is included in Section 5.1.2.2.1.1 (Adaptive Management).

5.5.5 THIRD-PARTY OBSERVERS

When assessing and developing mitigation, the Navy considered using third-party observers during training and testing to aid in the implementation of procedural mitigation. The use of third-party observers to conduct pre- or post-activity biological resource observations would be an ineffective mitigation because marine mammals would likely move into or out of the activity area, and mitigation must be implemented at the time the activity is taking place.

There are significant manpower and logistical constraints that make using third-party observers for every training and testing activity under the Proposed Action impractical. Training and testing activities often occur simultaneously and in various regions throughout the Study Area, some of which last for days or weeks at a time. Having third-party observers embark on Navy vessels or aircraft would result in safety and security clearance issues. Training and testing event planning includes careful consideration of capacity limitations when placing personnel on participating aircraft and vessels. The Navy is unable to add third-party observers on a ship or substitute a Navy Lookout with a third-party observer without causing a berthing shortage or exceedance of other space limitations, or impacting the ability for Lookouts to complete their other mission-essential duties. The use of third-party observers also presents national security concerns due to the requirement to provide advance notification of specific times and locations of Navy platform movements and activities (e.g., vessels using active sonar).

Reliance on the availability of third-party personnel for mitigation would be impractical because training and testing activity timetables oftentimes cannot be precisely fixed and are instead based on the free-flow development of tactical situations. Waiting for third-party aircraft or vessels to complete surveys, refuel, or transit on station would extend the length of the activity in a way that would diminish realism and delay training and testing schedules. Hiring third-party civilian vessels or aircraft to observe Navy training and testing activities would also be unsustainable due to the significant associated costs. Because many training and testing activities take place offshore, the amount of time observers would spend on station would be limited due to aircraft fuel restrictions. Fuel restrictions and distance from shore would increase safety risks should mechanical problems arise. The presence of civilian aircraft or

vessels in the vicinity of training and testing activities would present increased safety risks due to airspace conflicts and proximity to explosives.

5.5.6 Foreign Navy Mitigation

When assessing and developing mitigation, the Navy considered adopting the mitigation measures implemented by foreign navies. Mitigation measures are carefully developed for and assessed by each individual navy based on the potential impacts of their activities on the biological resources that live in their Study Areas, and the practicality of mitigation implementation based on their training mission and testing program requirements and the resources available for mitigation. The U.S. Navy's readiness considerations differ from those of foreign navies based on each navy's strategic reach, global mission, country-specific legal requirements, and geographic considerations. Most non-U.S. navies do not possess an integrated strike group and do not have integrated training requirements. The U.S. Navy's training is built around the integrated warfare concept and is based on the U.S. Navy's capabilities, the threats faced, the operating environment, and the overall mission. For this reason, not all measures developed for foreign navies would be effective at reducing impacts of U.S. Navy training or testing, or practical to implement by the U.S. Navy (and vice versa). For example, some navies implement active sonar ramp-up as mitigation for marine mammals; however, as described in Section 5.5.1 (Active Sonar), the U.S. Navy determined that active sonar ramp-up would be an ineffective mitigation measure for training and testing activities under the Proposed Action and would be impractical to implement because it would significantly impact training and testing realism.

The U.S. Navy will implement the mitigation measures as described in Section 5.3 (Procedural Mitigation to be Implemented) and Section 5.4 (Mitigation Areas to be Implemented) because they have been determined to be effective at avoiding or reducing impacts from the Proposed Action and practical to implement by the U.S. Navy. Many of these measures are the same as, or comparable to, those implemented by foreign navies. For example, most navies implement some form of procedural mitigation to cease certain activities if a marine mammal is observed in a mitigation zone (Dolman et al., 2009). Some navies also implement geographic mitigation to restrict activities within particularly important marine mammal breeding, feeding, or migration habitats. The U.S. Navy will implement several mitigation measures and environmental compliance initiatives that are not implemented by foreign navies. For example, as discussed in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives), the U.S. Navy will continue to sponsor scientific monitoring and research and comply with stringent reporting requirements.

5.5.7 Reporting Requirements

When assessing and developing mitigation, the Navy considered increasing its reporting requirements, such as additional reporting of vessel speeds and marine species observations. As discussed in Section 5.1.2.2 (Monitoring, Research, and Reporting Initiatives), the Navy developed its reporting requirements in conjunction with NMFS to be consistent with mission requirements and balance the usefulness of the information to be collected with the practicality of collecting it. The Navy's training and testing activity reports and incident reports are designed to verify mitigation implementation; comply with current permits, authorizations, and consultation requirements; and improve future environmental analyses. The Navy reports to NMFS if mitigation was implemented during sinking exercises (e.g., number of times explosive detonations were delayed due to marine mammal sightings). For major training exercises, the Navy's annual training and testing activity reports include information on each individual marine mammal sighting related to mitigation implementation. In the unlikely event a that a marine mammal

vessel strike occurs, the Navy provides NMFS with relevant information pertaining to the incident, including but not limited to vessel speed.

Additional administrative reporting would be ineffective as mitigation because it would not result in modifications to training or testing activities or further avoidance or reductions of potential impacts. For example, additional administrative reporting of vessel speed data would not result in modifications to vessel speeds (e.g., speed restrictions) or reduce the already low potential for marine mammal vessel strikes. Lookouts are not trained to make species-specific identification and would not be able to provide detailed scientific data if more detailed marine species observation reports were to be required. Furthermore, the Navy does not currently maintain a record management system to collect, archive, analyze, and report marine species observation or vessel speed data for every training and testing activity and all vessel movements. For example, the speed of Navy vessels can fluctuate an unlimited number of times during training and testing events. Developing and implementing a record management system of this magnitude would be unduly cost prohibitive and place a significant administrative burden on vessel operators and activity participants. Burdening operational Commanders, vessel operators, and event participations with requirements to complete additional administrative reporting would distract them from preparing a ready force and focusing on mission-essential tasks. Additional reporting requirements would draw event participants' attention away from the complex tactical tasks they are primarily obligated to perform, such as driving a warship or engaging in a gunnery event, which would adversely impact Navy personnel safety, public safety, and the effectiveness of training or testing.

5.6 MITIGATION SUMMARY

Table 5.6-1 and Table 5.6-2 summarize the mitigation measures that the Navy will implement under Alternative 1 or Alternative 2 of the Proposed Action. For specific requirements, additional information, and clarifications to the table summaries, see Section 5.3 (Procedural Mitigation to be Implemented), Section 5.4 (Mitigation Areas to be Implemented), and Appendix K (Geographic Mitigation Assessment).

Table 5.6-1: Summary of Procedural Mitigation

Stressor or Activity	*Mitigation Zone Sizes and Other Requirements*	*Protection Focus*
Environmental Awareness and Education	• Afloat Environmental Compliance Training program for applicable personnel	Marine mammals, Sea turtles
Active Sonar	Depending on sonar source: • 1,000 yd. power down, 500 yd. power down, and 200 yd. shut down • 200 yd. shut down	Marine mammals, Sea turtles
Air Guns	• 150 yd.	Marine mammals, Sea turtles
Pile Driving	• 100 yd.	Marine mammals, Sea turtles
Weapons Firing Noise	• 30° on either side of the firing line out to 70 yd.	Marine mammals, Sea turtles
Explosive Sonobuoys	• 600 yd.	Marine mammals, Sea turtles
Explosive Torpedoes	• 2,100 yd.	Marine mammals, Sea turtles
Explosive Medium-Caliber and Large-Caliber Projectiles	• 1,000 yd. (large-caliber projectiles) • 600 yd. (medium-caliber projectiles during surface-to-surface activities) • 200 yd. (medium-caliber projectiles during air-to-surface activities)	Marine mammals, Sea turtles
Explosive Missiles and Rockets	• 2,000 yd. (21–500 lb. net explosive weight) • 900 yd. (0.6–20 lb. net explosive weight)	Marine mammals, Sea turtles
Explosive Bombs	• 2,500 yd.	Marine mammals, Sea turtles
Sinking Exercises	• 2.5 NM	Marine mammals, Sea turtles
Explosive Mine Countermeasure and Neutralization Activities	• 2,100 yd. (6–650 lb. net explosive weight) • 600 yd. (0.1–5 lb. net explosive weight)	Marine mammals, Sea turtles, Birds
Explosive Mine Neutralization Activities Involving Navy Divers	• 1,000 yd. (21–60 lb. net explosive weight for positive control charges and charges using time-delay fuses) • 500 yd. (0.1–20 lb. net explosive weight for positive control charges)	Marine mammals, Sea turtles, Birds, Fish (scalloped hammerhead sharks)
Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading	• 700 yd.	Marine mammals, Sea turtles
Maritime Security Operations – Anti-Swimmer Grenades	• 200 yd.	Marine mammals, Sea turtles
Vessel Movement	• 500 yd. (whales) • 200 yd. (other marine mammals) • Vicinity (sea turtles)	Marine mammals, Sea turtles
Towed In-Water Devices	• 250 yd. (marine mammals) • Vicinity (sea turtles)	Marine mammals, Sea turtles
Small-, Medium-, and Large-Caliber Non-Explosive Practice Munitions	• 200 yd.	Marine mammals, Sea turtles
Non-Explosive Missiles and Rockets	• 900 yd.	Marine mammals, Sea turtles
Non-Explosive Bombs and Mine Shapes	• 1,000 yd.	Marine mammals, Sea turtles

Table 5.6-2: Summary of Mitigation Areas

Summary of Mitigation Area Requirements
Mitigation Areas for Shallow-water Coral Reefs and Precious Coral Beds (year-round)
• The Navy will not conduct precision anchoring (except in designated anchorages), explosive or non-explosive mine countermeasure and neutralization activities, explosive or non-explosive mine neutralization activities involving Navy divers, explosive or non-explosive small-, medium-, and large-caliber gunnery activities using a surface target, explosive or non-explosive missile and rocket activities using a surface target, and explosive or non-explosive bombing or mine laying activities (except in designated locations). • The Navy will not place mine shapes, anchors, or mooring devices on the seafloor (except in designated locations).
Mitigation Areas for Live Hard Bottom, Artificial Reefs, and Shipwrecks (year-round)
• The Navy will not conduct precision anchoring (except in designated anchorages), explosive mine countermeasure and neutralization activities (except in designated locations) or explosive mine neutralization activities involving Navy divers (except in designated locations). • The Navy will not place mine shapes, anchors, or mooring devices on the seafloor (except in designated locations).
Hawaii Island Mitigation Area (year-round)
• The Navy will not conduct more than 300 hours of MF1 surface ship hull-mounted mid-frequency active sonar or 20 hours of MF4 dipping sonar, or use explosives that could potentially result in takes of marine mammals during training and testing.[1]
4-Islands Region Mitigation Area (November 15 – April 15 for active sonar; year-round for explosives)
• The Navy will not use MF1 surface ship hull-mounted mid-frequency active sonar or explosives that could potentially result in takes of marine mammals during training and testing.[1]
Humpback Whale Special Reporting Areas (December 15 – April 15)
• The Navy will report the total hours of surface ship hull-mounted mid-frequency active sonar used in in the special reporting areas in its annual training and testing activity reports submitted to NMFS.
San Diego Arc, San Nicolas Island, and Santa Monica/Long Beach Mitigation Areas (June 1 – October 31)
• The Navy will not conduct more than a total of 200 hours of MF1 surface ship hull-mounted mid-frequency active sonar in the combined areas, excluding normal maintenance and systems checks, during training and testing.[1] • Within the San Diego Arc Mitigation Area, the Navy will not use explosives that could potentially result in the take of marine mammals during large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training and testing.[1] • Within the San Nicolas Island Mitigation Area, the Navy will not use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training.[1] • Within the Santa Monica/Long Beach Mitigation Area, the Navy will not use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training and testing.[1]
Santa Barbara Island Mitigation Area (year-round)
• The Navy will not use MF1 surface ship hull-mounted mid-frequency active sonar during training and testing, or explosives that could potentially result in the take of marine mammals during medium-caliber or large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training.[1]
Awareness Notification Message Areas (seasonal according to species)
• The Navy will issue awareness notification messages to alert ships and aircraft to the possible presence of humpback whales (November – April), blue whales (June – October), gray whales (November – March), or fin whales (November – May).

[1] If naval units need to conduct more than the specified amount of training or testing, they will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information in its annual activity reports submitted to NMFS.

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6 Regulatory Considerations

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6 REGULATORY CONSIDERATIONS

In accordance with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), federal agencies shall, to the fullest extent possible, integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively. This chapter summarizes environmental compliance for the Proposed Action, consistency with other federal, state, and local plans, policies, and regulations not considered in Chapter 3 (Affected Environment and Environmental Consequences); the relationship between short-term impacts; and the maintenance and enhancement of long-term productivity in the affected environment; irreversible and irretrievable commitments of resources, and energy conservation.

6.1 CONSISTENCY WITH OTHER APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS, AND EXECUTIVE ORDERS

Implementation of the Proposed Action for the Hawaii-Southern California Training and Testing (HSTT) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), would comply with applicable federal, state, and local laws, regulations, and executive orders. The United States (U.S.) Department of the Navy (Navy) consulted with regulatory agencies, as appropriate, during the NEPA process and prior to implementation of the Proposed Action to ensure that requirements are met. Table 6.1-1 summarizes the additional environmental compliance requirements not specifically assessed in the resource chapters. Section 1.6 (The Environmental Planning Process) provides brief excerpts of the primary federal statutes, executive orders, and guidance that form the regulatory framework for the resource evaluations in Chapter 3 (Affected Environment and Environmental Consequences). Documentation of consultation and coordination with regulatory agencies is provided in Appendix J (Agency Correspondence).

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action

Laws, Executive Orders, International Standards, and Guidance	*Status of Compliance*
LAWS	
Abandoned Shipwreck Act (43 United States Code [U.S.C.] sections 2101-2106)	For abandoned shipwrecks in United States (U.S.) Territorial Waters, the federal government asserts title to the resource. See Section 3.10 (Cultural Resources) for assessment and conclusion that the Proposed Action is consistent with the act.
Act to Prevent Pollution from Ships (33 U.S.C. sections 1901–1915)	The Act to Prevent Pollution from Ships applies to U.S. vessels worldwide and implements the requirements of annexes I (Oil Pollution), II (Noxious Liquid Substances Carried in Bulk), V (Ship-Generated Garbage), and VI (Air Pollution) of the International Convention for the Prevention of Pollution from Ships (MARPOL) for the United States. Act to Prevent Pollution from Ships excludes warships and naval auxiliaries from the preventive measures in annexes I, II, and VI. For annex V, Act to Prevent Pollution from Ships requires Navy ships and submarines to comply fully with discharge restrictions applicable outside of "special areas" designated under annex V and places limitations on Navy ship discharges within annex V special areas. Requirements associated with the Act to Prevent Pollution from Ships are implemented in accordance with the Navy Environmental and Natural Resources Program Manual and related Navy guidance documents governing waste management, pollution prevention, and recycling. At sea, the Navy complies with these regulations and operates in a manner that minimizes or eliminates any adverse effects to the marine environment. See Section 3.2 (Sediments and Water Quality) for the assessment.
Antiquities Act (16 U.S.C. sections 431–433)	In accordance with Navy procedures, the Proposed Action is consistent with the Act's objectives for protection of archaeological and historical sites and objects, preservation of cultural resources, and the public's access to them. See Section 3.10 (Cultural Resources) for the assessment.
Coastal Zone Management Act (16 U.S.C. sections 1451-1464)	The Navy has determined that the activities are consistent to the maximum extent practicable with Hawaii's enforceable policies under the Hawaii Coastal Zone Management Program. For California, the Navy has determined that the activities are fully consistent with the applicable enforceable policies of the California Coastal Management Plan. Hawaii and California have both objected to the Navy's determinations. See Section 6.1.1 (Coastal Zone Management Act Compliance) for discussions of Navy compliance with the Coastal Zone Management Act.
Historic Sites Act (16 U.S.C. sections 461–467)	In accordance with Navy procedures, the Proposed Action is consistent with the national policy for the preservation of historic sites, buildings, and objects of national significance. See Section 3.10 (Cultural Resources) for the assessment.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	*Status of Compliance*
LAWS	
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. sections 1801–1882)	The Proposed Action may have potential impacts on essential fish habitat and managed species (Section 6.1.3, Magnuson-Stevens Fishery Conservation and Management Act). The Navy consulted with the National Marine Fisheries Service (NMFS) for affected species and their habitats (Section 6.1.3).
Migratory Bird Treaty Act (16 U.S.C. sections 703–712)	Implementation of the Proposed Action is not anticipated to result in significant adverse effects on migratory bird populations; therefore, the Navy does not need to confer with the U.S. Fish and Wildlife Service. See Section 3.9 (Birds) for the assessment.
National Fishery Enhancement Act (33 U.S.C. sections 2101–2106)	The Proposed Action is consistent with regulations administered by the NMFS and U.S. Army Corps of Engineers concerning artificial reefs in the navigable waters of the United States. Impacts to artificial reefs are covered in the 2012 Essential Fish Habitat Assessment.
National Historic Preservation Act (16 U.S.C. sections 470 et seq.)	Pursuant to Section 106 of the National Historic Preservation Act, the Navy engaged California and Hawaii stakeholders in separate consultations. For California, the Navy consulted with the State Historic Preservation Office and the Advisory Council on Historic Preservation. The Navy concluded the process by finding No Historic Properties Affected. The California State Historic Preservation Officer concurred with the Navy's determination. For Hawaii, the Navy consulted with representatives from the State Historic Preservation Division, the National Park Service, the Office of Hawaiian Affairs, Native Hawaiian Organizations, and other interested parties. The Navy has determined there are historic properties present in the Hawaii Range Complex but the proposed training and testing will have no effect upon them. See Section 3.10 (Cultural Resources) for the assessment.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	*Status of Compliance*
LAWS	
National Marine Sanctuaries Act (16 U.S.C. sections 1431–1445c-1)	Two National Marine Sanctuaries administered by National Oceanic and Atmospheric Administration Office of National Marine Sanctuaries lie within or overlap the Study Area. These are discussed further in Section 6.1.2.7 (National Marine Sanctuaries). • The military activities the Navy proposed to be conducted in the Hawaiian Islands Humpback Whale National Marine Sanctuary all fall into classes of activities covered in the 1997 Final EIS/Management Plan for the Sanctuary, which under the Hawaiian Islands Humpback Whale National Marine Sanctuary regulations do not require permits or further consultation under section 304(d) unless the military activity is modified in a manner significantly greater than was considered in a previous consultation. These military activities are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which the Office of National Marine Sanctuaries found no consultation was required in a letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS and, therefore, consultation is not required. • Proposed military activities in the Channel Islands National Marine Sanctuary are consistent with those activities described in the sanctuary's regulations and in Section 3.5.9 (Department of Defense Activities, preexisting activities) of the 2009 Final Channel Islands National Marine Sanctuary Management Plan/Final Environmental Impact Statement. As demonstrated by the analysis in this EIS/OEIS, proposed activities are not significantly modified in such a way that possible adverse effects on Sanctuary resources or qualities are significantly different in manner than previously considered. In addition, all Navy activities are carried out in a manner that avoids to the maximum extent practicable any adverse impacts on Sanctuary resources or qualities. The military activities currently proposed are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which the Office of National Marine Sanctuaries found no consultation was required in a letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS; therefore, consultation is not required.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	*Status of Compliance*
LAWS	
Resource Conservation and Recovery Act (42 U.S.C. section 6901 et seq.)/Military Munitions Rule	Under the Resource Conservation and Recovery Act, the Military Munitions Rule identifies when conventional and chemical military munitions are considered solid waste. Military munitions are not considered solid waste based on the following condition stated in the 40 Code of Federal Regulations (CFR) section 266.202(a)(1)(i-iii). Specifically, munitions are not considered hazardous waste when: used for their intended purpose, including training of military personnel and explosive emergency response specialists; research and development activities; and when recovered, collected, and destroyed during range clearance events. This condition covers the uses of munitions included in the Proposed Action; therefore, the Resource Conservation and Recovery Act does not apply.
Rivers and Harbors Act (33 U.S.C. section 401 et seq.)	Under the Rivers and Harbors Act, a permit is required when construction is proposed in navigable waterways. The Navy does not anticipate construction in navigable waters under the Proposed Action. Therefore, no Army Corps of Engineer permits would be required.
Submerged Lands Act of 1953 (43 U.S.C. sections 1301–1315)	In accordance with the states' regulations, the Proposed Action is consistent with regulations concerning the Submerged Lands Act.
Sunken Military Craft Act (Public Law 108–375, 10 U.S.C. section 113 Note and 118 Stat. 2094–2098)	The Sunken Military Craft Act does not apply to actions taken by, or at the direction of, the United States. See Section 3.10 (Cultural Resources) for the assessment.
California Coastal National Monument Designation (Presidential Proclamation 7264, January 11, 2000), expanded areas including the Point Arena-Stornetta Public Lands (Presidential Proclamation 9089, March 11, 2014), and the Boundary Enlargement of the California Coastal National Monument (Presidential Proclamation 9563, January 12, 2017)	The California Coastal National Monument is located along the California coastline and comprises more than 20,000 unappropriated or unreserved islands, rocks, exposed reefs, and pinnacles occurring within 12 nautical miles off the coast of California between Mexico and Oregon (over 1,100 miles). Navy activities are not proposed to occur in these areas. The Navy and the Bureau of Land Management have agreed on the terms of a Memorandum of Understanding dated November 5, 2007, regarding Navy activities in the vicinity of monument resources. Implementation of the Proposed Action would be consistent with the Memorandum of Understanding and would not affect monument resources.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	*Status of Compliance*
LAWS	
Presidential Proclamation – Papahanaumokuakea Marine National Monument; Designated by Proclamation 8031 (June 15, 2006) and amended by Proclamation 8112 (February 28, 2007), and 50 CFR part 404 and Presidential Proclamation 9478 – Papahanaumokuakea Marine National Monument Expansion (August 31, 2016)	The proposed Navy activities would be carried out consistent with applicable laws. In accordance with Presidential Proclamation 8031 and Papahanaumokuakea Marine National Monument regulations (50 CFR part 404), all activities and exercises of the Armed Forces shall be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on Monument resources and qualities. Papahanaumokuakea Marine National Monument plays a critical role for traditional Native Hawaiians in regards to voyaging and wayfinding and is considered a sacred site (81 FR 60225). No new activities are proposed to occur within the Papahanaumokuakea Marine National Monument. Therefore, as analyzed in Section 3.10 (Cultural Resources), no adverse impacts on submerged cultural resources would occur as a result of the Proposed Action. However, the Proposed Action may cause disruptions to cultural voyaging and wayfinding, but these would be considered temporary as both Navy and cultural voyaging activities are considered transitory and there would be minimal to no overlap. While there has been no incident to date, should there be a threatened or actual event that may cause destruction of, loss of, or injury to a monument resource, a Monument Expansion resource, or quality (such as spill or grounding), the Department of Defense and Navy will coordinate with the Secretary of Commerce and Interior to respond to, provide mitigation, or restore the effects of any such harm. See Section 6.1.2.6 (National Monuments) for discussions of the Papahanaumokuakea Marine National Monument.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	*Status of Compliance*
EXECUTIVE ORDERS	
Executive Order 11990*, Protection of Wetlands*	In accordance with Navy procedures, implementation of the Proposed Action would not affect wetlands as defined in Executive Order 11990. The action being analyzed takes place at sea; therefore, no wetlands would be impacted by the Proposed Action.
Executive Order 12114, *Environmental Effects Abroad of Major Department of Defense Actions*	The Navy prepared this OEIS in accordance with Executive Order 12114 and Navy-implementing regulations found at 32 CFR part 187, Environmental Effects Abroad of Major Department of Defense Actions.
Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	In accordance with Navy procedures, the Proposed Action would not result in any disproportionately high and adverse human health or environmental effects on minority or low-income populations as all of the proposed activities occur in the ocean and in harbors and bays, where there are no human residences present (See Section 3.0.3.2, Resources and Issues Eliminated from Further Consideration). Because many of the subsistence fishers are of low-income populations, they have limited means and opportunity to travel offshore into federal waters to fish. Thus, it is assumed that the majority of the subsistence fishing would occur in waters close to the coastline (see Section 3.11.2.3, Subsistence Fishing).
Executive Order 12962*, Recreational Fisheries*	In accordance with Navy procedures, the Proposed Action would not affect federal agencies' ability to fulfill certain duties with regard to promoting the health and access of the public to recreational fishing areas. See Section 3.11 (Socioeconomics) for the assessment.
Executive Order 13045*, Protection of Children from Environmental Health Risks and Safety Risks*	In accordance with Navy procedures, the Proposed Action would not result in disproportionate environmental health or safety risks to children. See Section 3.0.3.2 (Resources and Issues Eliminated from Further Consideration).
Executive Order 13089*, Coral Reef Protection*	The Navy has prepared this EIS/OEIS in accordance with requirements that federal agencies whose actions affect U.S. coral reef ecosystems shall provide for implementation of measures needed to research, monitor, manage, and restore them, including reducing impacts from pollution and sedimentation. See Section 3.4 (Invertebrates) for the assessment.
Executive Order 13112*, Invasive Species*	In accordance with Navy procedures, the Proposed Action would not increase the number of or introduce new invasive species nor require the Navy to take measures to avoid introduction and spread of those species. Naval vessels are exempt from 33 CFR part 151 subpart D, Ballast Water Management for Control of Nonindigenous Species in Waters of the United States; however, the Navy follows ballast water protocols as required by the Chief of Naval Operations Instructions 5090.1D, *Environmental Readiness Program Manual*.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	*Status of Compliance*
EXECUTIVE ORDERS	
Executive Order 13158, *Marine Protected Areas*	The Navy has prepared this EIS/OEIS in accordance with requirements for the protection of existing national system marine protected areas. See Section 6.1.2 (Marine Protected Areas) for more information.
Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*	In accordance with Navy procedures, the Proposed Action would not have substantial direct effects on one or more Indian tribes, on the relationship between the federal government and Indian tribes, or on the distribution of power and responsibilities between the federal government and Indian tribes. See Table 8.2-1 for federally recognized tribes that were provided notification letters of the HSTT EIS/OEIS.
Executive Order 13840, *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States*	The Proposed Action is consistent with the comprehensive national policy for the *Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States* (which replaced Executive Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*).
Executive Order 13783, *On Promoting Energy Independence and Economic Growth*	The Proposed Action is consistent with the policy and immediate review of all agency actions that potentially burden the safe, efficient development of domestic energy resources. This Executive Order revokes Executive Order 13653, *Preparing the United States for the Impacts of Climate Change*.
Executive Order 13834, *Efficient Federal Operations*	The Proposed Action is consistent with the federal government's order to prioritize actions that reduce waste, cut costs, enhance the resilience of Federal infrastructure and operations, and enable more effective accomplishment of an agency's mission. This Executive Order revokes Executive Order 13693, *Planning for Federal Sustainability in the Next Decade*.
INTERNATIONAL STANDARDS	
International Convention for the Prevention of Pollution from Ships	The Proposed Action does include vessel operation and incidental discharges from ships; however, Navy vessels operating in the Study Area comply with applicable law and regulations, minimizing or eliminating potential impact from discharges from ships.

[1]The Final Environmental Impact Statement/Management Plan (FEIS/MP) for the Channel Islands National Marine Sanctuary was released in 2009, although the regulations cite 2008 for the FEIS/MP.
Notes: U.S. = United States, NMFS = National Marine Fisheries Service, HSTT = Hawaii and Southern California Training and Testing, EIS = Environmental Impact Statement, OEIS = Overseas Environmental Impact Statement, MMPA = Marine Mammal Protection Act, MBTA = Migratory Bird Treaty Act, ESA = Endangered Species Act

6.1.1 COASTAL ZONE MANAGEMENT ACT COMPLIANCE

The Coastal Zone Management Act of 1972 (16 United States Code [U.S.C.] section 1451, et seq.) encourages coastal states to be proactive in managing coastal zone uses and resources. The act established a voluntary coastal planning program and required participating states to submit a Coastal Management Plan to the National Oceanic and Atmospheric Administration for approval. Under the act, federal actions that have an effect on a coastal use or resource are required to be consistent, to the

maximum extent practicable, with the enforceable policies of federally approved Coastal Management Plans.

The Coastal Zone Management Act defines the coastal zone as extending "to the outer limit of State title and ownership under the Submerged Lands Act" (i.e., 3 nautical miles [NM] or 9 NM from the shoreline, depending on the location). The coastal zone extends inland only to the extent necessary to control the shoreline, but the shoreward extent is not relevant to the Proposed Action.

A consistency determination, a negative determination, or a *de minimis* exemption may be submitted for review of federal agency activities. A federal agency submits a consistency determination when it determines that its activity may have either a direct or an indirect effect on a state coastal use or resource. In accordance with 15 Code of Federal Regulations [CFR] section 930.39, the consistency determination will include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program. The consistency determination must be based on evaluation of the relevant enforceable policies of the management program. In accordance with 15 CFR section 930.35, "if a Federal agency determines that there will not be coastal effects, then the Federal agency shall provide the State agencies with a negative determination for a Federal agency activity: (1) Identified by a State agency on its list, as described in section 930.34(b), or through case-by-case monitoring of unlisted activities; or (2) Which is the same as or is similar to activities for which consistency determinations have been prepared in the past; or (3) For which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity." Thus, a negative determination must be submitted to a state if the agency determines no coastal effects and one or more of the triggers above is met. *De minimis* exemptions are activities proposed by the federal agency that have already been reviewed and approved by the state (after allowing for public review and comment), and those that the state has recognized as having insignificant direct or indirect (secondary or cumulative) effects on its coastal resources.

6.1.1.1 Hawaii Coastal Zone Management Program

Hawaii has an approved Coastal Zone Management Program (Chapter 205A, Hawaii Revised Statutes), administered by the Hawaii Office of Planning. The program meets the federal coastal zone management requirements in managing coastal areas and resources, including beaches, fishponds, scenic areas, marinas, wetlands, harbors, recreational areas, historic sites, and marine resources. Hawaii's Coastal Zone Management Program employs a wide variety of regulatory and non-regulatory techniques to address coastal issues and uphold environmental law. Among them are stewardship, planning, permitting, education, and outreach.

Based on an evaluation of the effects of the Proposed Action discussed in this EIS/OEIS and the enforceable policies of Hawaii's Coastal Zone Management (CZM) Program, and pursuant to 15 CFR section 930.39, the Navy submitted a consistency determination to the Hawaii Office of Planning in April 2018. The State of Hawaii's Office of Planning objected in part (to the use of explosives) and offered two conditional concurrences to the Navy's consistency determination. After considering Hawaii's position and careful review of the underlying law and regulations, the Navy maintains that it is consistent to the maximum extent practicable with Hawaii's enforceable policies under the Hawaii CZM Program. The Navy is completing regulatory processes with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service to ensure that the Navy's proposed actions will not put the population and the future of these species into jeopardy. The Navy emphasized its commitment to strict compliance with the ESA and made assurances that the activities proposed in the HSTT Environmental Impact Statement

(EIS) are consistent to the maximum extent practicable with the enforceable policies of the Hawaii CZM Program. In compliance with 15 CFR §930.43(e), the Navy also stated in the letter its decision to proceed over Hawaii's Office of Planning objection to the Navy's consistency determination. Copies of agency correspondence are found in Appendix J (Agency Correspondence).

6.1.1.2 California Coastal Management Program

The state of California has an approved Coastal Management Plan, administered by the California Coastal Commission, codifying the California Coastal Act of 1976 (California Public Resources Code, section 30000 et seq.), the McAteer-Petris Act (created the San Francisco Bay Conservation and Development Commission), and the Suisun Marsh Preservation Act implement California's Coastal Management Program. The California Coastal Act includes policies to protect and expand public access to shorelines, and to protect, enhance, and restore environmentally sensitive habitats, including intertidal and nearshore waters, wetlands, bays and estuaries, riparian habitat, certain woods and grasslands, streams, lakes, and habitat for rare and endangered plants and animals.

Based on an evaluation of the effects of the Proposed Action discussed in this EIS/OEIS and the enforceable policies of the California's Coastal Zone Management Plan, and pursuant to 15 CFR section 930.39, the Navy submitted a consistency determination to the California Coastal Commission in February 2018. The California Coastal Commission objected to the Navy's consistency determination based on its determination that the activities as proposed were not consistent to the maximum extent practicable with the marine resources protection policy (Section 30230) of the California Coastal Act, which is one of the enforceable policies under the California Coastal Management Program.

In August 2018, the Navy replied to the California Coastal Commission, responding to each specific objection raised in the Commission's July 2018 findings letter. The Navy continued to attempt to resolve the differences with the California Coastal Commission. Unable to resolve the differences, in accordance with 15 CFR section 930.43, the Navy informed the Coastal Commission of the decision to proceed over the objection based on the Navy's determinations that the proposed activities are fully consistent with the applicable enforceable polices of the California Coastal Management Program. Copies of agency correspondence are found in Appendix J (Agency Correspondence).

6.1.2 Marine Protected Areas

Many areas of the marine environment have some level of federal, state, or local management or protection. Marine protected areas are designated and managed at all levels of government by a variety of agencies and have been established by more than 100 legal authorities. Marine protected areas vary widely in purpose, managing agencies, management approaches, level of protection, and restrictions on human uses. They have been designated to achieve objectives ranging from the conservation of biodiversity, to the preservation of sunken historic vessels, to the protection of spawning species important to commercial and recreational fisheries. The levels of protection provided by these marine protected areas range from fully protected reserves (i.e., no take of any species is permitted) to sites allowing multiple uses including fishing, recreation, and industrial uses (National Marine Protected Areas Center, 2008).

Executive Order 13158, *Marine Protected Areas* (Federal Register 65(105): 34909–34911, May 26, 2000), directs the National Oceanic and Atmospheric Administration to establish a National Marine Protected Areas Center charged with developing a national system of marine protected areas, and with maintaining a list of sites formally accepted into the national system. A full list and map of areas

accepted in the national system of marine protected areas is available from the National Marine Protected Areas Center. Executive Order 13158 requires each Federal agency whose actions affect the natural or cultural resources that are protected by a national system of marine protected areas to identify such actions, and in taking such actions, avoid harm to those natural and cultural resources to the maximum extent practicable. Pursuant to Section 5 of Executive Order 13158, agency requirements apply only to the natural or cultural resources specifically afforded protection by the sites recognized in the List of National System Marine Protected Areas (National Marine Protected Areas Center, 2013). Although many sites contain coastal (within the continental shelf) lands and islands, only the resources of the protected coastal and ocean waters, and the submerged lands thereunder, are subject to Section 5 of Executive Order 13158 (National Park Service, 2006).

All resources of the marine protected areas located within the Study Area have been incorporated into the analyses in Sections 3.1 through 3.9 (Air Quality, Sediments and Water Quality, Vegetation, Invertebrates, Habitats, Fishes, Marine Mammals, Reptiles, and Birds). In accordance with Executive Order 13158, the Navy has considered the potential impacts of its proposed activities under the Preferred Alternative (Alternative 1) to the national system marine protected areas that contain marine waters within the Study Area, factoring in Navy standard operating procedures and mitigation when applicable to the stressor and resource, to avoid or minimize harm to natural and cultural resources for which these marine protected areas were designated to the maximum extent practicable.

The Navy implements standard operating procedures for aircraft safety, which involves pilots of Navy aircraft making every attempt to avoid large flocks of birds to reduce the safety risk involved with a potential bird strike. Since 2011, the Navy has required that all Navy flying units report all bird strikes through the Web-Enabled Safety System Aviation Mishap and Hazard Reporting System. The standard operating procedures for aircraft safety will benefit birds through a reduction in the potential for aircraft strike.

The Navy also has several standard operating procedures for vessel safety. For example, ships operated by or for the Navy assign personnel to stand watch at all times, day and night, when moving through the water (underway). Watch personnel undertake extensive training in accordance with the U.S. Navy Lookout Training Handbook or civilian equivalent. A primary duty of watch personnel is to ensure safety of the ship, including the requirement to detect and report all objects and disturbances sighted in the water that may be indicative of a threat to the ship and its crew, such as debris, a periscope, surfaced submarine, or surface disturbance. Per safety requirements, watch personnel also report any marine mammals sighted that have the potential to be in the direct path of the ship as a standard collision avoidance procedure. Navy vessels operate in accordance with the navigation rules established by the U.S. Coast Guard, and applicable navigation rules, including Inland Navigation Rules (33 CFR 83) and the International Regulations for Preventing Collisions at Sea (72 COLREGS), which were formalized in the Convention on the International Regulations for Preventing Collisions at Sea, 1972. Applicable navigation requirements include, but are not limited to, Rule 5 (Lookouts) and Rule 6 (Safe Speed). These rules require that vessels at all times proceed at a safe speed so that proper and effective action can be taken to avoid collision and so they can be stopped within a distance appropriate to the prevailing circumstances and conditions. The standard operating procedures for vessel safety could result in a secondary benefit to marine mammals through a reduction in the potential for vessel strike. For a full discussion of standard operating procedures, see Section 2.3.3 (Standard Operating Procedures).

In addition to standard operating procedures, the Navy will implement mitigation to avoid potential impacts from sonar, explosives, and physical disturbance and strike stressors on applicable resources.

For example, as described in Section 5.3.4 (Physical Disturbance and Strike Stressors), mitigation for vessel movements includes training Lookouts and watch personnel with Marine Species Awareness Training (which provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures) and requiring underway vessels to maneuver to maintain a specified distance from marine mammals. For a full discussion of mitigation, see Chapter 5 (Mitigation). Table 6.1-2 presents information on the national system marine protected areas located in the Study Area and shown in Figure 6.1-1 and Figure 6.1-2, as well as the training and testing activities that could occur within each area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
State Marine Protected Areas					
Ahihi-Kinau Natural Area Reserve (established in 1973, 8.4 km^2 in size)	1	Hawaii	Ecosystem	Prohibited: anchoring in any manner, injuring or removing any marine organism, damaging or disturbing any geological features, moving or damaging historic or prehistoric remains.	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Ahihi-Kinau Natural Area Reserve.
Hanauma Bay Marine Life Conservation District (established in 1967, 0.4 km^2 in size)	2	Hawaii	Ecosystem	Prohibited: operating any watercraft, injuring or removing any marine organism, damaging or disturbing any geological features.	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Hanauma Bay Marine Life Conservation District.
Kahoolawe Island Reserve (established in 1993, 202 km^2 in size)	3	Hawaii	Ecosystem	Prohibited: all entrance into and activities within the reserve (such as boating, fishing and diving) unless specifically authorized by the Island Reserve Commission.	The Navy conducts no activities on or near Kahoolawe Island. Submarines do conduct many underwater mine detection activities several nautical miles west of Kahoolawe. However, submarine underwater mine detection activities are not likely to harm the area's protected natural resources. No explosives are used in this marine protected area. Therefore, no significant impacts are expected within the Kahoolawe Island Reserve.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Kealakekua Bay Marine Life Conservation District (established in 1969, 1.2 km^2 in size)	4	Hawaii	Ecosystem	Prohibited: injuring or removing any marine organism (except within Subzone B), damaging or disturbing any geological features, anchoring of boats in Subzone A (may be anchored in Subzone B, only in sand).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Kealakekua Bay Marine Life Conservation District.
Molokini Shoal Marine Life Conservation District (established in 1977, 0.4 km^2 in size)	5	Hawaii	Ecosystem	Prohibited: injuring or removing any marine organism (except in Subzone B), damaging or disturbing any geological features, moor and anchoring of boats.	The Navy conducts sonar in the waters near Molokini Shoal Marine Life Conservation District. No explosives are used in this marine protected area. The Navy avoids impacting Conservation District resources and qualities to the maximum extent practicable. Mitigation measures are employed whenever sonar activities occur, as applicable. The Navy may conduct diver insertion or extraction on or near Molokini. However, diver insertion or extraction is not likely to impact the area's protected natural resources. Therefore, no significant impacts are expected to the Molokini Shoal Marine Life Conservation District.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Pupukea Marine Life Conservation District (established in 1983, 1 km^2 in size)	6	Hawaii	Ecosystem	Prohibited: injuring or removing any marine organism (outside of species and gear specific regulations), damaging or disturbing any geological features.	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Pupukea Marine Life Conservation District.
West Hawaii Regional Fishery Management Area (established in 1999, 226.3 km^2 in size)	7	Hawaii	Focal Resource	Prohibited: unpermitted uses of lay nets and aquarium collections.	Amphibious operations at Kawaihae Harbor are expected to occur in the area. However they would not impact the fishes in the area because no lay nets are used and fishes are not collected for any use. No explosives are used in this marine protected area. Therefore, no significant impacts are expected within the West Hawaii Regional Fishery Management Area.
Arrow Point to Lion Head Point (Catalina Island) State Marine Conservation Area (established in 2012, 1.6 km^2 in size)	8	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for commercial and/or recreational purposes. However, all commercial and recreational takes are allowed in accordance with current regulations, except the recreational take of invertebrates which is prohibited (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Arrow Point to Lion Head Point (Catalina Island) State Marine Conservation Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Blue Cavern (Catalina Island) State Marine Conservation Area (established in 2012, 6.8 km^2 in size)	9	California	Ecosystem	Take of all living marine resources is prohibited except for take pursuant to activities authorized under subsections of 14 California Code of Regulations 632(b)(124) (subsections 632[b][102][D] and 632[b][102][E]). Except as pursuant to Federal law, emergency caused by hazardous weather, or as provided in subsection 632(b)(102)(D), it is unlawful to anchor or moor a vessel in the Catalina Marine Science Center Marine Life Refuge (Section 10932, Fish and Game Code) (California Department of Fish and Game, 2012).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Blue Cavern (Catalina Island) State Marine Conservation Area.
Bird Rock (Catalina Island) State Marine Conservation Area (established in 2012, 19.9 km^2 in size)	10	California	Ecosystem	Take of all living marine resources is prohibited, except by fishing activities, which are restricted (California Department of Fish and Game, 2012).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Bird Rock (Catalina Island) State Marine Conservation Area.
Cabrillo State Marine Reserve (established in 2012, 1 km^2 in size)	11	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Cabrillo State Marine Reserve.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Casino Point (Catalina Island) State Marine Conservation Area (established in 2012, 0.02 km^2 in size)	12	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for commercial and/or recreational purposes, subject to only a few exceptions (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Casino Point (Catalina Island) State Marine Conservation Area.
Cat Harbor (Catalina Island) State Marine Conservation Area (established in 2012, 0.6 km^2 in size)	13	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for commercial and/or recreational purposes, subject to only a few exceptions (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Cat Harbor (Catalina Island) State Marine Conservation Area.
Farnsworth Bank ASBS[1] State Water Quality Protection Area (established in 1974, 0.15 km^2 in size)	14	California	Ecosystem	Waste discharges are prohibited.	The Navy does not discharge waste in or near this area. Sonar-related activities and other training and testing activities are not likely to harm the area's protected natural resources. A detailed analysis of Water Quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). Therefore, no significant impacts are expected within the Farnsworth Bank ASBS[1] State Water Quality Protection Area.
Farnsworth Offshore (Catalina Island) State Marine Conservation Area (established in 2012, 17.3 km^2 in size)	15	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for recreational and/or commercial purposes, with only a few specified exceptions (California Department of Fish and Wildlife, 2016).	Sonar-related activities and other training and testing activities are not likely to harm the area's protected natural resources. No explosives are used in this marine protected area. Therefore, no significant impacts are expected within the Farnsworth Offshore (Catalina Island) State Marine Conservation Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Farnsworth Onshore (Catalina Island) State Marine Conservation Area (established in 2012, 6.6 km^2 in size)	16	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for recreational and/or commercial purposes, with only a few specified exceptions (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Farnsworth Onshore (Catalina Island) State Marine Conservation Area.
La Jolla ASBS[1] State Water Quality Protection Area (established in 1974, 1.8 km^2 in size)	17	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including mine warfare training activities and underwater communications testing activities just offshore (within 3 NM) of this water quality protection area. The Navy does not discharge any waste in or near this area. A detailed analysis of water quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). No explosives are used in this marine protected area. Mine warfare training activities, underwater communications testing activities, and other training and testing activities are not likely to harm the area's protected natural resources. Therefore, no significant impacts are expected within the La Jolla ASBS[1] State Water Quality Protection Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Laguna Beach State Marine Conservation Area (established in 2012, 9 km^2 in size)	18	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for recreational and/or commercial purposes, with only a few specified exceptions (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Laguna Beach State Marine Conservation Area.
Laguna Beach State Marine Reserve (established in 2012, 16.2 km^2 in size)	19	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Laguna Beach State Marine Reserve.
Long Point (Catalina Island) State Marine Reserve (established in 2012, 4.3 km^2 in size)	20	California	Ecosystem	Take of all living marine resources is prohibited (California Department of Fish and Game, 2012).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Long Point (Catalina Island) State Marine Reserve.
Lover's Cove (Catalina Island) State Marine Conservation Area (established in 2012, 0.2 km^2 in size)	21	California	Ecosystem	Take of all living marine resources is prohibited except by fishing activities that are exempt of the prohibitions and maintenance of artificial structures, (California Department of Fish and Game, 2012).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Lover's Cove (Catalina Island) State Marine Conservation Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Matlahuayl State Marine Reserve (established in 2012, 2.7 km^2 in size)	22	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource. Boats may be launched and retrieved only in designated areas and may be anchored within the reserve only during daylight hours (California Department of Fish and Wildlife, 2016).	Navy or Navy-sponsored research activities could be conducted or originate in the area near Scripps. No proposed training or testing activities are expected to occur in the area. Therefore, no impacts are expected within the Matlahuayl State Marine Reserve.
Northwest Santa Catalina Island ASBS[1] State Water Quality Protection Area (established in 1974, 53.6 km^2 in size)	23	California	Ecosystem	Waste discharges are prohibited.	The Navy does not discharge waste in or near this area. A detailed analysis of water quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). No explosives are used in this marine protected area. Sonar-related activities and other training and testing activities are not likely to harm the area's protected natural resources. Therefore, no significant impacts are expected within the Northwest Santa Catalina Island ASBS[1] State Water Quality Protection Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
San Clemente Island ASBS[1] State Water Quality Protection Area (established in 1974, 199 km^2 in size)	24	California	Ecosystem	Waste discharges are prohibited. However, discharges incidental to military training and research, development, test, and evaluation operations are allowed. Discharges incidental to underwater demolition and other in-water explosions are not allowed in the two military closure areas in the vicinity of Wilson Cove and Castle Rock. Discharges must not result in a violation of the water quality objectives, including the protection of the marine aquatic life beneficial use, anywhere in the ASBS.[1]	The Navy conducts training and testing in all warfare areas, including amphibious, anti-surface warfare, anti-submarine warfare, electronic warfare, mine warfare, and expeditionary warfare activities in this area. The Navy does not discharge waste in or near this area in violation of the site specific regulations. A detailed analysis of water quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). No explosives are used in this marine protected area. Amphibious, anti-surface warfare, anti-submarine warfare, electronic warfare, mine warfare, expeditionary warfare, and other training and testing activities are not likely to harm the area's protected natural resources. Therefore, no significant impacts are expected within the San Clemente Island ASBS[1] State Water Quality Protection Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
San Diego-Scripps ASBS[1] State Water Quality Protection Area (established in 1974, 0.4 km^2 in size)	25	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including mine warfare training activities and underwater communications testing activities just offshore (within 3 NM) of this water quality protection area. However, no explosives are used in this marine protected area. The Navy does not discharge any waste in or near this area. A detailed analysis of water quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). Mine warfare training activities, underwater communications testing activities, and other training and testing activities are not likely to harm the area's protected natural resources. Therefore, no significant impacts are expected within the San Diego-Scripps ASBS[1] State Water Quality Protection Area.
San Diego-Scripps Coastal State Marine Conservation Area (established in 2012, 3.8 km^2 in size)	26	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for recreational and/or commercial purposes, unless following the specified exceptions (California Department of Fish and Wildlife, 2016).	Sonar-related activities and other training and testing activities, are not likely to harm the area's protected natural resources in this marine protected area. Therefore, no significant impacts are expected within the San Diego-Scripps Coastal State Marine Conservation Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
San Nicolas Island and Begg Rock ASBS[1] State Water Quality Protection Area (established in 1974, 257.6 km^2 in size)	27	California	Ecosystem	Discharges incidental to underwater demolition and other in-water explosions are not allowed. Discharges must not result in a violation of the water quality objectives, including the protection of the marine aquatic life beneficial use, anywhere in the ASBS[1].	A detailed analysis of water quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). No explosives are used in this marine protected area. Sonar-related activities and other training and testing activities are not likely to harm the area's protected natural resources. Therefore, no significant impacts are expected within the San Nicolas Island and Begg Rock ASBS[1] State Water Quality Protection Area.
Santa Barbara Island State Marine Reserve (established in 2003, 33 km^2 in size)	28	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource (California Department of Fish and Wildlife, 2016).	Sonar-related activities and other training and testing activities are not likely to harm the area's protected natural resources. No explosives are used in this marine protected area. Therefore, no significant impacts are expected within the Santa Barbara Island State Marine Reserve.
South La Jolla State Marine Conservation Area (established in 2012, 6.4 km^2 in size)	29	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for recreational and/or commercial purposes, unless following the specified exceptions (California Department of Fish and Wildlife, 2016).	Transits may occur in this area. No proposed training and testing activities are expected to occur in the area. Therefore, no significant impacts are expected within the South La Jolla State Marine Conservation Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
South La Jolla State Marine Reserve (established in 2012, 13.1 km^2 in size)	30	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource (California Department of Fish and Wildlife, 2016).	Transits may occur in this area. No proposed training and testing activities are expected to occur in the area. Therefore, no significant impacts are expected within the South La Jolla State Marine Reserve.
Southeast Santa Catalina Island ASBS[1] State Water Quality Protection Area (established in 1974, 11.2 km^2 in size)	31	California	Ecosystem	Waste discharges are prohibited.	The Navy does not discharge waste in or near this area. A detailed analysis of water quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). Sonar-related activities and other training and testing activities are not likely to harm the area's protected natural resources. No explosives are used in this marine protected area. Therefore, no significant impacts are expected within the Southeast Santa Catalina Island ASBS[1] State Water Quality Protection Area.
Swami's State Marine Conservation Area (established in 2012, 32.8 km^2 in size)	32	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for recreational and/or commercial purposes, unless following the specified exceptions (California Department of Fish and Wildlife, 2016).	No proposed activities are expected to occur in the area. Therefore, no impacts are expected within the Swami's State Marine Conservation Area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Western Santa Catalina Island ASBS[1] State Water Quality Protection Area (established in 1974, 9.1 km^2 in size)	33	California	Ecosystem	Waste discharges are prohibited.	The Navy does not discharge waste in or near this area. A detailed analysis of water quality impacts in the Study Area is included in Section 3.2 (Sediments and Water Quality). Therefore, no impacts are expected within the Western Santa Catalina Island ASBS[1] State Water Quality Protection Area.
Federal Marine Protected Areas					
National Wildlife Refuges					
Johnston Island National Wildlife Refuge (established in 1926, 2,190.5 km^2 in size)	34	U.S. Territory	Ecosystem	This refuge is captured within the Pacific Remote Islands Marine National Monument. The proclamation for that Monument indicates that prohibition of certain activities does not apply to activities and exercises of the Armed Forces. Any activities carried out within the area will be conducted in a manner consistent "so far as is reasonable and practical" with the prohibitions. If a Department of Defense (DoD) activity causes any destruction, loss, or injury to a resource within the refuge, then the DoD will coordinate with the Secretary of the Interior or Commerce, to take appropriate actions to respond, mitigate, restore, or replace the affected areas.	The Navy conducts no activities in or near the Johnston Island National Wildlife Refuge. Ships may transit in the vicinity of the refuge and within the Monument. Ships transiting in the vicinity are not expected to significantly impact the area's protected natural resources. Therefore, no significant impacts are expected to the Johnston Island National Wildlife Refuge or the Pacific Remote Islands Marine National Monument.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Midway Atoll National Wildlife Refuge (established in 1988, 2,356.5 km^2 in size)	35	Hawaii	Ecosystem	Prohibitions on activities within the Midway Atoll National Wildlife Refuge are the same as those that apply for the Papahanaumokuakea Marine National Monument and World Heritage Site (50 CFR part 404). Activities of the Armed Forces are not subject to those prohibited acts. The regulations state that "all activities and exercises of the Armed Forces shall be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on Monument resources and qualities." Additionally, these regulations require that "in the event of threatened or actual destruction of, loss of, or injury to a Monument resource or quality resulting from an incident, including but not limited to spills and groundings, caused by a component of the DoD or the United States Coast Guard, the cognizant component shall promptly coordinate with the Secretaries for the purpose of taking appropriate actions to respond to and mitigate the harm and, if possible, restore or replace the Monument resource or quality."	The Navy's proposed action includes activities conducted east of Nihoa Island and inside the eastern edge of the monument boundaries. The Navy conducts activities in a manner that avoids, to the extent practicable and consistent with operational requirements, impacts on Refuge resources and qualities. Therefore, no significant impacts are expected within the Midway Atoll National Wildlife Refuge.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
San Diego Bay National Wildlife Refuge (established in 1988, 17.2 km^2 in size)	36	California	Ecosystem	It is unlawful to injure, damage, take, or possess any living, geological, or cultural marine resource for recreational or commercial purposes. Swimming, operating personal watercraft (e.g., jet ski), and water skiing are not allowed on the refuge (U.S. Fish and Wildlife Service, 2014).	No activities are proposed within the San Diego Bay National Wildlife Refuge. Activities in the San Diego Bay outside of the National Wildlife Refuge would not injure, damage, take, or possess any living, geological, or cultural marine resource in the Refuge. Therefore, no impacts are expected within the San Diego Bay National Wildlife Refuge.
National Parks					
Kalaupapa National Historical Park (established in 1998, 43.1 km^2 in size)	37	Hawaii	Ecosystem	Prohibitions in the park include restrictions on commercial and recreational fishing.	No proposed activities overlap with the park. Therefore, no impacts are expected within the Kalaupapa National Historical Park.
Kaloko-Honokohau National Historical Park (established in 1978, 5.2 km^2 in size)	38	Hawaii	Ecosystem	Unpermitted uses of lay nets and aquarium collections are prohibited in the Park.	No proposed activities overlap with the park. Therefore, no impacts are expected within the Kaloko-Honokohau National Historical Park.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Channel Islands National Park (established in 1938, 994.3 km^2 in size)	39	California	Ecosystem	Vessel operations in excess of 5 mph or creating a wake in areas so designated or within 100 feet of a diver's marker, downed skier, or swimmer are prohibited; and operation of a vessel in excess of designated size, length or width restrictions within restricted areas is prohibited.	The Channel Islands National Park contains the land area of the islands and extends to 1 NM offshore from each island. A small part of Santa Barbara Island is within the Study Area. The only applicable activity proposed in this EIS/OEIS that may occur near this area is sonar training, and it would not occur within the 1 NM boundary of the park around Santa Barbara Island. No explosives are used in this marine protected area. Therefore, no impacts are expected to natural resources that are protected within the Channel Islands National Park.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
National Monuments					
Papahanaumokuakea Marine National Monument and World Heritage Site (established in 2006, 1,508,860.1 km^2 in size)	n/a	Hawaii	Ecosystem	The Monument's two Proclamations identify prohibitions on activities within the Monument. Proclamation 8031 provides that "all activities and exercises of the Armed Forces shall be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on Monument resources and qualities." Similarly, Proclamation 9478, which expanded the Monument, requires that the "U.S. Armed Forces ensure that its vessels and aircraft act in a manner consistent, so far as is practicable with the Proclamation by the adoption of appropriate measures not impairing operations or operation capabilities." Additionally, both Proclamations state that "in the event of threatened or actual destruction of, loss of, or injury to a Monument resource or quality resulting from an incident, including but not limited to spills and groundings, caused by a component of the DoD or the United States Coast Guard, the cognizant component shall promptly coordinate with the Secretaries for the purpose of taking appropriate actions to respond to and mitigate the harm and, if possible, restore or replace the Monument resource or quality."	Vessels and aircraft used in the conduct of military training and testing would be operated in a manner consistent with the requirements of Presidential Proclamations 8031 and 9478, so far as is practicable. As analyzed in Section 3.10 (Cultural Resources), no adverse impacts on cultural resources would occur as a result of the Proposed Action. While there has been no incident to date, should there be a threatened or actual event that may cause destruction of, loss of, or injury to a Monument resource or quality (such as spill or grounding), the Department of Defense and Navy will coordinate with the Secretary of Commerce and Interior to respond to, provide mitigation or restoration of the effects of any such harm. No significant adverse effect is likely.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
National Marine Sanctuaries					
Hawaiian Islands Humpback Whale National Marine Sanctuary (established in 1992, 3,537.2 km^2 in size)	n/a	Hawaii	Species and habitat	See Section 6.1.2.7.1 (Hawaiian Islands Humpback Whale National Marine Sanctuary) for details. Federal regulations prohibit approaching humpback whales within 100 yards (90 meters) when in the water except as authorized under the MMPA, as amended by the ESA, and 1,000 feet (300 meters) when operating an aircraft except when in a designated flight corridor for takeoff or landing from an airport or runway or as authorized under the MMPA, as amended by the ESA. Other prohibited activities are listed in 15 CFR 922.184.	Military activities the Navy proposes to conduct in the Hawaiian Islands Humpback Whale National Marine Sanctuary all fall into classes of activities covered in the 1997 Final EIS/Management Plan for the Sanctuary, which under the Hawaiian Islands Humpback Whale National Marine Sanctuary regulations do not require permits or further consultation under section 304(d) unless the military activity is modified in a manner significantly greater than was considered in a previous consultation. These activities are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which the Office of National Marine Sanctuaries found no consultation was required in a letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS and, therefore, consultation is not required.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	*Figure 6.1-1 and 6.1-2 Reference Number*	*Location Within the Study Area*	*Protection Focus*	*Summary of Relevant Regulations*	*Navy Proposed Activities under the Preferred Alternative and Marine Protected Area Considerations*
Channel Islands National Marine Sanctuary (established in 1980, 3,804 km^2 in size)	n/a	California	Ecosystem	See section 6.1.2.7.2 (Channel Islands National Marine Sanctuary) for details. Military activities pre-existing the Sanctuary effective date of Sanctuary regulations (September 1980) and those specifically listed in the *Channel Islands National Marine Sanctuary FMP/Final EIS* are exempt from the prohibitions identified in 15 CFR part 922.72 subpart G. Other activities that are modified, new, or not considered pre-existing may be exempted by the Director after consultation between the Director and the DoD.	Proposed military activities are consistent with those activities described in the sanctuary's regulations and in Section 3.5.9 (Department of Defense Activities, preexisting activities) of the 2009[1] Final Channel Islands National Marine Sanctuary Management Plan/Final Environmental Impact Statement. As demonstrated by the analysis in this EIS/OEIS, proposed activities are not significantly modified in such a way that possible adverse effects on Sanctuary resources or qualities are significantly different in manner than previously considered. In addition, all Navy activities are carried out in a manner that avoids to the maximum extent practicable any adverse impacts on Sanctuary resources or qualities. The military activities currently proposed are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which the Office of National Marine Sanctuaries found no consultation was required in a letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS and, therefore, consultation is not required.

[1]The Final Environmental Impact Statement/ Management Plan (FEIS/MP) for the Channel Islands National Marine Sanctuary was released in 2009, although the regulations cite 2008 for the FEIS/MP.

Notes: (1) ASBS is an Area of Special Biological Significance; (2) mph = miles per hour, NM = nautical miles, NM^2 = square nautical miles, U.S. = United States, n/a = not applicable, km^2 = square kilometers, CFR = Code of Federal Regulations, ESA = Endangered Species Act, MMPA = Marine Mammal Protection Act, NMSA = National Marine Sanctuaries Act

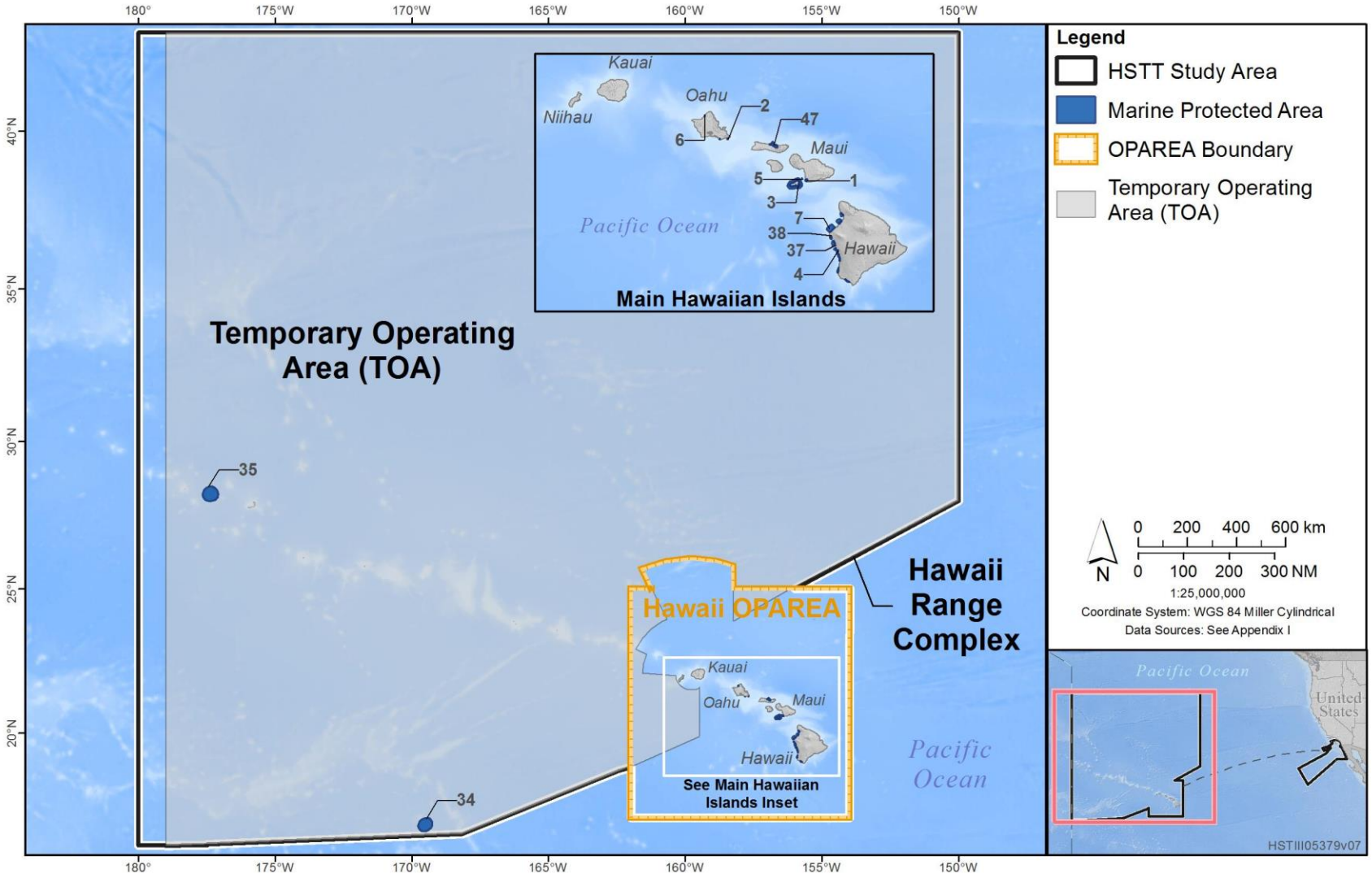


Figure 6.1-1: Location of Marine Protected Areas in the Hawaii Range Complex

Notes: HSTT = Hawaii-Southern California Training and Testing, OPAREA = Operating Area

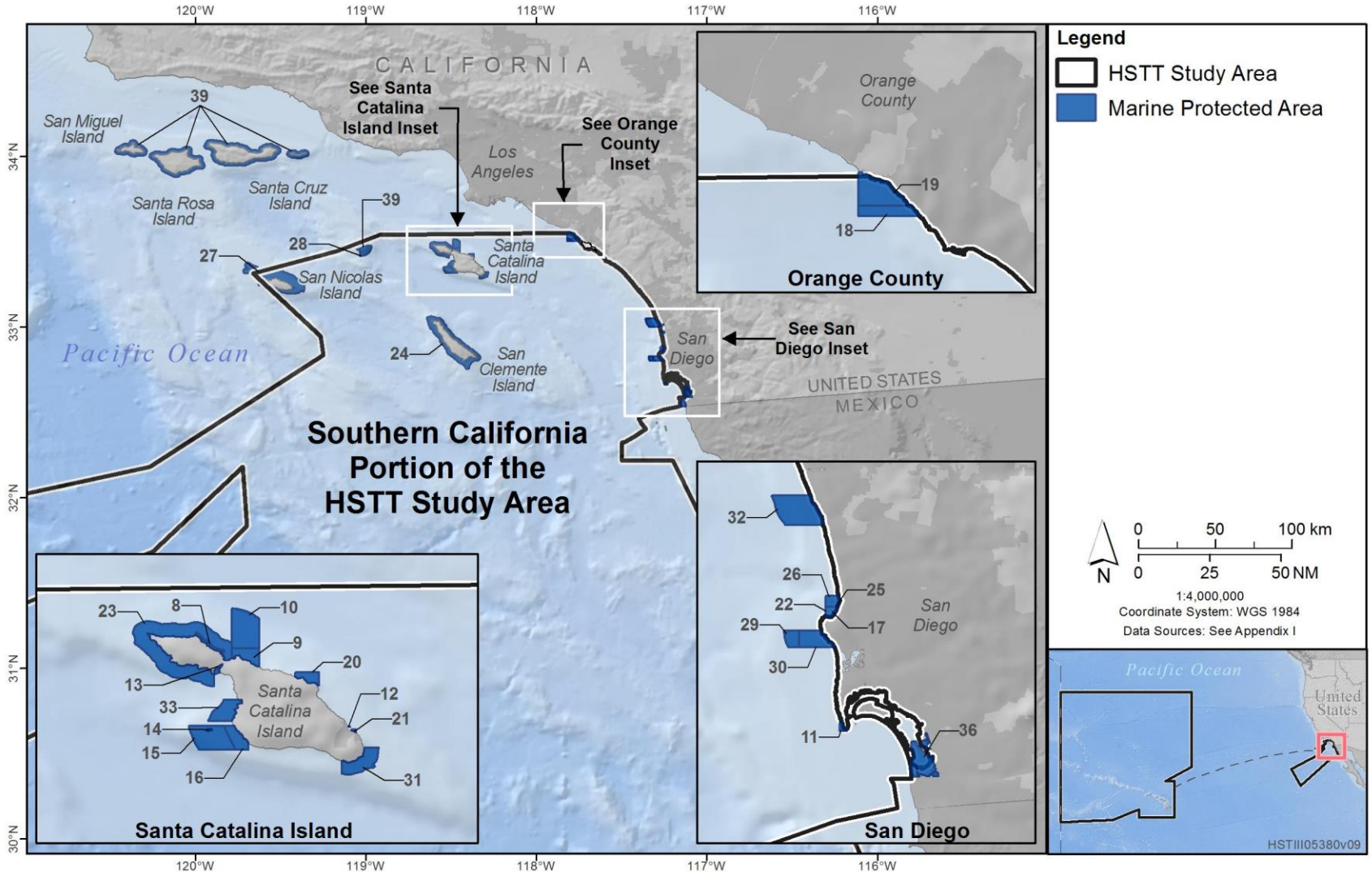


Figure 6.1-2: Location of Marine Protected Areas in the Southern California Portion of the Study Area

Note: HSTT = Hawaii-Southern California Training and Testing

6.1.2.1 State Marine Protected Areas

State governments have established marine protected areas, including state parks and species-specific sanctuaries, for the management of fisheries, nursery grounds, shellfish beds, recreation, tourism, and for other uses. These areas have a diverse array of conservation objectives, from protecting ecological functions, to preserving shipwrecks, to maintaining traditional or cultural interaction with the marine environment. There are 43 state or local marine protected areas within the Study Area that are included in the National System of Marine Protected Areas (Table 6.1-2 and Figures 6.1-1 and 6.1-2).

6.1.2.2 National Estuarine Research Reserves

National Estuarine Research Reserve System sites protect estuarine land and water and provide habitat for wildlife. These sites also provide educational opportunities for students, teachers, and the public; and serve as laboratories for scientists (15 CFR part 921). The National Estuarine Research Reserve Program was established through the Coastal Zone Management Act and is administered in coordination with the National Marine Sanctuary System. Each reserve is managed by a state agency or university with input from local partners on a site-specific basis. There are no National Estuarine Research Reserve System sites within the Study Area.

6.1.2.3 National Wildlife Refuges

Refuges are managed by the U.S. Fish and Wildlife Service (USFWS) in accordance with *Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System*, the National Wildlife Refuge System Administration Act of 1966, and the National Wildlife Refuge System Improvement Act of 1997. The National Wildlife Refuge System serves as a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and habitats. National wildlife refuges are managed on a site-specific basis. Activities conducted within a refuge must not impair existing wildlife-dependent recreational uses or reduce the potential of the refuge to provide quality, compatible, wildlife-dependent recreation into the future. The USFWS is directed to continue, consistent with existing laws and interagency agreements, authorized or permitted refuge uses necessary to facilitate military preparedness; however, new agreements permitting military preparedness activities on refuges are discouraged (U.S. Fish and Wildlife Service, 2006). There are three national wildlife refuge areas within the Study Area, the Johnston Island National Wildlife Refuge and Midway Atoll National Wildlife Refuge, and San Diego Bay National Wildlife Refuge (Table 6.1-2 and Figures 6.1-1 and 6.1-2).

6.1.2.4 Gear Restricted Areas

The National Marine Fisheries Service (NMFS) is responsible for overseeing Regional Fishery Management Councils (Western Pacific and Pacific Fishery Management Councils) that are established under the Magnuson-Stevens Act. These councils create and implement Fishery Management Plans, which help conserve and manage important fisheries in the United States (50 CFR Chapter 6). One management strategy used is the creation of Gear Restricted Areas, some of which are included in the National System of marine protected areas. There are no Gear Restricted Areas within the Study Area.

6.1.2.5 National Parks

The National Park Service administers all national parks, national seashores, and some of the national recreation areas and national monuments to conserve the scenery and the natural and historic objects and wildlife contained within. Park managers control all park usage to ensure that park resources and values are preserved for the future. Unacceptable impacts are those that fall short of impairment but

are still not acceptable within a particular park's environment, as determined by the professional judgment of the park manager in accordance with *National Park Service Management Policies 2006* (National Park Service, 2006). Military services may request the use of park areas for noncombat exercises. Permits are approved at the discretion of the park superintendent. There are three National Parks (Kalaupapa National Historical Park, Kaloko-Honokohau National Historical Park, Channel Islands National Park) within the Study Area that are included in the National System of Marine Protected Areas (Table 6.1-2 and Figures 6.1-1 and 6.1-2).

6.1.2.6 National Monuments

Marine national monuments are designated through Presidential Proclamation under the authority of the Antiquities Act of 1906 (as codified in 54 U.S.C. section 320301). Marine national monuments are often co-managed by state, federal, and local governments as trustees, in order to preserve diverse habitats and ecosystem functions. Within the Study Area there is one marine national monument, Papahanaumokuakea Marine National Monument (Table 6.1-2). The Monument was designated through Proclamation 8031 of June 15, 2006, amended by Proclamation 8112 of February 28, 2007, and more recently expanded into an adjacent area depicted on Figure 6.1-3 through Proclamation 9478 of August 26, 2016. The Monument is also a United Nations Educational, Scientific and Cultural Organization World Heritage Site as discussed in Section 3.10 (Cultural Resources).

6.1.2.6.1 Papahanaumokuakea Marine National Monument

Papahanaumokuakea Marine National Monument (the Monument) is one of the largest conservation areas in the world, encompassing 582,578 square miles in a chain of islands, reefs, and banks that extends to the northwest of the main Hawaiian Islands (National Marine Sanctuaries, 2016). This monument is within the Hawaii portion of the Study Area, northwest of the Hawaii OPAREA and encompassed within the Temporary Operating Area of the Hawaii Range Complex (see Figure 6.1-3). The Monument is managed by the State of Hawaii, Office of Hawaiian Affairs, Department of Commerce National Oceanic and Atmospheric Administration, and the Department of Interior (USFWS), with the guidance of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve Advisory Council; the Department of Defense (DoD) has a sitting member on this council. In 2008, the Monument co-trustees adopted a Management Plan. This Management Plan describes a comprehensive and coordinated management regime to achieve priority mission needs over the next five years with a focus on an ecosystem management approach for the conservation of the natural, cultural, and historic resources, and qualities of the Monument.

The Papahanaumokuakea Marine National Monument contains more than 75 seamounts and a non-volcanic ridge that extends southwest towards Johnston Atoll (Proclamation 9478). The protected area contains 14 million seabirds, of which 22 species breed and nest within the boundaries of the monument. Of the over 7,000 species of marine life, one-quarter are found only in the Hawaiian Islands (National Marine Sanctuaries, 2016). More than 260 fish species inhabit the reefs of the Papahanaumokuakea Marine National Monument, with relatively few species being herbivorous, the majority being carnivorous, or open ocean fish species (National Marine Sanctuaries, 2016). See Section 3.3 (Vegetation), Section 3.4 (Invertebrates), and Section 3.6 (Fishes) for additional information on species and bathymetry in the Study Area.

The Monument's ecosystem supports a range of marine mammals, including the Hawaiian monk seal (*Monachus schauinslandi*), the Hawaiian spinner dolphin (*Stenella longirostris*), and bottlenose dolphins (*Tursiops truncatus*) (National Marine Sanctuaries, 2009a). The Hawaiian monk seal, which does not

exist outside of this area, is the most endangered marine mammal in the U.S. and the only seal that depends on coral reefs. Transient marine mammals in the Papahanaumokuakea Marine National Monument include spotted dolphins (*Stenella frontalis*) and humpback whales (*Megaptera novaeangliae*). Seasonally or periodically present whales include the sperm whale (*Physeter macrocephalus*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), and North Pacific right whale (*Eubalaena japonica*). See Section 3.7 (Marine Mammals) for additional information on these species.

Five species of sea turtles occur in the Monument (U.S. Fish and Wildlife Service et al., 2008). The Papahanaumokuakea Marine National Monument islands provide important nesting habitat for the threatened green sea turtle, with French Frigate Shoals alone supporting more than 80 percent of the nesting population for all the Hawaiian Islands. See Section 3.8 (Reptiles) for additional information on these species.

The Monument is also a place of special cultural significance for the Native Hawaiian community and provides a unique opportunity to manage marine resources in a manner that honors the rich heritage of the Native Hawaiian culture. In the past five years, there have been a variety of permitted Native Hawaiian activities in the Monument, including navigator training on traditional voyaging canoes, inter-tidal zone monitoring, experiential research during solstice and equinox events, Hawaiian language immersion expeditions, at sea education and culture programs, and the documentation and assessment of cultural sites on various islands. While most of the terrestrial activities take place on Nihoa and Mokumanamana at the eastern end and at Midway Atoll at the western end, the marine activities can take place anywhere in both the original and expanded Monument.

In addition, the Papahanaumokuakea Marine National Monument boundaries include Midway Atoll, which has been designated as a National Memorial to the Battle of Midway. Aircraft and shipwrecks from the Battle of Midway are considered war graves.

Presidential Proclamations 8031 (June 15, 2006) and 9478 (August 25, 2016) both provide activities and exercises of the U.S. Armed Forces an exemption from the prohibitions that are identified in each Proclamation. However, within the original designated Monument area, Proclamation 8031 requires that activities and exercises of the U.S. Armed Forces be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on monument resources and qualities (50 CFR part 404.9(c)). Within the expansion area, Proclamation 9478 requires that the U.S. Armed Forces ensure that its vessels and aircraft act in a manner consistent, so far as is practicable with the Proclamation by the adoption of appropriate measures not impairing operations or operation capabilities. In the event of a threatened or actual destruction of, loss of, or injury to a Monument resource or quality resulting from an incident, including but not limited to spills and groundings, caused by a component of the DoD, the cognizant Component shall promptly coordinate with the Secretary of Interior and Commerce to respond to and mitigate the harm, and, if possible, restore or replace the Monument resource.

The training and testing activities that could occur within the Monument include training by individual ships transiting to and from the Western Pacific on deployment or occasional positioning of ships supporting testing or other events outside of the Monument. Activities can include:

- Air warfare
- Surface warfare

- Anti-submarine warfare
- Electronic warfare

Infrequent missile overflight of the Monument for test events can occur as sometimes the Temporary Operating Area is activated for those events in conjunction with U.S. Coast Guard Notice to Mariners and the Federal Aviation Administration Notices to Airmen. However, the majority of test events do not require entry or overflight of the Monument.

Pursuant to 50 CFR 404.4(a)(1), the U.S. Armed Forces are exempt from the reporting requirements that apply to other vessels entering and exiting the monument.

6.1.2.7 National Marine Sanctuaries

Under Title III of the Marine Protection, Research, and Sanctuaries Act of 1972 (also known as the National Marine Sanctuaries Act), the National Oceanic and Atmospheric Administration can establish as national marine sanctuaries areas of the marine environment with special conservation, recreational, ecological, historical, cultural, archaeological, scientific, educational, or aesthetic qualities. Sanctuary regulations prohibit destroying, causing the loss of, or injuring any sanctuary resource managed under the law or regulations for that sanctuary (15 CFR part 922). National marine sanctuaries are managed on a site-specific basis, and each sanctuary has site-specific regulations. Most, but not all sanctuaries have site-specific regulatory exemptions from the prohibitions for certain military activities.

Additionally, section 304(d) of the National Marine Sanctuaries Act requires federal agencies to consult with the Office of National Marine Sanctuaries whenever their proposed actions are likely to destroy, cause the loss of, or injure a sanctuary resource. There are two national marine sanctuaries managed by the Office of National Marine Sanctuaries within the Study Area, the Hawaiian Islands Humpback Whale National Marine Sanctuary and Channel Islands National Marine Sanctuary (Table 6.1-2 and Figures 6.1-3 and 6.1-4). The National Marine Sanctuaries are described in additional detail below.

6.1.2.7.1 Hawaiian Islands Humpback Whale National Marine Sanctuary

The Hawaiian Islands Humpback Whale National Marine Sanctuary is a single-species managed sanctuary, composed of 1,035 square nautical miles (NM^2) of the waters around Maui, Lanai, and Molokai; and smaller areas off the north shore of Kauai, off Hawaii's west coast, and off the north and southeast coasts of Oahu. The Sanctuary is entirely within the Hawaii Range Complex of the Study Area and constitutes one of the world's most important Hawaii humpback whale Distinct Population Segment habitats, and is a primary region for humpback reproduction in the United States (National Marine Sanctuaries Program, 2002).

Scientists estimate that more than 50 percent of the entire North Pacific humpback whale population migrates to Hawaiian waters each winter to mate, calve, and nurse their young. The North Pacific humpback whale population has been split into two Distinct Population Segments. The Hawaii humpback whale Distinct Population Segment migrates to Hawaiian waters each winter and is not listed under the Endangered Species Act (ESA). In addition to protection under the MMPA, the Hawaii humpback whale Distinct Population Segment is protected in Hawaiian waters by the Hawaiian Islands National Marine Sanctuary Act. The sanctuary boundaries extend from the shoreline to 600-feet deep in many areas, encompassing a variety of marine ecosystems, including sea grass beds and coral reefs. The sanctuary was created to protect humpback whales and their habitat (Office of National Marine Sanctuaries, 2010).

Congress authorized the Hawaiian Islands Humpback Whale National Marine Sanctuary in 1992, and the Governor of Hawaii formally approved it in 1997. The Sanctuary completed its first 5-year review process in 2002 by updating the existing management plan and the Governor approved the final revised management plan for implementation in state waters.

The military activities the Navy proposed to be conducted in the Hawaiian Islands Humpback Whale National Marine Sanctuary all fall into classes of activities covered in the 1997 Final EIS/Management Plan for the Sanctuary, which under the Hawaiian Islands Humpback Whale National Marine Sanctuary regulations do not require permits or further consultation under section 304(d) unless the military activity is modified in a manner significantly greater than was considered in a previous consultation. These military activities are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which the Office of National Marine Sanctuaries found no consultation was required in a letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS and, therefore, consultation is not required.

The Hawaiian Islands Humpback Whale National Marine Sanctuary overlaps with the Main Hawaiian Islands Humpback Whale Reproduction Area identified in Van Parijs (2015) and Baird et al. (2015), and as shown in Figure K.3-1 of Appendix K (Geographic Mitigation Assessment). As discussed in Appendix K, Section K.3.1 (Main Hawaiian Islands Humpback Whale Reproduction Area), the use of sonar and other transducers primarily occur farther offshore than the designated boundaries of the Hawaiian Islands Humpback Whale Reproduction Area. Explosive events are typically conducted in areas that are designated for explosive use, which are areas outside of the Main Hawaiian Islands Humpback Whale Reproduction Area. Refer to Appendix K, Section K.3.1 (Main Hawaiian Islands Humpback Whale Reproduction Area) for detailed biological and operational assessments.

Since 2009, the Navy has adhered to a Humpback Whale Cautionary Area within the Sanctuary, an area identified as having one of the highest concentrations of humpback whales during the critical winter months. The use of mid-frequency active sonar training and testing within the existing cautionary area between December 15 and April 15 requires authorization by the Commander, U.S. Pacific Fleet. As added protection, the Navy is going to expand the size and extend the season of the current Humpback Whale Cautionary Area, now renamed the 4-Islands Region Mitigation Area. The Navy will restrict the use of all surface ship hull-mounted mid-frequency active sonar during unit level training and major training exercises in the 4-Islands Region Mitigation Area from November 15 through April 15. Should national security present a requirement for surface ship hull-mounted mid-frequency active sonar or explosives during training or testing during the restricted time period (November 15 to April 15), the Navy would require approval from a designated Command authority prior to use in the mitigation area. The size of the 4-Islands Region Mitigation Area will expand to include an area north of Maui and Molokai and will overlap an area identified as biologically important for the critically endangered main Hawaiian Islands insular false killer whales (Baird et al., 2015; Van Parijs, 2015).

This measure to include additional area north of Maui and Molokai for this 4-Islands Region Mitigation Area provides further protective measures for humpback whales and false killer whales. This area would not be off-limits; however, it would require a request to the appropriate designated Navy command authority prior to usage of surface ship hull-mounted mid-frequency active sonar from November 15 through April 15. The Navy will also provide NMFS with advance notification and include the information in the annual training and testing reports. The expansion of the 4-Islands Region Mitigation Area is due in part that, although humpbacks have recovered to the point of ESA delisting or down-listing, most

Pacific stocks of humpbacks have been experiencing a decline in migratory rates and physical health (e.g., emaciation, increase in strandings, fewer migrations) in the Pacific.

The Navy is establishing additional geographic mitigation areas that overlap with portions of the Hawaiian Islands Humpback Whale National Marine Sanctuary. A Hawaii Island Mitigation Area will be established where the Navy will not conduct more than 300 hours of MF1 surface ship hull-mounted mid-frequency active sonar or 20 hours of MF4 dipping sonar, or use explosives that could potentially result in takes of marine mammals during training and testing. Should national security present a requirement to conduct more than 300 hours of MF1 surface ship hull-mounted mid-frequency active sonar or 20 hours of MF4 dipping sonar, or use explosives that could potentially result in the take of marine mammals during training or testing, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., sonar hours or explosives usage) in its annual activity reports submitted to NMFS.

This measure is designed to provide additional protection for humpback whales, ESA-listed main Hawaiian Islands insular false killer whales and two species of beaked whales (Cuvier and Blainville's). This area also overlaps with other identified biologically important areas for other marine mammal species such as dwarf sperm whale, pygmy killer whale, melon-headed whale, short-finned pilot whale, and dolphin species for which the Mitigation Areas would provide additional protection (Baird et al., 2015; Van Parijs, 2015).

The Navy will continue to issue an annual humpback whale awareness notification message to remind ships and aircraft to be extra vigilant during times of high densities of humpback whales while in transit and to maintain certain distances from animals during the operation of ships and aircraft.

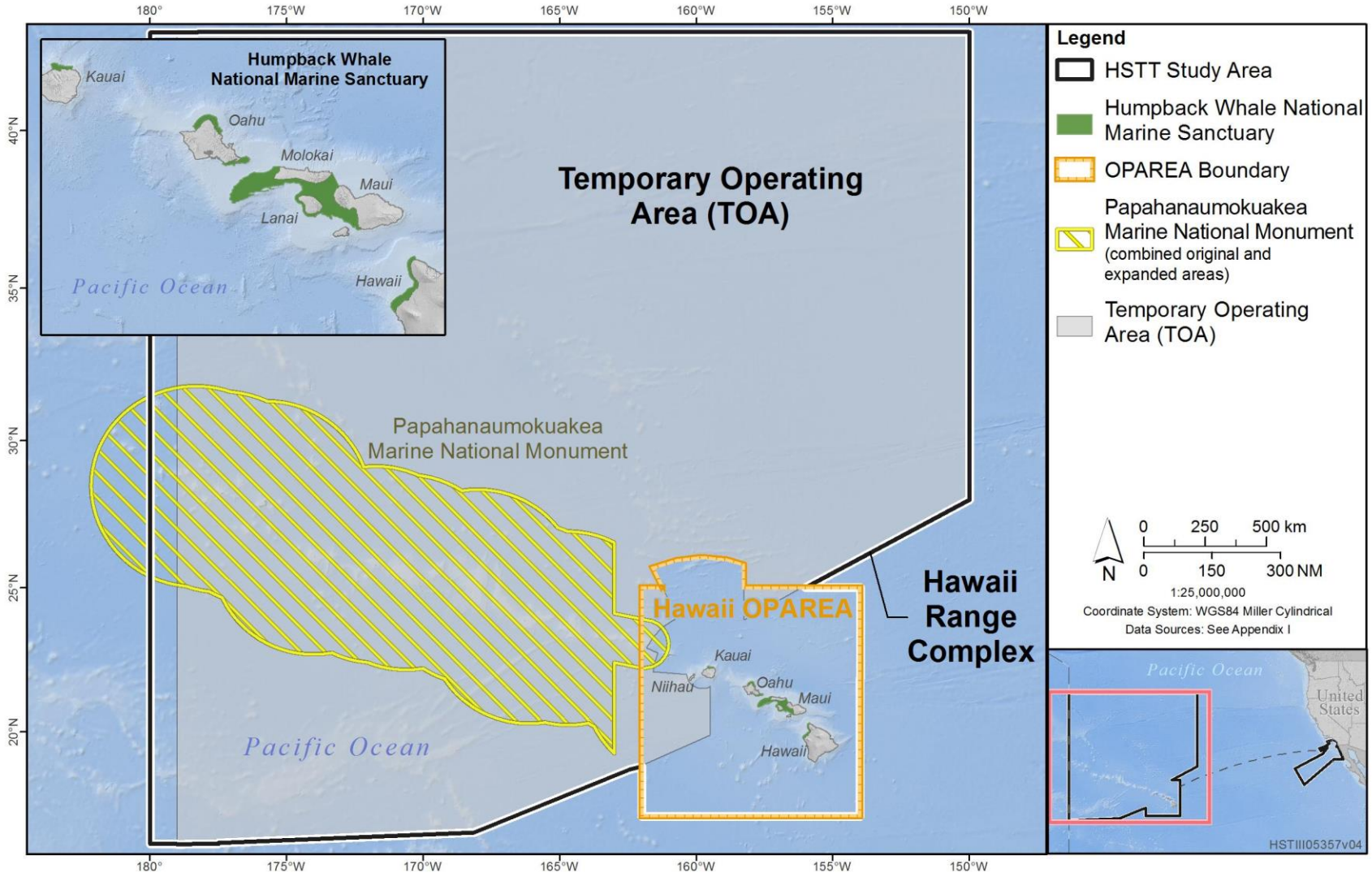


Figure 6.1-3: Papahanaumokuakea Marine National Monument and the Hawaiian Islands Humpback Whale National Marine Sanctuary

Notes: HSTT = Hawaii-Southern California Training and Testing, OPAREA = Operating Area

6.1.2.7.2 Channel Islands National Marine Sanctuary

The Channel Islands National Marine Sanctuary is an ecosystem-based managed sanctuary consisting of an area of 1,109 NM^2 around Anacapa Island, Santa Cruz Island, Santa Rosa Island, San Miguel Island, and Santa Barbara Island to the south. Only 92 NM^2, or about 8 percent of the sanctuary, occurs within the Southern California portion of the Study Area (see Figure 6.1-4). The Study Area overlaps with the sanctuary at Santa Barbara Island.

As an ecosystem-based managed sanctuary, key habitats include kelp forest, surfgrass and eelgrass, intertidal zone, nearshore subtidal, deepwater benthic, and water column habitat. The diversity of habitats onshore and offshore contributes to the high species diversity in the Channel Islands National Marine Sanctuary, with more than 195 species of birds, at least 33 species of cetaceans, four species of sea turtles, at least 492 species of algae and four species of sea grasses, a variety of invertebrates (including two endangered species [black abalone and the white abalone]), and 481 species of fish (National Marine Sanctuaries, 2009b). See Section 3.3 (Vegetation), Section 3.4 (Invertebrates), Section 3.6 (Fishes), Section 3.7 (Marine Mammals), Section 3.8 (Reptiles), and Section 3.9 (Birds) for additional information on the discussion of impacts from proposed activities to these species.

Channel Island National Marine Sanctuary regulations (15 CFR part 922, subpart G) provide that identified prohibitions do not apply to military activities carried out by the DoD as of September 1980 (effective date of the regulations) and specifically identified in Section 3.5.9 (Department of Defense Activities) of the *Final Channel Islands National Marine Sanctuary Management Plan/Final Environmental Impact Statement* (January 2009). The regulations also provide that the DoD exemption does not apply should DoD activities be modified: (1) in any way that requires preparation of an Environmental Assessment or Environmental Impact Statement pursuant to NEPA; or (2) in location or frequency, but not limited to these factors, such that possible adverse effects on Sanctuary resources are significantly greater or significantly different in manner than previously considered for the unmodified activity. In addition, the DoD exemption does not apply should there be new circumstances or information relevant to a Sanctuary resource or quality that were not addressed in the January 2009 *Final Channel Islands National Marine Sanctuary Management Plan/Final Environmental Impact Statement.* Lastly, all DoD activities must be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on Sanctuary resources and qualities.

Of the DoD activities identified in the Final Channel Islands National Marine Sanctuary Management Plan/Final Environmental Impact Statement, some sources of sonar and the use of in-water devices are the only training and testing activities proposed in this EIS/OEIS that occur in the overlap area between the Sanctuary and the HSTT Study Area. Increases to military activities described in the Proposed Action would not occur in the Sanctuary. Training activities that could occur in the area have not been modified in location/frequency in a way that would cause greater effects to sanctuary resources/qualities than originally contemplated. Although Navy has prepared an EIS/OEIS, the basis for the EIS/OEIS is not due to a modification of activities within the Channel Islands Marine National Sanctuary overlap area or in a manner due to relevant new circumstances or information in relation to Sanctuary resources or qualities in that area.

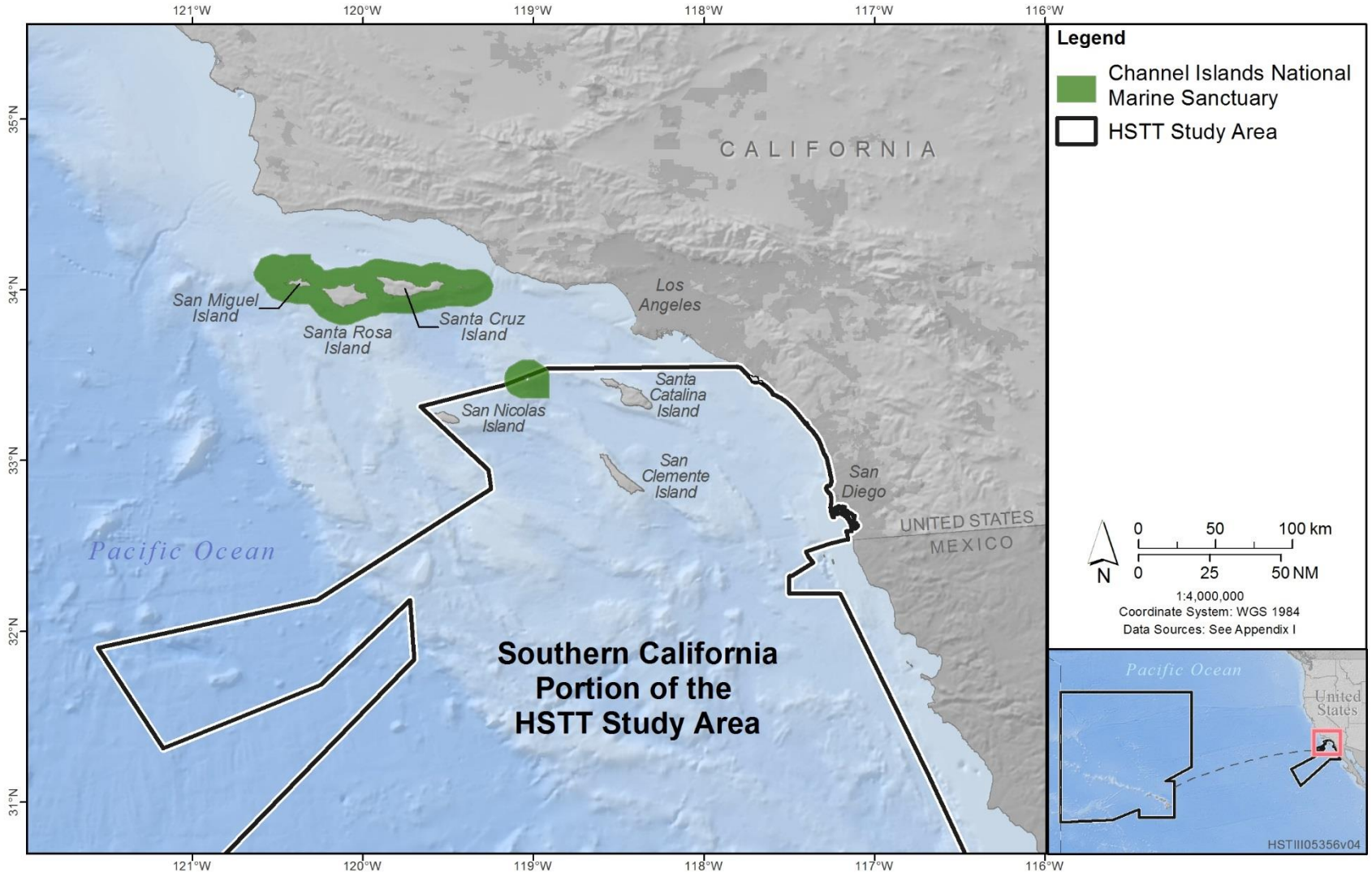


Figure 6.1-4: Channel Islands National Marine Sanctuary

Note: HSTT = Hawaii-Southern California Training and Testing

Proposed military activities are consistent with those activities described in the sanctuary's regulations and in Section 3.5.9 (Department of Defense Activities, preexisting activities) of the 2009 Final Channel Islands National Marine Sanctuary Management Plan/Final Environmental Impact Statement. As demonstrated by the analysis in this EIS/OEIS, proposed activities are not significantly modified in such a way that possible adverse effects on Sanctuary resources or qualities are significantly different in manner than previously considered. In addition, all military activities are carried out in a manner that avoids to the maximum extent practicable any adverse impacts on Sanctuary resources or qualities. The military activities currently proposed are also the same classes of activities previously analyzed in the Navy's 2013 HSTT Final EIS/OEIS and for which the Office of National Marine Sanctuaries found no consultation was required in a letter dated August 16, 2013. The activities have not been modified in a manner significantly greater than those considered in the 2013 HSTT Final EIS/OEIS; therefore, consultation is not required.

To provide additional protective measures for all protected marine species in the Channel Islands National Marine Sanctuary, the Navy is proposing a Santa Barbara Island Mitigation Area effective year-round. Within the Santa Barbara Mitigation Area, the Navy will not use MF1 surface ship hull-mounted mid-frequency active sonar during training or testing, or explosives that could potentially result in the take of marine mammals during medium-caliber or large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training. Should national security present a requirement to use MF1 surface ship hull-mounted mid-frequency active sonar during training or testing, or explosives that could potentially result in the take of marine mammals during medium-caliber or large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., sonar hours or explosives usage) in its annual activity reports submitted to NMFS.

The Navy is also proposing a San Nicolas Island Mitigation Area, effective June 1 to October 31. Within this mitigation area, the Navy will not conduct more than a total of 200 hours of MF1 surface ship hull-mounted mid-frequency active sonar in the combined areas, excluding normal maintenance and systems checks, during training and testing. Should national security present a requirement to conduct more than 200 hours of MF1 surface ship hull-mounted mid-frequency active sonar in the combined areas during training and testing (excluding normal maintenance and systems checks), naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. In addition, the Navy will not use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training. Should national security present a requirement to use explosives that could potentially result in the take of marine mammals during mine warfare, large-caliber gunnery, torpedo, bombing, and missile (including 2.75" rockets) activities during training, naval units will obtain permission from the appropriate designated Command authority prior to commencement of the activity. The Navy will provide NMFS with advance notification and include the information (e.g., sonar hours or explosives usage) in its annual activity reports submitted to NMFS.

6.1.3 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (16 U.S.C. section 1801–1891[d]), as amended by the 1996 Sustainable Fisheries Act (Public Law 104–297), and the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (Public Law 109-479), governs marine fisheries management in U.S. waters in order to promote long-term economic and biological sustainability for fisheries up to 200 NM from shore. Its main objectives are to prevent

overfishing, rebuild overfished stocks, increase long-term economic and social benefits, and ensure a safe and sustainable supply of seafood (National Oceanic and Atmospheric Administration Fisheries, 2017). The Sustainable Fisheries Act of 1996 amended the law to establish procedures that identify, conserve, and enhance Essential Fish Habitat for species regulated under a federal fisheries management plan. Consultation with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service on all actions or proposed actions that may adversely affect Essential Fish Habitat is required for federal action agencies under section 305(b)(2) of the Magnuson-Stevens Act.

The Magnuson-Stevens Fishery Conservation and Management Act defines an adverse effect as "any impact that reduces quality and/or quantity of Essential Fish Habitat. Adverse effects may include direct or indirect physical, chemical or biological alterations of the waters or substrate and the loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystem components, if such modifications reduce the quality and/or quantity of Essential Fish Habitat. Adverse effects to Essential Fish Habitat may result from actions occurring within Essential Fish Habitat or outside of Essential Fish Habitat and maybe include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.810). In addition to Essential Fish Habitat designations, areas called Habitat Areas of Particular Concern are also designated by the regional Fisheries Management Councils. Designated Habitat Areas of Particular Concern are discrete subsets of Essential Fish Habitat that provide extremely important ecological functions or are especially vulnerable to degradation.

The Proposed Action has the potential to impact essential fish habitat and managed species within the Study Area. As stated in Sections 3.3 (Vegetation), 3.4 (Invertebrates), 3.5 (Habitats), and 3.6 (Fishes), the Essential Fish Habitat Assessment prepared for the 2013 HSTT EIS/OEIS is still valid because this Draft EIS/OEIS covers similar activities in the same study area to those analyzed in 2013 (copy of the Essential Fish Habitat [EFH] Assessment is available at www.hstteis.com). Based on recommendations from previous consultations on essential fish habitat and managed species, the Navy would continue to implement agreed upon mitigation measures to avoid and minimize impacts on these resources. The Navy will also implement the applicable mitigation measures within any newly identified shallow-water coral reefs, precious coral beds, live hard bottom, or artificial reefs that have been designated as essential fish habitat since 2013 and for which georeferenced data is available. For example, data from benthic habitat mapping surveys conducted as a result of previous consultations are being used by the Navy to avoid impacts on sensitive habitats (e.g., seagrass, shallow coral reefs, precious coral beds, live hardbottom, etc.) to the extent practicable during activities that have the potential to impact sensitive habitat. The Navy will continue to include maps based on the best available georeferenced data for these sensitive areas as provided by NMFS (i.e., where the available data accurately indicate the natural boundary of a seafloor resource and are not generalized within large geometric areas, such as large grid cells) in the Navy's Protective Measures Assessment Protocol to ensure these areas are considered in planning of training and testing and avoided as necessary. In addition, in areas other than established anchorages, the Navy will not conduct precision anchoring within the anchor swing circle diameter or within a 350-yard radius around these seafloor resources, as indicated by the best available georeferenced data (see Section 5.4.1, Mitigation Areas for Seafloor Resources for details).

The Navy submitted EFH packages to NMFS Pacific Island and West Coast Region Offices to initiate supplemental EFH consultations. For the Hawaii Range Complex, supplemental EFH consultation with the NMFS Pacific Island Regional Office (PIRO) focused on new activities since the 2013 EFH consultation and any new applicable science not already considered by the Navy. The NMFS PIRO letter of October 11, 2018 provided the NMFS response to the Navy's consultation request and included a revised (from

the original 2013 consultation) conservation recommendation. On October 16, 2018 the Navy provided the response with the Navy's reasons for not following the recommendation, including the scientific justification for disagreeing with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects.

For the Southern California portion of the HSTT Study Area, supplemental EFH consultation with the NMFS West Coast Region Office was specific to the changes in seafloor devices and underwater detonation and changes in "bin" definitions.

On October 3, 2018, consultation with the NMFS West Coast Region Office was completed. NMFS West Coast Region Office agreed that the Navy's proposed conservation measures are sufficient to avoid, minimize, or offset impacts to EFH and did not provide additional EFH conservation recommendations. Copies of agency correspondence are found in Appendix J (Agency Correspondence).

6.2 Relationship Between Short-Term Use of the Environment and Maintenance and Enhancement of Long-Term Productivity

In accordance with the Council on Environmental Quality regulations (40 CFR part 1502), this EIS/OEIS analyzes the relationship between the short-term impacts on the environment and the effects those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This means that choosing one option may reduce future flexibility in pursuing other options, or that committing a resource to a certain use may often eliminate the possibility for other uses of that resource. The Navy, in partnership with NMFS, is committed to furthering the understanding of marine resources and developing ways to lessen or eliminate the impacts Navy training and testing activities may have on these resources. For example, the Navy and NMFS collaborate on the Integrated Comprehensive Monitoring Program for marine species to assess the impacts of training activities on marine species and investigate population-level trends in marine species distribution, abundance, and habitat use in various range complexes and geographic locations where Navy training occurs.

The Proposed Action could result in both short- and long-term environmental impacts. However, these are not expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or general welfare of the public. The Navy is committed to sustainable military range management, including co-use of the Study Area with the general public and commercial and recreational interests. This commitment to co-use of the Study Area will maintain long-term accessibility of the HSTT EIS/OEIS training and testing areas. Sustainable range management practices are specified in range complex management plans under the Navy's Range Sustainment Program. Among other benefits, these practices protect and conserve natural and cultural resources and preserve access to training areas for current and future training requirements while addressing potential encroachments that threaten to impact range and training area capabilities.

6.3 Irreversible or Irretrievable Commitment of Resources

NEPA requires that environmental analysis include identification of "any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented" (42 U.S.C. section 4332). Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy or

minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., the disturbance of a cultural site).

For the Proposed Action, most resource commitments would be neither irreversible nor irretrievable. Most impacts would be short term and temporary, or long lasting but within historical or desired conditions. Because there would be no building or facility construction, the consumption of material typically associated with such construction (e.g., concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irretrievably lost.

Implementation of the Proposed Action would require fuels used by aircraft and vessels. Since fixed- and rotary-wing aircraft and ship activities may increase or decrease relative to the baseline, total fuel use would fluctuate depending on the year under the Proposed Action. Therefore, total fuel consumption would fluctuate depending on the year under the Proposed Action (Section 6.4, Energy Requirements and Conservation Potential of Alternatives and Efficiency Initiatives), and this nonrenewable resource would be considered irretrievably lost (see Chapter 4, Cumulative Impacts, and the following discussion on the Navy's Climate Change Roadmap).

6.4 Energy Requirements and Conservation Potential of Alternatives and Efficiency Initiatives

The DoD consumed approximately 1.3 percent of the total U.S. oil and petroleum consumption in Fiscal Year 2013. It is the largest single user in the nation (Statement Burke, 2014). The Navy consumes approximately 26 percent of the total DoD share (U.S. Department of Defense, 2016). In Fiscal Year 2013, the Navy consumed almost 90 million barrels of liquid fuel (Statement Burke, 2014). In 2016 the DoD published a new Operational Energy Strategy to update the 2011 strategy and transform the way energy is consumed in military operations; the strategy sets the overall direction for operational energy security (U.S. Department of Defense, 2011). The 2016 strategy shifts focus towards three objectives: (1) increasing future warfighting capability by including energy throughout future force development; (2) identifying and reducing logistic and operational risks from operational energy vulnerabilities; (3) and enhancing the force's mission effectiveness with updated equipment and improvements in training, exercises, and operations (U.S. Department of Defense, 2016).

Pursuant to the operational strategy report in 2011, the DoD published an implementation plan to integrate operational energy considerations and transformation into existing programs, processes, and institutions (U.S. Department of Defense, 2012). These documents provide guidance to the DoD in how to better use energy resources and transform the way we power current and future forces.

Training and testing activities within the Study Area would result in an increase in energy demand over the No Action Alternative. The increased energy demand would arise from an increase in fuel consumption, mainly from aircraft and vessels participating in training and testing. Aircraft fuel consumption is estimated to increase by approximately 33 percent and 37 percent per year under Alternative 1 and Alternative 2, respectively, when compared to current rates of aircraft fuel consumption. Vessel fuel consumption is estimated to remain the same under Alternative 1 and to increase by approximately 41 percent per year under Alternative 2, when compared to current rates of vessel fuel consumption. Conservative assumptions were made in developing the estimates, and therefore the actual amount of fuel consumed during training and testing events may be less than estimated. The alternatives could result in a net cumulative reduction in the global energy (fuel) supply.

Energy requirements would be subject to any established energy conservation practices. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing activities. No additional conservation measures related to direct energy consumption by the proposed activities are identified. The Navy's energy vision given in the Operational Energy Strategy report (U.S. Department of Defense, 2016) is consistent with energy conservation practices and states that the Navy values energy as a strategic resource, understands how energy security is fundamental to executing our mission afloat and ashore, and is resilient to any potential energy future.

The Navy is committed to improving energy security and environmental stewardship by reducing its reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will help conserve the world's resources for future generations. The Navy Climate Change Roadmap identifies actions the Environmental Readiness Division took to implement Executive Order 13653, *Preparing the United States for the Impacts of Climate Change* (which has since been revoked and replaced with Executive Order 13783, *Promoting Energy Independence and Economic Growth*).

Two Navy programs—the Incentivized Energy Conservation Program and the Naval Sea Systems Command's Fleet Readiness, Research and Development Program—are helping the fleet conserve fuel via improved operating procedures and long-term initiatives. The Incentivized Energy Conservation Program encourages the operation of ships in the most efficient manner while conducting their mission and supporting the Secretary of the Navy's efforts to reduce total energy consumption on naval ships. The Naval Sea Systems Command's Fleet Readiness, Research, and Development Program includes the High-Efficiency Heating, Ventilating, and Air Conditioning and the Hybrid Electric Drive for DDG-51 class ships, which are improvements to existing shipboard technologies that will both help with fleet readiness and decrease the ships' energy consumption and greenhouse gas emissions. These initiatives are expected to greatly reduce the consumption of fossil fuels (Section 3.1, Air Quality). Furthermore, to offset the impact of its expected near-term increased fuel demands and achieve its goals to reduce fossil fuel consumption and greenhouse gas emissions, the Navy has launched the first vessels of its "Great Green Fleet in San Diego (Olson, 2016). The Great Green Fleet was a year-long, Department of the Navy initiative that demonstrated the sea service's efforts to transform its energy use (U.S. Department of the Navy, 2016). The Great Green Fleet's centerpiece was a Carrier Strike Group that deployed on alternative fuels, including nuclear power for the carrier and a blend of advanced biofuel made from beef fat and traditional petroleum for its escort ships (U.S. Department of the Navy, 2016). Throughout 2016, other platforms included ships, aircraft, amphibious and expeditionary forces, and shore installations from the Department of the Navy that participated in the Great Green Fleet by using energy efficient systems, operational procedures, and/or alternative fuel during the course of planned mission functions throughout the world (U.S. Department of the Navy, 2016).

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8 Public Involvement and Distribution

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8 PUBLIC INVOLVEMENT AND DISTRIBUTION

This chapter describes the efforts to involve the public in preparing the Hawaii-Southern California Training and Testing (HSTT) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), including distribution of the Draft EIS/OEIS.

8.1 PROJECT WEBSITE

A public website was established for this project: www.hstteis.com. This website address was published in the *Notice of Intent to Prepare an Environmental Impact Statement/Overseas Environmental Impact Statement for Hawaii-Southern California Training and Testing and Notice of Public Scoping Meetings* (see Appendix G, Federal Register Notices). It was subsequently reprinted in newspaper advertisements, agency letters, postcards for the Notice of Intent, and in the Draft EIS/OEIS Release Subscriber email. The scoping meeting fact sheets, public meeting notifications, technical reports, and various other materials are available on the project website and will be made available throughout the course of the project.

8.2 SCOPING PERIOD

The public scoping period began with issuance of the Notice of Intent in the *Federal Register* on November 12, 2015. Due to an incorrect date listed, a corrected Notice of Intent was released in the *Federal Register* on December 1, 2015. This notice included a project description, scoping meeting dates, and locations (Appendix G, Federal Register Notices). Comments were provided by mail and through the EIS/OEIS website at: http://www.hstteis.com. The United States (U.S.) Department of the Navy (Navy) conducted public scoping meetings to obtain comments on the scope of the EIS/OEIS and to identify specific environmental concerns or topics for consideration in the document. The scoping period lasted 60 days, concluding on January 12, 2016. The scoping period provided a variety of opportunities for the public to comment on the scope of the EIS/OEIS.

8.2.1 PUBLIC SCOPING NOTIFICATION

The Navy made significant efforts to notify the public to ensure maximum public participation during the scoping process. A summary of these efforts follows.

8.2.1.1 Notification Letters

Notice of Intent and Notice of Scoping Meeting letters were distributed on November 13, 2015, to 661 federally recognized tribes; state-elected officials; and federal, regional, and state agencies. Entities that received the scoping notification letter are listed in Table 8.2-1, and an example of the letter is in Figure 8.2-1.

Table 8.2-1: Entities that Received the Scoping Notification Letter

California Federally Recognized Tribes	
Barona Band of Mission Indians Campo Kumeyaay Nation (Formerly Campo Band of Mission Indians) Ewiiaapaayp Band of Kumeyaay Indians Iipay Nation of Santa Ysabel Inaja-Cosmit Band of Mission Indians Jamul Indian Village La Jolla Band of Luiseno Mission Indians of the La Jolla Reservation La Posta Band of Mission Indians Los Coyotes Band of Cahuilla & Cupeno Indians	Manzanita Band of Mission Indians Mesa Grande Band of Mission Indians Pala Band of Luiseno Mission Indians Pauma Band of Luiseno Mission Indians of the Pauma & Yuima Reservation Pechanga Band of Luiseno Mission Indians San Pasqual Band of Diegueno Indians Soboba Band of Luiseno Indians Sycuan Band of the Kumeyaay Nation Viejas Band of Mission Indians
California Non-Federally Recognized Tribes	
Fernandeño Tataviam Band of Mission Indians Gabrielino-Tongva Tribal Council of San Gabriel	Gabrielino-Tongva of the Los Angeles Basin Gabrielino-Tongva Tribe
Hawaii	
State Elected Officials and State Agencies	
Office of the Governor State Senators (all) State Representatives (all) Department of Business, Economic Development, and Tourism Hawaii Coastal Zone Management Program State Land Use Commission Department of Hawaiian Home Lands, Office of the Chairman Department of Health Department of Land and Natural Resources Division of Aquatic Resources Division of Conservation and Resources Enforcement Division of Forestry and Wildlife Division of State Parks Historic Preservation Division Island Burial Councils (Hawaii, Kauai/Niihau, Maui/Lanai, Molokai, and Oahu) Office of Conservation and Coastal Lands Department of Transportation Airports Division Harbors Division Office of Hawaiian Affairs	
Local	
City and County of Honolulu County of Hawaii County of Kauai County of Maui	

Table 8.2-1: Entities that Received the Scoping Notification Letter (continued)

California
State Elected Officials and State Agencies
Office of the Governor
Office of Planning and Research, Military Affairs
State Senators (Districts 27, 33, 35, 38, and 39)
State Assembly members (Districts 54, 55, 74, 75, 76, 77, 78, and 79)
California Coastal Commission
Department of Conservation
Division of Land Resource Protection
Department of Fish and Game
Marine Life Protection Act Blue Ribbon Task Force
Marine Region 7
South Coast Region 5
Wildlife Branch
Department of Parks and Recreation
Department of Public Health
Department of Transportation
Division of Aeronautics, Office of Airports
Department of Toxic Substance Control
Region 4
Department of Veterans Affairs
Environmental Protection Agency
Air Resources Board
Office of Environmental Health Hazard Assessment
Office of the Secretary
Natural Resources Agency
Office of Historic Preservation
State Lands Commission
State Water Resources Control Board
Los Angeles Regional Water Quality Control Board
San Diego Regional Water Quality Control Board
Santa Ana Regional Water Quality Control Board
Wildlife Conservation Board
Local
City of Avalon
City of Coronado
City of Dana Point
City of Huntington Beach
City of Imperial Beach
City of Laguna Beach
City of Long Beach
City of Los Angeles
City of Malibu
City of Newport Beach
City of Oceanside
City of San Diego
County of Los Angeles

Table 8.2-1: Entities that Received the Scoping Notification Letter (continued)

Local (continued)
County of Orange
County of San Diego
Port of Long Beach
Port of Los Angeles
San Diego Unified Port District
Federal Agencies
U.S. Senators (Hawaii, California)
U.S. Representatives (California Districts 35, 36, 37, 44, 46, 48, 49, 50, 52, and Hawaii Districts 1 and 2)
Federal Aviation Administration
Washington, D.C., Headquarters
Western Pacific Region
U.S. Army Corps of Engineers
Pacific Ocean Division
Honolulu District
South Pacific Division
Los Angeles District
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Washington, D.C., Headquarters
Southwest Regional Offices
Southwest Fisheries Science Center
Pacific Islands Regional Office
Pacific Islands Fisheries Science Center
Office of Habitat Conservation
Southwest Regional Office
Pacific Islands Regional Habitat Conservation Division
Office of Protected Resources
Headquarters and Pacific Islands Region
Channel Islands National Marine Sanctuary
Hawaiian Islands Humpback Whale National Marine Sanctuary
Papahānaumokuākea Marine National Monument
U.S. Department of Homeland Security
U.S. Coast Guard
District 11
District 14
Office of Operating and Environmental Standards

Table 8.2-1: Entities that Received the Scoping Notification Letter (continued)

Federal Agencies (continued)
U.S. Department of the Interior
Bureau of Indian Affairs
Pacific Regional Office
Southern California Agency
Bureau of Land Management
California Coastal National Monument
Bureau of Ocean Energy Management, Regulation, and Enforcement
National Offshore Office
Pacific Outer Continental Shelf Region
Channel Islands National Park
National Park Service
Pacific West Region
Office of Environmental Policy and Compliance
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California Water Science Center
Pacific Islands Water Science Center
Western Fisheries Research Center



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UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/1161
November 2, 2015

The Honorable Jerry Brown
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Sacramento, CA 95814

Dear Governor Brown:

Subject: NOTIFICATION OF PREPARATION OF THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

This letter is to inform you that the Department of the Navy is preparing an Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to evaluate the potential environmental effects associated with ongoing military readiness activities, which include training and research, development, testing and evaluation activities (hereafter referred to as "testing") conducted within the Hawaii-Southern California Training And Testing (HSTT) Study Area. An EIS/OEIS for HSTT was completed in December 2013; this new HSTT document will support current and future military readiness activities in the HSTT Study Area beyond December 2018. The Navy is requesting your comments on the scope, content, and issues to be considered during the development of the HSTT EIS/OEIS.

The HSTT Study Area consists of the in-water areas of the Southern California Range Complex (including San Diego Bay); in-water areas of the Silver Strand Training Complex; in-water areas of the Hawaii Range Complex; areas on the high seas where training and sonar testing and maintenance may occur during vessel transit between the Hawaii and Southern California Range Complexes; the Temporary Operating Area north and west of the Hawaii Range Complex; and specific Navy pier side, port, and harbor locations (see Enclosure 1).

The Proposed Action is to continue Navy training and testing activities in the HSTT Study Area. The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure that the Navy can meet its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas, consistent with

Figure 8.2-1: Stakeholder Scoping Notification Letter

Subject: NOTIFICATION OF PREPARATION OF THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

Congressional direction in Section 5062 of Title 10 of the U.S. Code.

In order to achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities at levels required to support Navy military readiness requirements beginning in December 2018 into the reasonably foreseeable future; and

- Accommodate evolving mission requirements associated with force structure changes, including those resulting from the development, testing, and ultimate introduction of new platforms (vessels, aircraft, and weapon systems) into the fleet, thereby ensuring critical Navy requirements are met.

Environmental issues that will be addressed in the HSTT EIS/OEIS include, but are not limited to, the following resource areas: biological resources (including marine mammals and threatened and endangered species), sediments and water quality, air quality, noise, cultural resources, socioeconomic resources, and public health and safety. Your input in identifying the specific issues and concerns that should be assessed, in these areas and any additional areas, is important to the process.

In compliance with the National Environmental Policy Act (NEPA) of 1969, the Navy is holding open house public scoping meetings to support an early and open process for determining the scope of issues to be addressed and for identifying significant issues related to the Proposed Action. Scoping meetings will inform the public of the Proposed Action and NEPA process and give community members opportunity to submit written and oral comments on the scope, environmental resources, and local issues to be addressed in the HSTT EIS/OEIS. Input from the public scoping meetings will be used to help identify potentially significant issues to be analyzed in the Draft EIS/OEIS.

Three public open house scoping meetings will be conducted in Southern California and Hawaii. Members of the public may arrive at any time during the advertised times. There will be no formal presentation; however, Navy representatives will be available to provide information and answer questions about the Proposed Action.

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Figure 8.2-1: Stakeholder Scoping Notification Letter (continued)

Subject: NOTIFICATION OF PREPARATION OF THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

The open house public scoping meeting schedule is as follows:

In California:
Tuesday, December 1, 2015, 5:00 to 8:00 p.m.
Marina Village Conference Center Starboard Room
1936 Quivira Way, San Diego, CA 92109

In Hawaii:
Thursday, December 3, 2015, 5:00 to 8:00 p.m.
Island School Main Hall
3-1875 Kaumuali'i Highway, Lihue, HI 96766

Saturday, December 5, 2015, 11:00 a.m. to 2:00 p.m.
Ke'ehi Lagoon Memorial Los Banos Room
2685 N. Nimitz Highway, Honolulu, HI 96819

Regardless of whether you are able to participate in the public scoping meetings, you may send written comments to:

Naval Facilities Engineering Command, Pacific
Attention: HSTT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

You may also submit comments online at **www.HSTTEIS.com**. All comments must be postmarked or received online by **January 12, 2016,** to be considered in the Draft EIS/OEIS.

For more information, please visit the project website at **www.HSTTEIS.com**. If you would like additional information or to receive a project briefing, please contact Mr. Alex Stone at (619) 545-8128 or alex.stone@navy.mil.

Sincerely,

Larry M. Foster

L. M. FOSTER
Director, Environmental Readiness
By direction

Enclosure: 1. HSTT Study Area

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Figure 8.2-1: Stakeholder Scoping Notification Letter (continued)

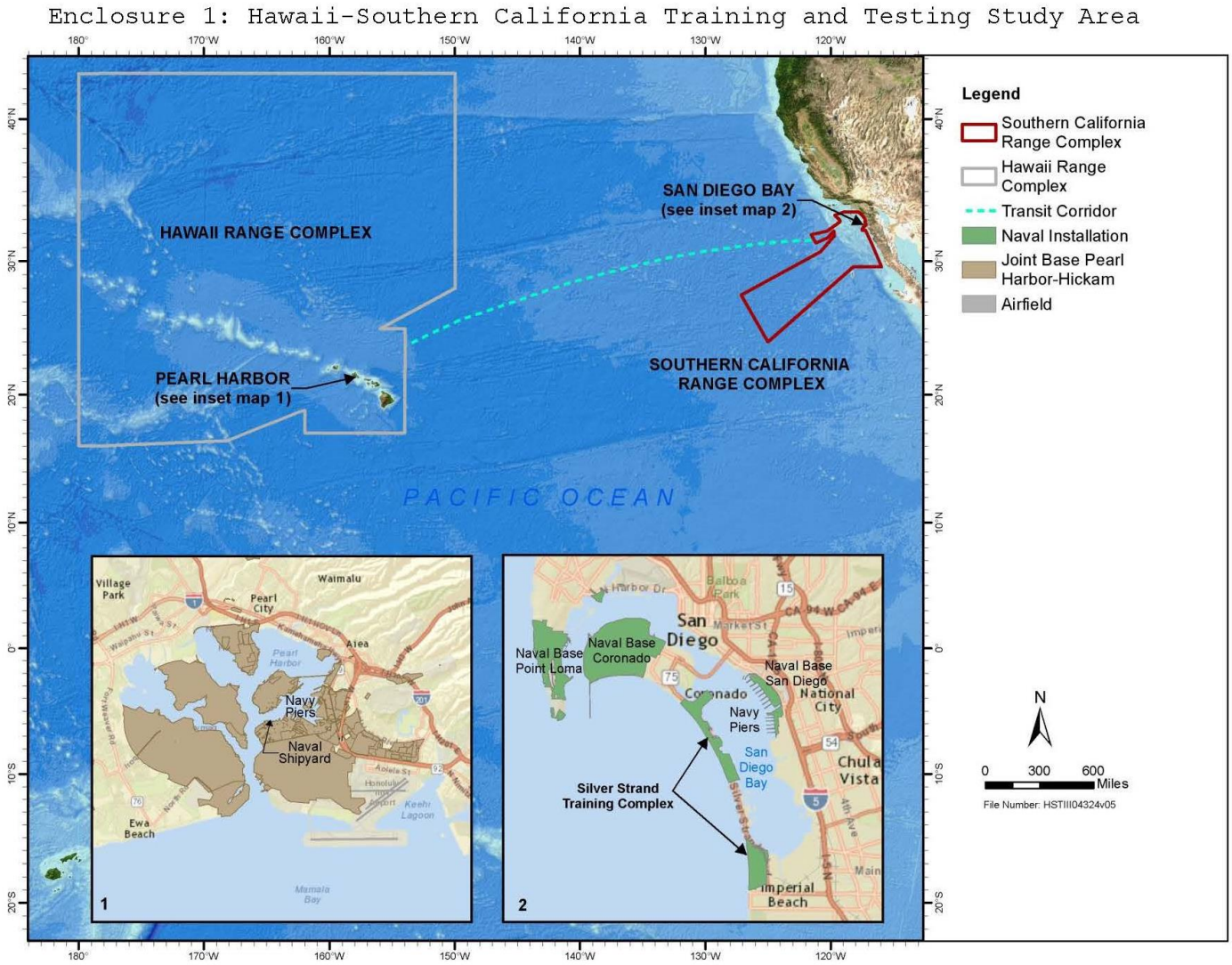


Figure 8.2-1: Stakeholder Scoping Notification Letter (continued)

8.2.1.2 Postcard Mailers

On November 12, 2015, postcards were mailed to 1,051 recipients on the project mailing list, including individuals, nonprofit organizations, and for-profit organizations. The postcards included the dates, locations, and times for the scoping meetings, as well as the website address for more information. An example of the postcard is shown in Figure 8.2-2 and Figure 8.2-3.



Figure 8.2-2: Postcard Mailer for Scoping (front)

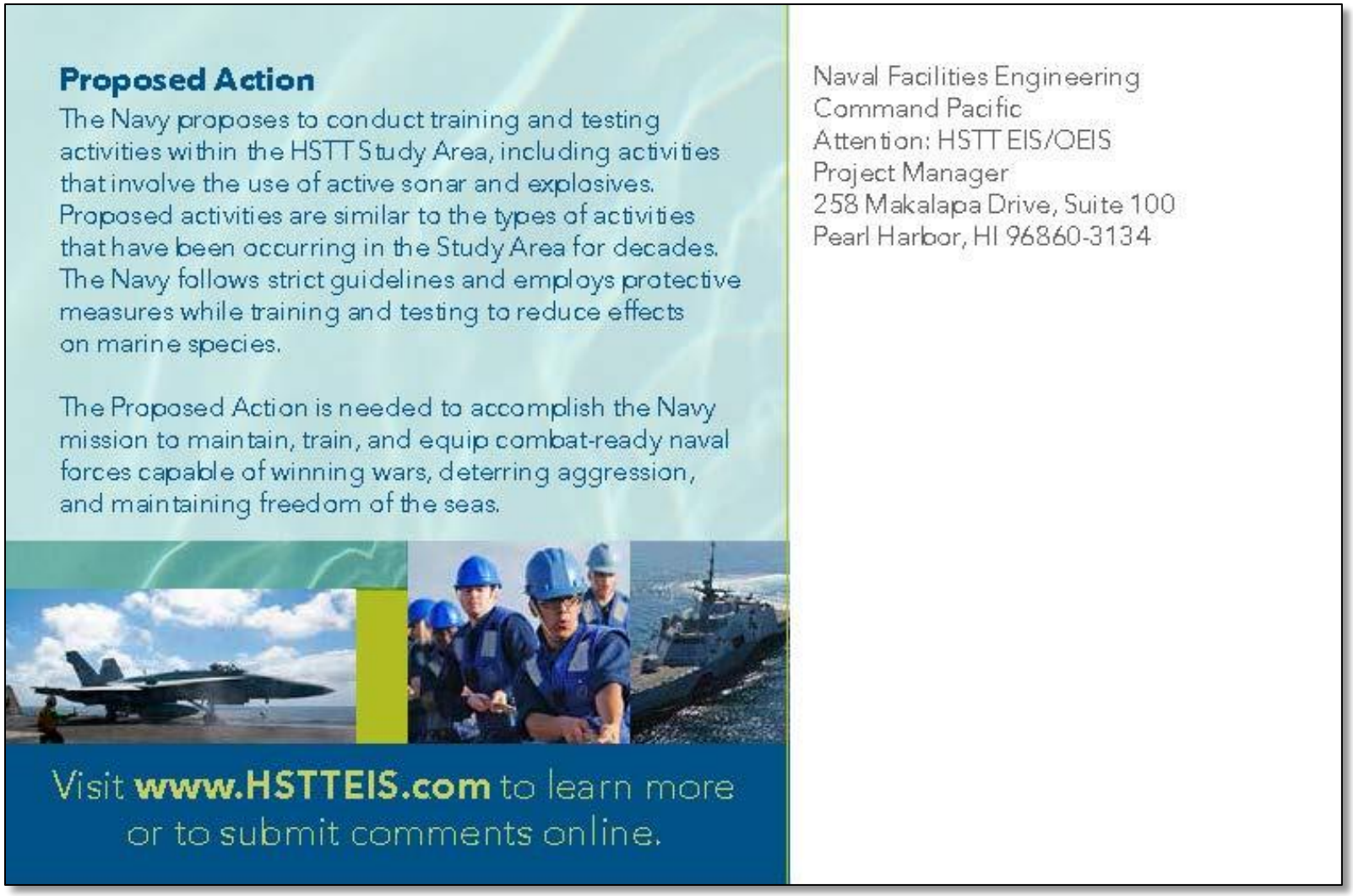


Figure 8.2-3: Postcard Mailer for Scoping (back)

8.2.1.3 Newspaper Advertisements

To announce the scoping period, advertisements were placed in the listed newspapers in the following cities on the dates indicated in Table 8.2-2. The advertisements included a description of the Proposed Action, the address of the project website, the duration of the comment period, and information on how to provide comments. An example of the advertisement is shown in Figure 8.2-4.

Table 8.2-2: Newspaper Announcements of Scoping Meetings

San Diego/California *The San Diego Union-Tribune* November 13, 2015 November 14, 2015 November 15, 2015	**Wailuku/Maui** *Maui News* November 13, 2015 November 14, 2015 November 15, 2015
Honolulu/Oahu *Honolulu Star-Advertiser* November 13, 2015 November 14, 2015 November 15, 2015	**Lihue/Kauai** *The Garden Island* November 13, 2015 November 15, 2015 November 16, 2015
Hilo/Hawaii *Hawaii Tribune-Herald* November 13, 2015 November 14, 2015 November 15, 2015	

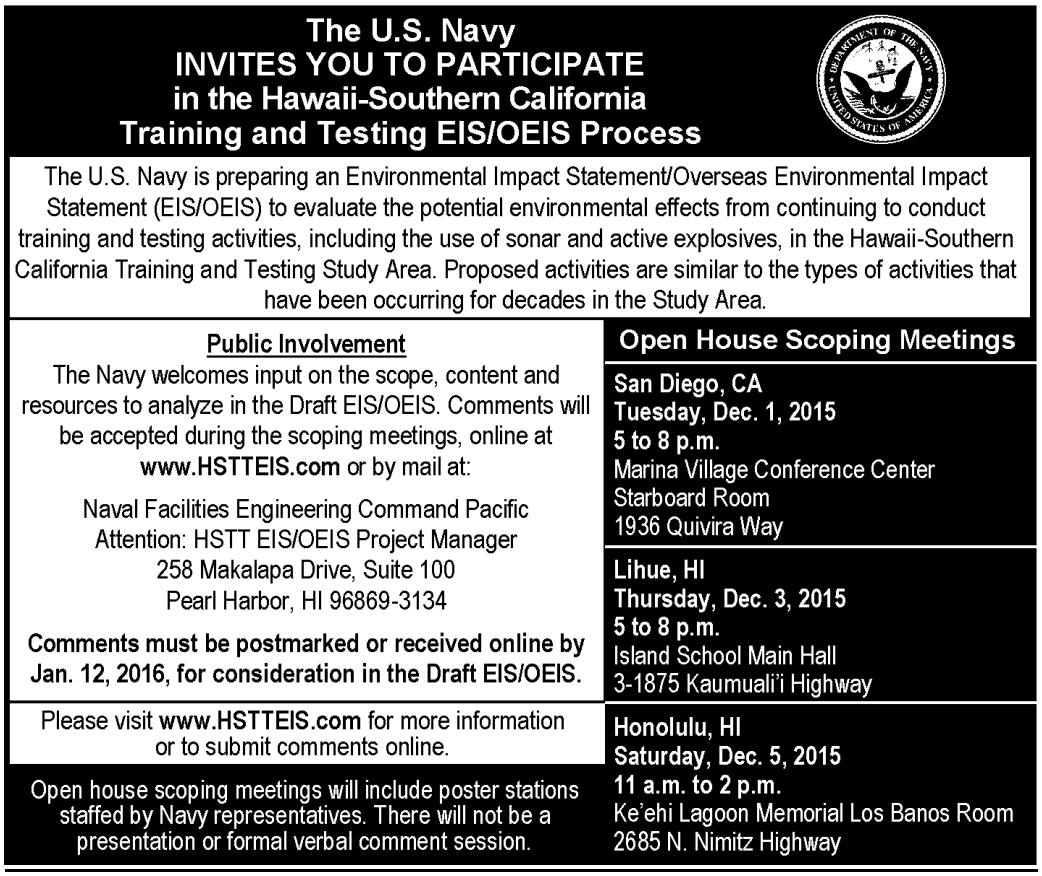


Figure 8.2-4: Newspaper Announcement of Scoping

8.2.1.4 Press Releases

Press releases to announce the scoping meetings were distributed on November 12, 2015. The press releases provided a description of the Proposed Action, address of the project website, duration of the comment period, and information on the public meetings. The press releases also provided information on the availability of the Navy Environmental Media Officer to meet with the media in advance of the meetings. The press release from Navy Region Hawaii and Naval Surface Group Middle Pacific is shown in Figure 8.2-5. The press release issued by Navy Region Southwest is shown in Figure 8.2-6.

**COMMANDER, NAVY REGION HAWAII &
NAVAL SURFACE GROUP
MIDDLE PACIFIC**
PUBLIC AFFAIRS OFFICE
850 TICONDEROGA STREET, SUITE 110
PEARL HARBOR, HAWAII 96860
PHONE: 808-473-2888 FAX: 808-473-2876
www.cnic.navy.mil/hawaii

Nov. 12, 2015
Release # 15-039

POC: Bill Doughty, 473-2877
bill.doughty@navy.mil

NAVY SEEKS PUBLIC INPUT AT OPEN HOUSE SCOPING MEETINGS

PEARL HARBOR – The Navy has published a Notice of Intent (NOI) in the Federal Register to prepare the Hawaii-Southern California Training and Testing (HSTT) Statement/Overseas Environmental Impact Statement (EIS/OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation activities ("training and testing") conducted within the HSTT Study Area. An EIS/OEIS for HSTT was completed in December 2013; this new HSTT document will support current and future military readiness activities in the HSTT Study Area beyond December 2018.

The Navy is initiating the scoping process to identify community concerns and issues for analysis in the HSTT Phase III EIS/OEIS. The Navy is seeking public involvement and input, which are fundamental to developing the Navy's EIS/OEIS under the National Environmental Policy Act (NEPA). As part of the public participation process, the Navy will hold meetings in Southern California and Hawaii next month to obtain public input on the scope of the HSTT Phase III EIS/OEIS.

The HSTT Study Area consists of the in-water areas of the Southern California Range Complex (including San Diego Bay); in-water areas of the Silver Strand Training Complex; in-water areas of the Hawaii Range Complex; areas on the high seas where training and sonar testing and maintenance may occur during vessel transit between the Hawaii and Southern California Range Complexes; the Temporary Operating Area north and west of the Hawaii Range Complex; and specific Navy pierside, port, and harbor locations.

The public is invited to attend open-house style scoping meetings for information about the Navy's Proposed Action and to give written and oral comments on environmental aspects to be addressed in the EIS/OEIS. The public may arrive at any time during the advertised times. There will be no formal presentation; however, Navy representatives will be available to provide information and answer questions about the Proposed Action and the NEPA process.

Figure 8.2-5: Navy Region Hawaii and Naval Surface Group Middle Pacific Press Release

Public comments will be accepted throughout the 60-day comment period. All written comments must be postmarked or received online by **January 12, 2016**, to be considered in the Draft EIS/OEIS. Written comments may be mailed to:

Naval Facilities Engineering Command, Pacific
Attention: HSTT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Comments may also be submitted online at **www.HSTTEIS.com** or in person at one of the two scoping meetings that will be held:

Date: **Thursday, December 3, 2015**
Time: 5 to 8 p.m.
Location: Island School Main Hall
3-1875 Kaumuali'i Highway
Lihue, HI 96766

Date: **Saturday, December 5, 2015**
Time: 11 a.m. to 2 p.m.
Location: Ke'ehi Lagoon Memorial Los Banos Room
2685 N. Nimitz Highway
Honolulu, HI 9666

One open house public meeting will also be held in Southern California on December 1, 2015.

Project information can be found on the website (**www.HSTTEIS.com**) and at the following information repositories in Hawaii:

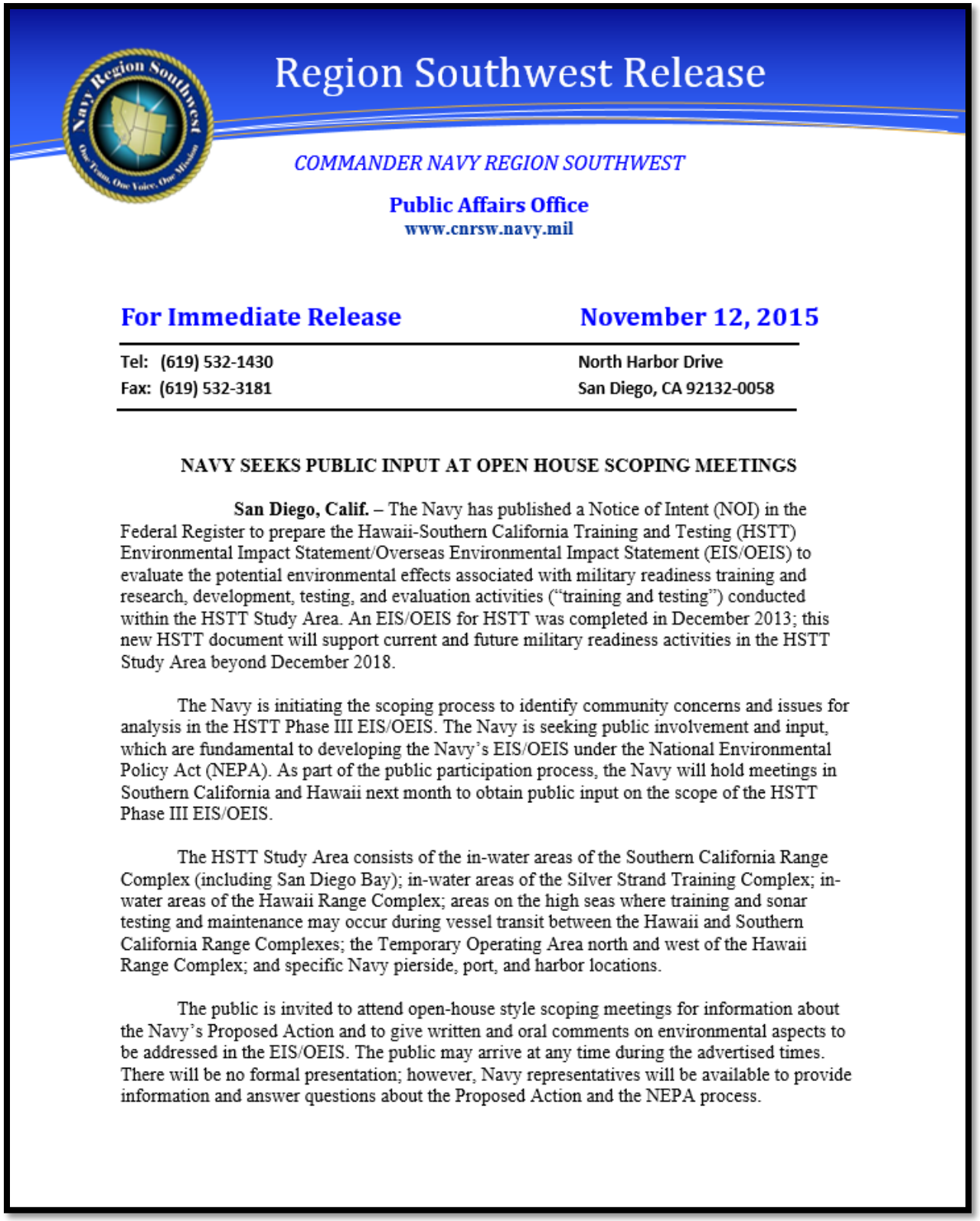
- Hawaii State Library, 478 S. King St., Honolulu, HI
- Hilo Public Library, 300 Waianuenue Ave., Hilo, HI 96720
- Lihue Public Library, 4344 Hardy St., Lihue, HI 96766
- Kahului Public Library, 90 School St., Kahului, HI 96732
- Kailua-Kona Public Library, 75-138 Hualalai Road, Kailua-Kona, HI 96740

-USN-

NOTE: Media interested in attending any of the public meetings or seeking further information should contact LCDR Matt Knight at William.M.Knight@navy.mil; 808-474-3970.

To learn more about the Navy's energy, environment, and climate change initiatives, visit http://greenfleet.dodlive.mil/home.

Figure 8.2-5: Navy Region Hawaii and Naval Surface Group Middle Pacific Press Release (continued)



Region Southwest Release

COMMANDER NAVY REGION SOUTHWEST

Public Affairs Office
www.cnrsw.navy.mil

For Immediate Release **November 12, 2015**

Tel: (619) 532-1430
Fax: (619) 532-3181

North Harbor Drive
San Diego, CA 92132-0058

NAVY SEEKS PUBLIC INPUT AT OPEN HOUSE SCOPING MEETINGS

San Diego, Calif. – The Navy has published a Notice of Intent (NOI) in the Federal Register to prepare the Hawaii-Southern California Training and Testing (HSTT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation activities ("training and testing") conducted within the HSTT Study Area. An EIS/OEIS for HSTT was completed in December 2013; this new HSTT document will support current and future military readiness activities in the HSTT Study Area beyond December 2018.

The Navy is initiating the scoping process to identify community concerns and issues for analysis in the HSTT Phase III EIS/OEIS. The Navy is seeking public involvement and input, which are fundamental to developing the Navy's EIS/OEIS under the National Environmental Policy Act (NEPA). As part of the public participation process, the Navy will hold meetings in Southern California and Hawaii next month to obtain public input on the scope of the HSTT Phase III EIS/OEIS.

The HSTT Study Area consists of the in-water areas of the Southern California Range Complex (including San Diego Bay); in-water areas of the Silver Strand Training Complex; in-water areas of the Hawaii Range Complex; areas on the high seas where training and sonar testing and maintenance may occur during vessel transit between the Hawaii and Southern California Range Complexes; the Temporary Operating Area north and west of the Hawaii Range Complex; and specific Navy pierside, port, and harbor locations.

The public is invited to attend open-house style scoping meetings for information about the Navy's Proposed Action and to give written and oral comments on environmental aspects to be addressed in the EIS/OEIS. The public may arrive at any time during the advertised times. There will be no formal presentation; however, Navy representatives will be available to provide information and answer questions about the Proposed Action and the NEPA process.

Figure 8.2-6: Navy Region Southwest Press Release

Public comments will be accepted throughout the 60-day comment period. All written comments must be postmarked or received online by **January 12, 2016**, to be considered in the Draft EIS/OEIS. Written comments may be mailed to:

Naval Facilities Engineering Command, Pacific
Attention: HSTT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Comments may also be submitted online at **www.HSTTEIS.com** or in person at the scoping meeting. The open house scoping meeting will be held from 5 to 8 p.m. at the following location:

Date: **Tuesday, December 1, 2015**
Location: Marina Village Conference Center Starboard Room
1936 Quivira Way
San Diego, CA 92109

Two open house public scoping meetings will also be held in Hawaii on December 3 and 5, 2015.

Project information can be found on the website (**www.HSTTEIS.com**) and at the following information repositories in Southern California:

- Coronado Public Library, 640 Orange Ave., Coronado, CA 92118
- Long Beach Main Library, 101 Pacific Ave., Long Beach, CA 90822
- San Diego Central Library, 820 E. St., San Diego, CA 92101

NOTE: Media interested in attending any of the public meetings or seeking further information should contact Kevin Dixon, Navy Region Southwest Environmental Public Affairs Officer (619.532.1430).

To learn more about the Navy's energy, environment, and climate change initiatives, visit http://greenfleet.dodlive.mil/home

– USN –

Figure 8.2-6: Navy Region Southwest Press Release (continued)

8.2.2 PROJECT VIDEO

Two project videos were developed to support the scoping phase and provide information to the public on the types of training and testing the Navy conducts and its importance, and on the Navy's marine species mitigation and monitoring efforts. The project videos were uploaded to the project website. Topics for the project video included

- general project overview,
- Navy's mission,
- importance of training and testing in the HSTT Study Area,
- importance of training and testing with sonar and explosives,
- existing marine mitigation measures and monitoring efforts, and
- environmental stewardship programs.

8.2.3 PUBLIC SCOPING MEETINGS

Scoping meetings were held on December 1, 3, and 5, 2015, in the cities of San Diego, California; Lihue, Hawaii; and Honolulu, Hawaii, respectively. The meetings were structured in an open-house format, presenting informational posters and written information, with Navy staff and project experts available to answer participants' questions.

There were 11 attendees at the San Diego meeting, including a representative of Congressman Scott Peters, U.S. Representative of California's 52nd District; along with non-governmental organizations such as the Natural Resources Defense Council, San Diego Audubon Society, Port of San Diego, and the University of San Diego.

The Lihue meeting had 20 attendees and two written comments. There were representatives from the Kauai Community Radio, KKCR Hanalei KAQA Kilauea, The Garden Island Media; a representative of Governor David Ige, Governor of the State of Hawaii; and non-governmental organizations, including Luluku Farmer's Association, the University of Hawaii, the Surfrider Foundation, and the Kauai Westside Watershed Council.

The Honolulu meeting had eight attendees and one written comment. Elected official representation included a representative of Senator Gil Riviere, Senator of Hawaii's 23rd District; a representative of Congressman Mark Takai, U.S. Representative from Hawaii's 1st Congressional District; and non-governmental organizations, including Cultural Surveys Hawaii, Hawaii Pacific University, and Ke'ehi Memorial Organization.

8.2.4 PUBLIC SCOPING COMMENTS

Scoping participants submitted comments in four ways:

- Oral statements at the public meetings (as recorded by the tape recorder)
- Written comments at the public meetings
- Written letters (received any time during the public comment period)
- Comments submitted directly on the project website (received any time during the public comment period)

The Navy received oral, written, and electronic comments from federal agencies, state agencies, non-governmental organizations, individuals, and community groups. A total of 534 website comments were submitted using the electronic comment form on the project website. A total of 24 written comments were also mailed or submitted at the public scoping meetings. Additionally, the Navy received a form letter comment with 73,529 signatures. The comments requested the Navy to analyze environmental issues from physical and biological resources, such as sonar impacts on marine mammals, to human resources, such as public health and safety. A sampling of some of the specific concerns follows. Scoping comments were considered during the preparation of the EIS/OEIS.

8.2.4.1 A True No Action Alternative Analysis

Comments stated that the EIS/OEIS should have a true No Action Alternative in which the National Marine Fisheries Service would not issue a permit for training and testing activities, and Naval Training and Testing activities would cease to occur in the HSTT Study Area. Comments stated that the analysis should include these true No Action Alternative impacts on marine biota, air quality, water quality, socioeconomics, cultural resources, and human health and safety.

The HSTT EIS/OEIS analyzes a No Action Alternative where the Navy would not conduct the proposed training and testing activities in the HSTT Study Area.

8.2.4.2 Time-Area Management and Mitigation Areas

Comments stated that the EIS/OEIS should have reasonable alternatives that incorporate mitigation measures such as time-area management, which would mitigate impacts of noise and other disturbances to marine mammals and sea turtles as activities would happen selectively to allow for areas to sometimes be closed for conservation. Areas of concern include areas identified by the National Marine Fisheries Service as important to marine species, the Cross Seamount in Hawaii, and the Southern California Bight.

Chapter 5 (Mitigation) describes the mitigation measures that the Navy will implement to avoid or reduce potential impacts from the HSTT EIS/OEIS Proposed Action.

8.2.4.3 Cumulative Impact Analysis

Comments suggested that the cumulative impacts should be assessed in respect to trend data. A suggested methodology that was developed by the Federal Highway Administration and Caltrans with the assistance of the Environmental Protection Agency for assessing cumulative impacts follows an eight-step process (California Department of Transportation, 2005). The eight steps in the suggested process are summarized as the following: (1) identify the resources to consider in the cumulative impact analysis, (2) define the geographic boundary or Resource Study Area for each resource to be addressed, (3) describe the current health and historical context of each resource, (4) identify the direct and indirect impacts of the proposed project that might contribute to a cumulative impact on the identified resources, (5) Identify the set of other current and reasonably foreseeable future actions or projects and their associated environmental impacts, (6) assess the potential cumulative impacts, (7) report the results of the cumulative impact analysis, and (8) assess the need for mitigation and/or recommendations for actions by other agencies to address a cumulative impact (California Department of Transportation, 2005).

All potential cumulative impacts are identified and addressed in Chapter 4 (Cumulative Impacts) of this EIS/OEIS. Chapter 5 (Mitigation), describes the mitigation measures that the Navy will implement to avoid or reduce potential impacts from the HSTT EIS/OEIS Proposed Action.

8.2.4.4 Water Quality and Hazardous Materials

Comments requested that water quality and hazardous materials be evaluated in regard to the fate and transport of toxins from ammunition/explosives and sinking exercise vessel use, and their cumulative impacts on ocean water quality.

Section 3.2 (Sediments and Water Quality) discusses the potential impacts of explosives, chemicals, and other materials associated with the Proposed Action on sediments and water quality. Cumulative impacts are discussed in Chapter 4 (Cumulative Impacts).

8.2.4.5 Air Quality and Air Traffic Patterns

Comments suggested that the EIS/OEIS should quantify carbon pollution contribution from military activities to air quality, and the impacts on air traffic patterns.

Section 3.1 (Air Quality) describes criteria pollutants and greenhouse gas emissions associated with the HSTT EIS/OEIS Proposed Action.

8.2.4.6 Human Health and Socioeconomic Impacts

Comments requested that human health and socioeconomic changes be evaluated to assess whether activities will bring new personnel stationed in the Study Area, and if there will be impacts on traffic.

Section 3.12 (Public Health and Safety) discusses the potential impacts associated with the Proposed Action on public health and safety. Potential Impacts on socioeconomic resources are discussed in Section 3.11 (Socioeconomics).

8.2.4.7 Simulation

Comments stated that simulated activities should be considered for military training and testing rather than using sonar and explosives.

Section 2.4.3 (Alternatives Eliminated from Further Consideration) provides details why simulation does not meet the purpose and need for the Proposed Action.

8.2.4.8 Look-out Effectiveness

Comments questioned the effectiveness of lookouts in marine mammal monitoring and suggested that they should be reevaluated during poor visibility conditions. Thermal imaging should be incorporated to lookout for not only marine mammals but also seabirds and other species of concern.

Chapter 5 (Mitigation) discusses the use of thermal detection and the lack of research done to support the use of it during any Navy activities.

8.2.4.9 Impacts of Training and Testing on Marine Mammals

Comments stated that impacts of training and testing on marine mammals are of great concern and need to be addressed in the EIS/OEIS. Ship strikes to fin whales and other species in the HSTT Study Area could be mitigated by a reduction in ship speed at times or in areas that have a high density of species

present. The Navy Acoustic Effects Model is too general and should do more to reduce takes on focal species. Impacts of dipping sonar on marine mammals should be more extensively studied and analyzed. Signal modification should be considered to reduce the takes of marine mammals. Areas of concern for beaked whales include the Southern California Bight, San Nicholas Basin, Santa Catalina Basin, the southernmost edge of the California current west of Tanner and Cortez Banks, and the Northern Catalina Basin and San Clemente Basin. The Proposed Action should comply with the Marine Mammal Protection Act and the Endangered Species Act. Vessel noise should be added to acoustic impacts in the Marine Mammal Analysis.

Section 3.7 (Marine Mammals) discusses the potential impacts on marine mammals from the Navy's proposed training and testing activities, including takes. Chapter 5 (Mitigation) describes the mitigation measures that the Navy will implement to avoid or reduce potential impacts from the Proposed Action.

8.2.4.10 Impacts on Focal Species and Essential Fish Habitat

Comments stated that impacts on focal species and habitats, such as Essential Fish Habitat, should be analyzed in greater detail. These focal species include Endangered Species Act species, Marine Mammal Protection Act species, coral reefs, marine mammals (specifically beaked whales and fin whales), green sea turtles, and protected seabirds.

The Navy complies with the Marine Mammal Protection Act and the Endangered Species Act. Analysis of impacts associated with the Proposed Action on biological resources are in Sections 3.3 (Vegetation), 3.4 (Invertebrates), 3.5 (Habitats), 3.6 (Fishes), 3.7 (Marine Mammals), 3.8 (Reptiles), and 3.9 (Birds) of the EIS/OEIS. Chapter 5 (Mitigation) describes the mitigation measures that the Navy will implement to avoid or reduce potential impacts from the Proposed Action.

8.3 Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement

The Draft EIS/OEIS public review and comment period began with issuance of the Notice of Availability and Notice of Public Meetings in the *Federal Register* on October 13, 2017 (Appendix G, Federal Register Notices). The *Federal Register* notices included notification of the availability of the Draft EIS/OEIS and where it can be accessed; an overview of the Proposed Action and its purpose and need; public commenting information; and the locations, dates, and times of public meetings. The purpose of the public meetings was to inform the public about the Proposed Action and to solicit public comments on the environmental issues addressed and analyzed in the Draft EIS/OEIS. The Draft EIS/OEIS public review and comment period lasted 60 days, concluding on December 12, 2017. Comments were accepted by mail, through the EIS/OEIS website at: http://www.hstteis.com, and at the public meetings.

8.3.1 Notification of Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Public Meetings

The Navy made significant efforts to facilitate maximum public participation during the Draft EIS/OEIS public review and comment period. A summary of these efforts follows.

8.3.1.1 Notification Letters

Letters were sent to California federally recognized tribes; California non-federally recognized tribes; federal, state, and local elected officials; and, federal, state, and local governmental agencies. The letters provided a description of the Proposed Action, address of the project website, duration of the comment period, and information on the public meetings. A tribal notification letter was distributed on

the day of the release of the Draft EIS/OEIS to appropriate federally recognized tribes and non-federally recognized tribes. A total of 22 tribal letters were mailed. A stakeholder notification letter was distributed on the day of the release of the Draft EIS/OEIS to appropriate and interested federal, state, and local government agencies, non-governmental organizations, and persons expressing an interest in the Proposed Action and Draft EIS/OEIS. A total of 551 stakeholder notification letters were mailed. Entities that received the notification letters are listed in Table 8.3-1. Figure 8.3-1 provides an example of a notification letter.

Table 8.3-1: Entities that Received the Draft Environmental Impact Statement/Overseas Environmental Impact Statement Notification Letters

California Federally Recognized Tribes	
Barona Band of Mission Indians	Manzanita Band of Mission Indians
Campo Kumeyaay Nation (Formerly Campo Band of Mission Indians)	Mesa Grande Band of Mission Indians
Ewiiaapaayp Band of Kumeyaay Indians	Pala Band of Luiseno Mission Indians
Iipay Nation of Santa Ysabel	Pauma Band of Luiseno Mission Indians of the Pauma & Yuima Reservation
Inaja-Cosmit Band of Mission Indians	Pechanga Band of Luiseno Mission Indians
Jamul Indian Village	San Pasqual Band of Diegueno Indians
La Jolla Band of Luiseno Mission Indians of the La Jolla Reservation	Soboba Band of Luiseno Indians
La Posta Band of Mission Indians	Sycuan Band of the Kumeyaay Nation
Los Coyotes Band of Cahuilla & Cupeno Indians	Viejas Band of Mission Indians
California Non-Federally Recognized Tribes	
Fernandeño Tataviam Band of Mission Indians	
Gabrielino-Tongva Tribe	
Hawaii	
State Elected Officials and State Agencies	
Office of the Governor	
Office of Lieutenant Governor	
State Senators (all)	
State Representatives (all)	
House Committee on Veterans, Military, and International Affairs, and Culture and the Arts	
Department of Business, Economic Development, and Tourism	
Hawaii Coastal Zone Management Program	
State Land Use Commission	
Department of Defense	
Army National Guard	
Department of Hawaiian Home Lands, Office of the Chairman	
Department of Health	
Clean Water Branch	
Environmental Management Division	
Department of Land and Natural Resources	
Division of Aquatic Resources	
Division of Conservation and Resource Enforcement	
Division of Forestry and Wildlife	
Division of State Parks	
Historic Preservation Division	
Island Burial Councils (Hawaii, Kauai, Maui, and Oahu)	
Office of Conservation and Coastal Lands	

Table 8.3-1: Entities that Received the Draft Environmental Impact Statement/Overseas Environmental Impact Statement Notification Letters (continued)

State Elected Officials and State Agencies (continued)
Department of Transportation
Airports Division
Harbors Division
Hazard Evaluation and Emergency Response Office
Office of Environmental Quality Control
Office of Hawaiian Affairs
Office of Planning
Western Pacific Regional Fishery Management Council
Local
City and County of Honolulu
County of Hawaii
County of Kauai
County of Maui
California
State Elected Officials and State Agencies
Office of the Governor
Governor's Office of Planning and Research, Military Affairs
State Senators (Districts 27, 33, 35, 37, 38, and 39)
State Assembly members (Districts 54, 55, 71, 74, 75, 76, 77, 78, and 79)
California Coastal Commission
Department of Boating and Waterways
Department of Conservation
Department of Fish and Wildlife
Air Services Unit
Habitat Conservation Planning Branch
Marine Region 7
Marine Region Habitat Conservation Program
Marine Region San Diego Field Office
South Coast Region 5
Wildlife Branch
Environmental Protection Agency
Air Resources Board
Fish and Game Commission
Marine Life Protection Act Initiative
Natural Resources Agency
Department of Conservation
Silver Strand State Beach
State Clearinghouse
State Ocean Protection Council
State Water Resources Control Board
Ocean Unit, Division of Water Quality
Wildlife Conservation Board

Table 8.3-1: Entities that Received the Draft Environmental Impact Statement/Overseas Environmental Impact Statement Notification Letters (continued)

Local
City of Avalon
City of Chula Vista
City of Coronado
City of Dana Point
City of Huntington Beach
City of Imperial Beach
City of Laguna Beach
City of Long Beach
City of Los Angeles
City of Malibu
City of National City
City of Newport Beach
City of Oceanside
City of San Diego
County of Los Angeles
County of Orange
County of San Diego
Port of Long Beach
Port of Los Angeles
Port of San Diego
Regional Water Quality Control Board
Los Angeles Region
San Diego Air Pollution Control District
San Diego Unified Port District
South Coast Air Quality Management District
Federal Agencies
U.S. Senators (Hawaii, California)
U.S. Representatives (California Districts 35, 36, 37, 42, 43, 44, 45, 48, 49, 50, 51, 52, 53, and Hawaii Districts 1 and 2)
Advisory Council on Historic Preservation
Council on Environmental Quality
Federal Aviation Administration
Los Angeles Air Route Traffic Control Center
Washington, D.C., Headquarters
Western Pacific Region
International Boundary and Water Commission
Marine Mammal Commission
National Marine Protected Areas Center
National Science Foundation
Pacific Fishery Management Council
Pacific States Marine Fisheries Commission
U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Natural Resources Conservation Service

Table 8.3-1: Entities that Received the Draft Environmental Impact Statement/Overseas Environmental Impact Statement Notification Letters (continued)

Federal Agencies (continued)
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
Office for Coastal Management
Office of National Marine Sanctuaries
National Marine Fisheries Service
Pacific Islands Regional Office
Protected Resources Division
West Coast Region
Pacific Islands
Channel Islands National Marine Sanctuary
Hawaiian Islands Humpback Whale National Marine Sanctuary
Papahānaumokuākea Marine National Monument
U.S. Department of State
Bureau of Oceans and International Environmental and Scientific Affairs
U.S. Department of the Interior
Bureau of Indian Affairs
Southern California Agency
Bureau of Land Management
California Coastal National Monument
Bureau of Safety and Environmental Enforcement
Bureau of Ocean Energy Management
National Offshore Office
Pacific Outer Continental Shelf Region
Channel Islands National Park
National Park Service
Pacific West Region
Office of Environmental Policy and Compliance
U.S. Fish and Wildlife Service
Carlsbad Office
Division of Refuges
Pacific Regional Office
Pacific Southwest Regional Office
Sacramento Office
Ventura Office
San Diego Bay National Wildlife Refuge
Hakalau Forest National Wildlife Refuge
Kakahaia National Wildlife Refuge
Kilauea Point National Wildlife Refuge
Pacific Islands Fish and Wildlife Office
U.S. Geological Survey
Western Region Offices
California Water Science Center
Marine Coastal Group
Pacific Coastal and Marine Science Center
Pacific Islands Water Science Center
Western Fisheries Research Center

DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N465/1210
October 02, 2017

NAME
ORGANIZATION
ADDRESS
CITY, STATE ZIP CODE

Dear NAME:

SUBJECT: NOTICE OF AVAILABILITY OF THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

This letter is to inform you that the Department of the Navy (Navy) has prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to re-evaluate potential environmental impacts associated with ongoing military readiness activities, which include training and research, development, testing, and evaluation activities (hereafter referred to as "training and testing") conducted within the Hawaii-Southern California Training and Testing (HSTT) EIS/OEIS Study Area (hereafter referred to as the "Study Area"). The Navy welcomes your review and substantive comments on the Draft EIS/OEIS.

The Navy prepared the Draft EIS/OEIS to support the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act. The Navy previously completed an EIS/OEIS in December 2013 for training and testing activities occurring within the Study Area from 2013 to 2018; this updated analysis will support future activities beginning in 2018. In this Draft EIS/OEIS, the Navy evaluates new, relevant information, such as more recent marine mammal density data and new scientific information, and updates the environmental analyses as appropriate.

The Study Area consists of the at-sea areas off the coasts of Hawaii and Southern California, areas on the high seas between the Navy's Hawaii and Southern California range complexes where training and testing may occur during vessel transit, the Temporary Operating Area north and west of the Hawaii Range Complex, and select Navy pierside and harbor locations (Enclosure 1).

The Proposed Action is to conduct Navy training and testing activities within the Study Area. These activities include the use of active sonar and explosives while employing marine species protective mitigation measures. Proposed training and testing activities are similar to the types of activities that have occurred in the Study Area for decades. The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can

Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement

5090
Ser N465/1210
October 02, 2017

accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in Section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities at levels required to support Navy military readiness requirements beginning in 2018; and
- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Navy is holding five public meetings to provide information and an opportunity for the public to comment on the Draft EIS/OEIS. Public meetings will include an open-house information session, during which time Navy representatives will be available to provide information and answer questions. A Navy presentation and public oral comment session will occur during the meetings. Written and oral comments will be accepted throughout each public meeting.

Concurrent with the National Environmental Policy Act public involvement process, the Navy is conducting National Historic Preservation Act section 106 consultations regarding potential effects of the Proposed Action on historic properties. Historic properties include districts, sites, buildings, structures, or objects listed or eligible for listing in the National Register of Historic Places. During each of the meetings, an information station will be available, where subject matter experts will explain the section 106 process and solicit public input.

The public meeting schedule is as follows:

In Hawaii:

Date: Monday, November 6, 2017, 4:00 to 8:00 p.m.
Location: Oahu Veterans Center,
Fred Ballard Hall
1298 Kukila St.
Honolulu, HI 96818

Date: Tuesday, November 7, 2017, 4:00 to 8:00 p.m.
Location: Maui High School,
Cafeteria
660 S. Lono Ave.
Kahului, HI 96732

2

Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

5090
Ser N465/1210
October 02, 2017

Date: Wednesday, November 8, 2017, 4:00 to 8:00 p.m.
Location: Kauai Veterans Center,
Main Ballroom
3215 Kapule Highway
Lihue, HI 96766

Date: Thursday, November 9, 2017, 4:00 to 8:00 p.m.
Location: Waiakea High School,
Cafeteria
155 W. Kawili St.
Hilo, HI 96720

In California:
Date: Monday, November 13, 2017, 5:00 to 8:00 p.m.
Location: Portuguese Hall,
Main Hall
2818 Avenida de Portugal
San Diego, CA 92106

To review the Draft EIS/OEIS and for additional information, including details on the key differences between the 2013 Final EIS/OEIS and the 2017 Draft EIS/OEIS, please visit the project website at **www.HSTTEIS.com**. The Draft EIS/OEIS is also available at the following local public libraries:

Hawaii State Library
478 S. King St.
Honolulu, HI 96813

Hilo Public Library
300 Waianuenue Ave.
Hilo, HI 96720

Kahului Public Library
90 School St.
Kahului, HI 96732

Kailua-Kona Public Library
75-138 Hualalai Road
Kailua-Kona, HI 96740

Lihue Public Library
4344 Hardy St.
Lihue, HI 96766

City of San Diego Central Library
330 Park Blvd.
San Diego, CA 92101

Coronado Public Library
640 Orange Ave.
Coronado, CA 92118

Long Beach Main Library
101 Pacific Ave.
Long Beach, CA 90822

The 60-day public comment period will begin October 13, 2017, and end December 12, 2017. All comments must be postmarked or received online by **December 12, 2017**, for consideration in the Final EIS/OEIS. All comments submitted during the 60-day public comment period will become part of the public record and substantive comments will be addressed in the Final EIS/OEIS.

3

Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

5090
Ser N465/1210
October 02, 2017

Comments may be submitted online at **www.HSTTEIS.com**, at the public meetings, or by mail to:

Naval Facilities Engineering Command Pacific
Attention: HSTT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

If you would like additional information or to receive a project briefing, please contact Mr. Alex Stone at 619-545-8128 or alexander.stone@navy.mil.

Please help the Navy inform the community about the availability of the Draft EIS/OEIS and public meetings by sharing this information with your staff and interested individuals.

Sincerely,

L. M. FOSTER
By direction

Enclosure: 1. Hawaii-Southern California Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement Study Area

4

Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

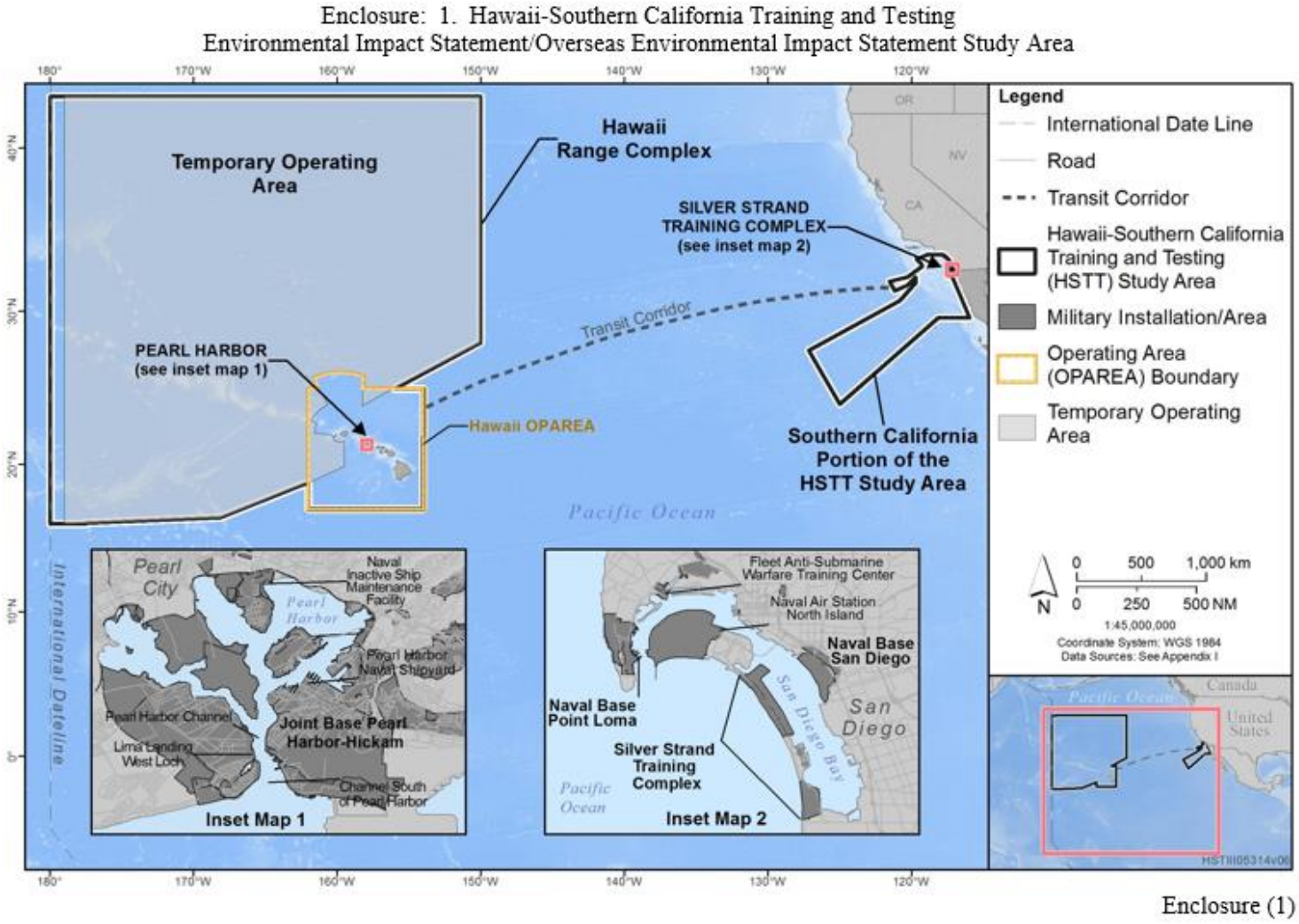


Figure 8.3-1: Stakeholder Letter for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

8.3.1.2 Subscribers Email

Project information was also distributed via the project web site subscribers' email distribution list. The email was sent to announce the availability of the Public Release Draft EIS/OEIS and provide information on ways to comment and public meeting times and locations (Figure 8.3-2).



DO NOT REPLY TO THIS AUTOMATED EMAIL

Hawaii-Southern California Training and Testing Draft Environmental Impact Statement/Overseas Environmental Impact Statement Available for Public Review and Comment

You previously requested to receive information regarding the Department of the Navy's Hawaii-Southern California Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). This email provides an update on the draft document and ways to participate in the environmental planning process.

The Notice of Availability for the U.S. Navy's Draft EIS/OEIS was published in the Federal Register on Oct. 13, 2017. The Navy welcomes and appreciates your substantive comments on the Draft EIS/OEIS during the public comment period (Oct. 13, 2017, to Dec. 12, 2017). All comments will become part of the public record and substantive comments will be addressed in the Final EIS/OEIS.

You can participate in the Navy's environmental planning process through attendance at one of the five scheduled public meetings and by submitting substantive comments (written or oral) on the Navy's Draft EIS/OEIS during these meetings. Comments can also be submitted via the project website or by mail. Comments must be postmarked or received online by Dec. 12, 2017, for consideration in the Final EIS/OEIS.



Navy representatives will be available during the public meetings to provide information and answer questions. Public meetings will include an open house information session, followed by a short presentation by the Navy and public oral comment session.

Public meetings in Hawaii will be held from 4:00 to 8:00 p.m. on:

Figure 8.3-2: Email Sent to Website Subscribers for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings

- **Monday, Nov. 6, 2017**: Oahu Veterans Center, Fred Ballard Hall, 1298 Kukila St., Honolulu, HI 96818
- **Tuesday, Nov. 7, 2017**: Maui High School, Cafeteria, 660 S. Lono Ave., Kahului, HI 96732
- **Wednesday, Nov. 8, 2017**: Kauai Veterans Center, Main Ballroom, 3215 Kapule Highway, Lihue, HI 96766
- **Thursday, Nov. 9, 2017**: Waiakea High School, Cafeteria, 155 W. Kawili St., Hilo, HI 96720

A public meeting in San Diego will be held from 5:00 to 8:00 p.m. on:

- **Monday, Nov. 13, 2017**: Portuguese Hall, Main Hall, 2818 Avenida de Portugal, San Diego, CA 92106

Information on the Draft EIS/OEIS, the public meeting locations and times, and ways to provide substantive comments is provided on the project website at www.HSTTEIS.com.

The Navy appreciates your interest and participation in the environmental planning process.

Hawaii-Southern California Training and Testing EIS/OEIS
www.HSTTEIS.com

Unsubscribe

MailChimp

Figure 8.3-2: Email Sent to Website Subscribers for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (continued)

8.3.1.3 Public Involvement Website

A public involvement website, www.hstteis.com, housed a series of fact sheets and videos that explained specifics of the Proposed Action and described the overall planning process. Topics included on the website are listed below:

- National Environmental Policy Act Process and Timeline
- Importance of Navy Training and Testing
- Study Area Map Proposed Action and Alternatives
- Training and Testing Active Sonar and Explosives
- Navy Acoustic Effects Model
- Marine Resource Protection
- Public Access and Safety
- Participating Navy Commands

The website provided additional in-depth informational videos that covered the following topics:

- The Importance of Navy Training and Testing
- Proposed Action and Alternatives
- Training and Testing Active Sonar and Explosives
- Introduction to Navy Acoustic Effects Model
- Marine Resource Protection
- Public Access and Safety

8.3.1.4 Postcards

On October 12, 2017, postcards were mailed to over 800 recipients on the project mailing list, including individuals; non-governmental organizations; community and business groups; fishing, aviation, and recreation groups; and private companies. The postcards included the dates, locations, and times for the public meetings, as well as the website address for more information, commenting information, and a brief summary of the Proposed Action. An example of the Notice of Availability postcard is shown in Figure 8.3-3 and Figure 8.3-4.



Figure 8.3-3: Postcard for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (front)

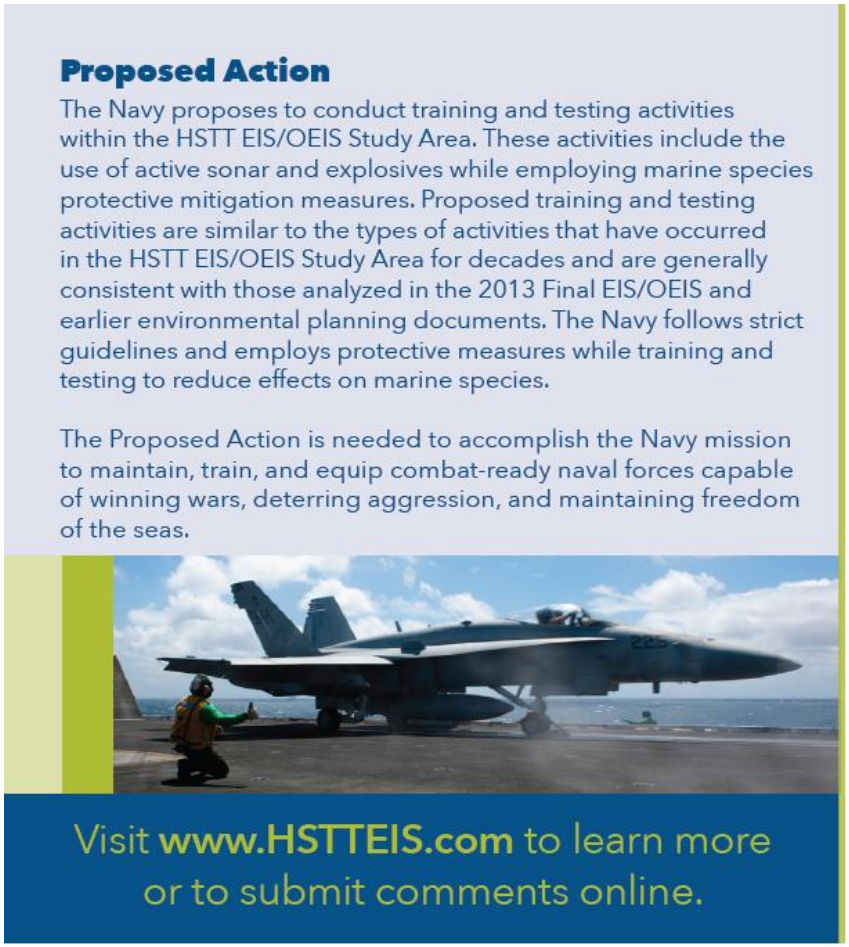


Figure 8.3-4: Postcard for the Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (back)

8.3.1.5 Press Releases and Public Service Announcements

Press releases to announce the availability of the Draft EIS/OEIS and public meetings were distributed on October 13, 2017. The press releases provided a description of the Proposed Action, project website, duration of the comment period and commenting methods, information repositories, and locations, dates, and times of the public meetings. The press releases also provided information on the availability of the Navy to meet with the media in advance of the meetings. These press releases are shown in Figure 8.3-5 and Figure 8.3-6. A Public Service Announcement was distributed on October 13, 2017 to announce the public meetings. The Public Service Announcement provided the public meeting locations and project website. This Public Service Announcement is shown in Figure 8.3-7.

COMMANDER, NAVY REGION HAWAII
PUBLIC AFFAIRS OFFICE
850 TICONDEROGA STREET, SUITE 110
PEARL HARBOR, HAWAII 96860
PHONE: 808-473-2888 FAX: 808-473-2876
www.cnic.navy.mil/hawaii

FOR IMMEDIATE RELEASE
POCs: Kathy Isobe, EPAO; 808-473-0662
and Robert Purdy, PMRF PAO; 808-335-4740

October 13, 2017
Release #17-037

HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT AVAILABLE FOR PUBLIC REVIEW AND COMMENT

[HONOLULU] — The U.S. Navy has prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to re-evaluate potential environmental impacts associated with ongoing military readiness activities, which include training and research, development, testing, and evaluation activities (hereafter referred to as "training and testing") conducted within the Hawaii-Southern California Training and Testing (HSTT) EIS/OEIS Study Area (hereafter referred to as the "Study Area"). The Navy welcomes the public's review and substantive comments on the Draft EIS/OEIS.

The Navy prepared the Draft EIS/OEIS to support the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act. The Navy previously completed an EIS/OEIS in December 2013 for training and testing activities occurring within the Study Area from 2013 to 2018; this updated analysis will support future activities beginning in 2018. In this Draft EIS/OEIS, the Navy evaluates new, relevant information, such as more recent marine mammal density data and new scientific information, and updates environmental analyses as appropriate.

Proposed Action:

The Proposed Action is to conduct Navy training and testing activities within the Study Area. These activities include the use of active sonar and explosives while employing marine species protective mitigation measures. Proposed training and testing activities are similar to the types of activities that have occurred in the Study Area for decades. The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in Section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

Figure 8.3-5: Navy Region Hawaii and Naval Surface Group Middle Pacific Press Release of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings

- Conduct training and testing activities at levels required to support Navy military readiness requirements beginning in 2018; and

- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area consists of the at-sea areas off the coasts of Hawaii and Southern California, areas on the high seas between the Navy's Hawaii and Southern California range complexes where training and testing may occur during vessel transit, the Temporary Operating Area north and west of the Hawaii Range Complex, and select Navy pierside and harbor locations.

Public Meetings:

The Navy is holding five public meetings, four on Hawaii and one in Southern California, to provide information and an opportunity for the public to comment on the Draft EIS/OEIS. Public meetings will include an open-house information session, during which time Navy representatives will be available to provide information and answer questions. A Navy presentation and public oral comment session will occur during the meetings. Written and oral comments will be accepted throughout each public meeting.

Concurrent with the National Environmental Policy Act public involvement process, the Navy is conducting National Historic Preservation Act section 106 consultations regarding potential effects of the Proposed Action on historic properties. Historic properties include districts, sites, buildings, structures, or objects listed or eligible for listing in the National Register of Historic Places. During each of the meetings, an information station will be available, where subject matter experts will explain the section 106 process and solicit public input.

Four public meetings will be held on the Hawaiian Islands from 4:00 to 8:00 p.m., at the following locations:

Monday, Nov. 6, 2017
Oahu Veterans Center,
Fred Ballard Hall
1298 Kukila St.
Honolulu, HI 96818

Tuesday, Nov. 7, 2017
Maui High School,
Cafeteria
660 S. Lono Ave.
Kahului, HI 96732

Wednesday, Nov. 8, 2017
Kauai Veterans Center

Figure 8.3-5: Navy Region Hawaii and Naval Surface Group Middle Pacific Press Release of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (continued)

Main Ballroom
3215 Kapule Highway
Lihue, HI 96766

Thursday, Nov. 9, 2017
Waiakea High School
Cafeteria
155 W. Kawili St.
Hilo, HI 96720

One public meeting will be held in San Diego from 5:00 to 8:00 p.m., at the following location:

Monday, Nov. 13, 2017
Portuguese Hall
Main Hall
2818 Avenida de Portugal
San Diego, CA 92106

Public Comment Period and Availability of Draft EIS/OEIS:

The 60-day public comment period will begin Oct. 13, 2017, and end Dec. 12, 2017. All comments must be postmarked or received online by **Dec. 12, 2017**, for consideration in the Final EIS/OEIS. All comments submitted during the 60-day public comment period will become part of the public record and substantive comments will be addressed in the Final EIS/OEIS. Comments may be submitted online at **www.HSTTEIS.com**, at the public meetings, or by mail to:

Naval Facilities Engineering Command Pacific
Attention: HSTT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

To review the Draft EIS/OEIS and for additional information, including details on the key differences between the 2013 Final EIS/OEIS and the 2017 Draft EIS/OEIS, please visit the project website at **www.HSTTEIS.com**. The Draft EIS/OEIS is also available at the following local public libraries:

- Hawaii State Library, 478 S. King St., Honolulu, HI 96813
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- Kahului Public Library, 90 School St., Kahului, HI 96732
- Kailua-Kona Public Library, 75-138 Hualalai Road, Kailua-Kona, HI 96740
- Lihue Public Library, 4344 Hardy St., Lihue, HI 96766
- City of San Diego Central Library, 330 Park Blvd., San Diego, CA 92101
- Coronado Public Library, 640 Orange Ave., Coronado, CA 92118
- Long Beach Main Library, 101 Pacific Ave., Long Beach, CA 90822

Figure 8.3-5: Navy Region Hawaii and Naval Surface Group Middle Pacific Press Release of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (continued)

Please help inform your community by sharing the information in this press release.

MEDIA AVAILABILITY: There is an opportunity for media to speak with project personnel 30 minutes before each meeting. Media interested in attending or seeking further information should contact Kathy Isobe, Environmental Public Affairs Officer, at 808-473-0662, and Robert Purdy, Pacific Missile Range Facility Public Affairs Officer, at 808-335-4740.

– USN –

Figure 8.3-5: Navy Region Hawaii and Naval Surface Group Middle Pacific Press Release of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (continued)

Region Southwest Advisory

COMMANDER NAVY REGION SOUTHWEST and U.S. PACIFIC FLEET

Public Affairs Office
www.cnrsw.navy.mil

FOR IMMEDIATE RELEASE **October 12, 2017**

Tel: (619) 532-1430
Fax: (619) 532-3181
937 N. Harbor Drive
San Diego, CA 92132-0058

HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING DRAFT ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT AVAILABLE FOR PUBLIC REVIEW AND COMMENT

San Diego, CA — The U.S. Navy has prepared a Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) to re-evaluate potential environmental impacts associated with ongoing military readiness activities, which include training and research, development, testing, and evaluation activities (hereafter referred to as "training and testing") conducted within the Hawaii-Southern California Training and Testing (HSTT) EIS/OEIS Study Area (hereafter referred to as the "Study Area"). The Navy welcomes the public's review and substantive comments on the Draft EIS/OEIS.

The Navy prepared the Draft EIS/OEIS to support the issuance of federal regulatory permits and authorizations under the Marine Mammal Protection Act and the Endangered Species Act. The Navy previously completed an EIS/OEIS in December 2013 for training and testing activities occurring within the Study Area from 2013 to 2018; this updated analysis will support future activities beginning in 2018. In this Draft EIS/OEIS, the Navy evaluates new, relevant information, such as more recent marine mammal density data and new scientific information, and updates environmental analyses as appropriate.

Proposed Action:

The Proposed Action is to conduct Navy training and testing activities within the Study Area. These activities include the use of active sonar and explosives while employing marine species protective mitigation measures. Proposed training and testing activities are similar to the types of activities that have occurred in the Study Area for decades. The purpose of the Proposed Action is to maintain a ready force, which is needed to ensure the Navy can accomplish its mission to maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas, consistent with Congressional direction in Section 5062 of Title 10 of the U.S. Code.

To achieve and maintain military readiness, the Navy proposes to:

- Conduct training and testing activities at levels required to support Navy military readiness requirements beginning in 2018; and

Figure 8.3-6: Navy Region Southwest Press Release of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings

- Accommodate evolving mission requirements, including those resulting from the development, testing, and introduction of new vessels, aircraft, and weapons systems into the fleet.

The Study Area consists of the at-sea areas off the coasts of Hawaii and Southern California, areas on the high seas between the Navy's Hawaii and Southern California range complexes where training and testing may occur during vessel transit, the Temporary Operating Area north and west of the Hawaii Range Complex, and select Navy pierside and harbor locations.

Public Meetings:

The Navy is holding five public meetings, four on Hawaii and one in Southern California, to provide information and an opportunity for the public to comment on the Draft EIS/OEIS. Public meetings will include an open-house information session, during which time Navy representatives will be available to provide information and answer questions. A Navy presentation and public oral comment session will occur during the meetings. Written and oral comments will be accepted throughout each public meeting.

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Fred Ballard Hall
1298 Kukila St.
Honolulu, HI 96818

Tuesday, Nov. 7, 2017
Maui High School,
Cafeteria
660 S. Lono Ave.
Kahului, HI 96732

Wednesday, Nov. 8, 2017
Kauai Veterans Center
Main Ballroom
3215 Kapule Highway
Lihue, HI 96766

Thursday, Nov. 9, 2017
Waiakea High School,
Cafeteria
155 W. Kawili St.
Hilo, HI 96720

Figure 8.3-6: Navy Region Southwest Press Release of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (continued)

One public meeting will be held in San Diego from 5:00 to 8:00 p.m., at the following location:

Monday, Nov. 13, 2017
Portuguese Hall,
Main Hall
2818 Avenida de Portugal
San Diego, CA 92106

Public Comment Period and Availability of Draft EIS/OEIS:

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Naval Facilities Engineering Command Pacific
Attention: HSTT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

To review the Draft EIS/OEIS and for additional information, including details on the key differences between the 2013 Final EIS/OEIS and the 2017 Draft EIS/OEIS, please visit the project website at **www.HSTTEIS.com**. The Draft EIS/OEIS is also available at the following local public libraries:

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- Kahului Public Library, 90 School St., Kahului, HI 96732
- Kailua-Kona Public Library, 75-138 Hualalai Road, Kailua-Kona, HI 96740
- Lihue Public Library, 4344 Hardy St., Lihue, HI 96766
- City of San Diego Central Library, 330 Park Blvd., San Diego, CA 92101
- Coronado Public Library, 640 Orange Ave., Coronado, CA 92118
- Long Beach Main Library, 101 Pacific Ave., Long Beach, CA 90822

Please help inform your community by sharing the information in this press release.

MEDIA AVAILABILITY: There is an opportunity for media to speak with project personnel 30 minutes before each meeting. Media interested in attending or seeking further information should contact Helen K. Haase, Command Navy Region Southwest Public Affairs Office, at (619)532-1430.

– USN –

Figure 8.3-6: Navy Region Southwest Press Release of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings (continued)

COMMANDER, NAVY REGION HAWAII
PUBLIC AFFAIRS OFFICE
850 TICONDEROGA STREET, SUITE 110
PEARL HARBOR, HAWAII 96860
PHONE: 808-473-2888 FAX: 808-473-2876
www.cnic.navy.mil/hawaii

FOR IMMEDIATE RELEASE **October 13, 2017**
POC: Kathy Isobe, EPAO; 808-473-0662 **Release #17-038**

PUBLIC SERVICE ANNOUNCEMENT
October 13, 2017

Public Meetings for the Hawaii-Southern California Training and Testing Draft Environmental Impact Statement/Overseas Environmental Impact Statement

(30 Seconds)

FOR IMMEDIATE RELEASE

ANNOUNCER

THE U-S NAVY INVITES YOU TO ATTEND PUBLIC MEETINGS TO LEARN ABOUT AND COMMENT ON THE POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH ONGOING NAVAL TRAINING AND TESTING ACTIVITIES CONDUCTED WITHIN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT STUDY AREA.

THE PUBLIC MEETINGS, CONSISTING OF AN OPEN HOUSE AND NAVY PRESENTATION, WILL TAKE PLACE FROM FOUR TO EIGHT P-M ON: *(Select appropriate location)*

- NOVEMBER SIXTH AT OAHU VETERANS CENTER IN HONOLULU
- NOVEMBER SEVENTH AT MAUI HIGH SCHOOL IN KAHULUI
- NOVEMBER EIGHTH AT KAUAI VETERANS CENTER IN LIHUE
- NOVEMBER NINTH AT WAIAKEA HIGH SCHOOL IN HILO

YOU CAN LEARN MORE ABOUT THE PROJECT AND PROVIDE COMMENTS AT THE PUBLIC MEETINGS OR AT W-W-W **DOT H-S-T-T E-I-S DOT COM**.

Figure 8.3-7: Public Service Announcement of Public Meetings in Hawaii

8.3.1.6 Newspaper Advertisements

To announce the availability of the Draft EIS/OEIS and public meetings, advertisements were placed in area newspapers in the following cities on the dates indicated in Table 8.3-2. The advertisements included a description of the Proposed Action, the project website, the duration of the comment period, and information on how to provide comments. The Hawaii advertisement is shown in Figure 8.3-8, and the San Diego advertisement is shown in Figure 8.3-9.

Table 8.3-2: Newspaper Announcements of Draft Environmental Impact Statement/Overseas Environmental Impact Statement Public Meetings

San Diego/California *The San Diego Union-Tribune* October 13, 2017 November 11, 2017 November 12, 2017 November 13, 2017	**Wailuku/Maui** *Maui News* October 13, 2017 November 5, 2017 November 6, 2017 November 7, 2017
Honolulu/Oahu *Honolulu Star-Advertiser* October 13, 2017 November 4, 2017 November 5, 2017 November 6, 2017	**Lihue/Kauai** *The Garden Island* October 13, 2017 November 5, 2017 November 7, 2017 November 8, 2017
Hilo/Hawaii *Hawaii Tribune-Herald* October 13, 2017 November 5, 2017 November 8, 2017 November 9, 2017	

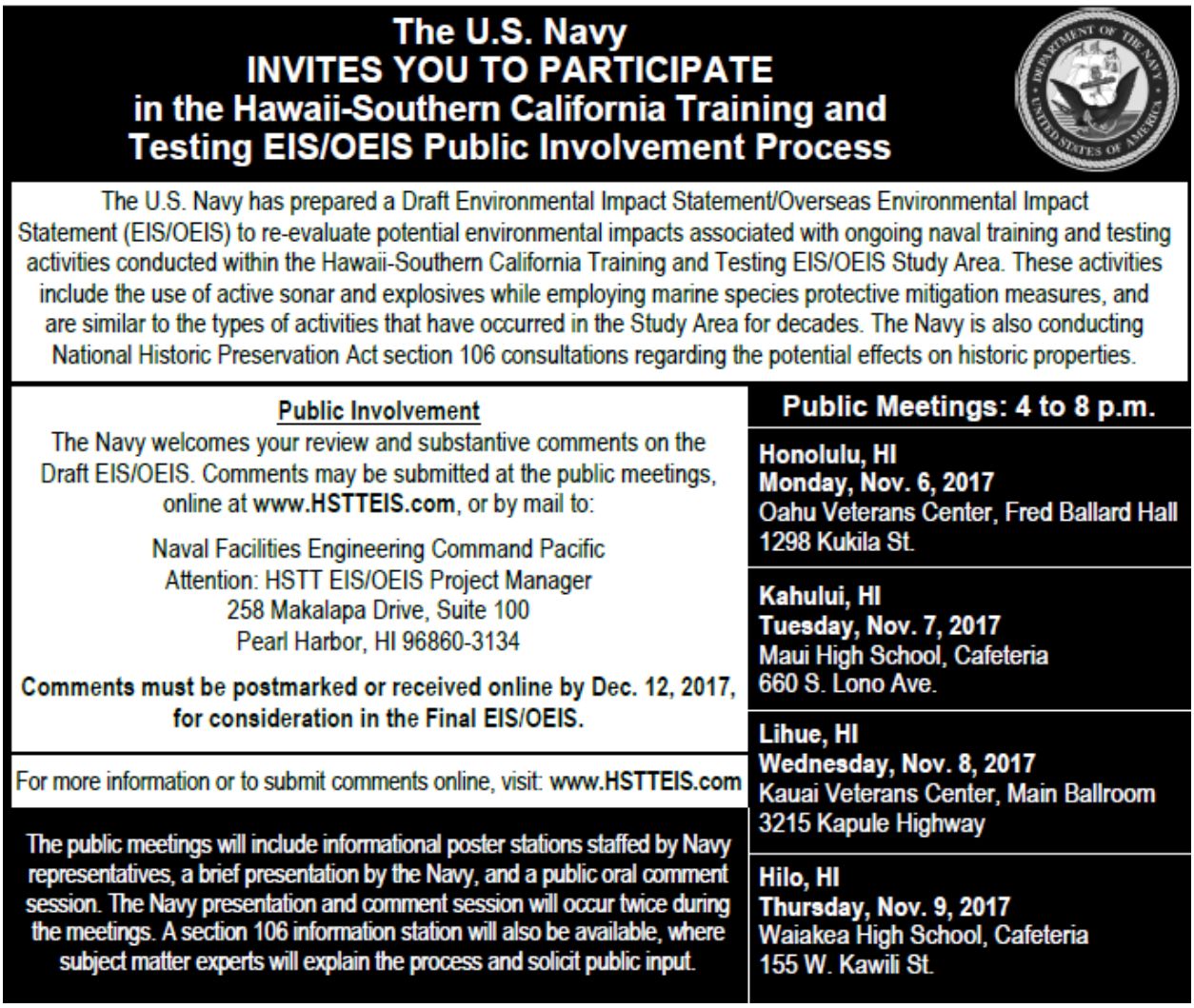


Figure 8.3-8: Hawaii Newspaper Announcement of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings



Figure 8.3-9: Southern California Newspaper Announcement of Notification of Availability of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement and Announcement of Public Meetings

8.3.2 PUBLIC MEETINGS

The Navy held public meetings to inform the public about the Proposed Action and to solicit public comments on the Draft EIS/OEIS. The public meetings included informational poster stations staffed by Navy representatives, a brief presentation by the Navy, and a public oral comment session. Members of the public could arrive at any time during the public meetings. The public meetings in Hawaii were held from 4:00 to 8:00 p.m. The public meeting in San Diego was held from 5:00 to 8:00 p.m. The public meetings dates and locations are shown in Table 8.3-3.

Table 8.3-3: Public Meetings Locations

LOCATION	DATE	ADDRESS
Honolulu, Oahu	November 6, 2017	Oahu Veterans Center, Fred Ballard Hall 1298 Kukila St.
Kahului, Maui	November 7, 2017	Maui High School, Cafeteria 660 S. Lono Ave.
Lihue, Kauai	November 8, 2017	Kauai Veterans Center, Main Ballroom 3215 Kapule Highway
Hilo, Hawaii	November 9, 2017	Waiakea High School, Cafeteria 155 W. Kawili St.
San Diego, California	November 13, 2017	Portuguese Hall, Main Hall 2818 Avenida de Portugal

8.4 Distribution of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement

All of the parties that were notified of the availability of the Draft EIS/OEIS were directed to access the document electronically on the project website (http://www.hstteis.com) or to access hard copies as available at the information repositories discussed in Section 8.4.2 (Repositories).

8.4.1 Federal Agencies

The U.S. Environmental Protection Agency Headquarters and Regional offices, received an electronic version of the Draft EIS/OEIS on October 6, 2017. The National Marine Fisheries Service headquarters along with National Marine Fisheries Service Hawaii and Southwest Regional Offices received hard copies and electronic copies of the Draft EIS/OEIS.

8.4.2 Repositories

The Draft EIS/OEIS was mailed in hard copy form along with an electronic CD/DVD to the information repository locations shown in Table 8.4-1, and should be made available to the public for a minimum of one year.

Table 8.4-1: Information Repositories with a Hard Copy and CD/DVD of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement

San Diego City of San Diego Central Library 330 Park Blvd. San Diego, CA 92101	**Maui** Kahului Public Library 90 School St. Kahului, HI 96732
Coronado Coronado Public Library 640 Orange Ave. Coronado, CA 92118	**Kauai** Lihue Public Library 4344 Hardy St. Lihue, HI 96766

Table 8.4-1: Information Repositories with a Hard Copy and CD/DVD of the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (continued)

Long Beach Long Beach Main Library 101 Pacific Ave. Long Beach, CA 90822	**Hawaii Island** Kailua-Kona Public Library 75-138 Hualalai Road Kailua-Kona, HI 96740
Oahu Hawaii State Library 478 S. King St. Honolulu, HI 96813	**Hawaii Island** Hilo Public Library 300 Waianuenue Ave. Hilo, HI 96720

8.5 COMMENTS ON THE DRAFT EIS/OEIS

Comments on the Draft HSTT EIS/OEIS were received from 5 federal agencies, 7 state/local government agencies, 20 non-governmental organizations, 1 tribal government, 1 form letter (received from approximately 1,850 commenters), and approximately 343 private individuals for a total of 2,241 comment submissions. All public comments can be accessed on the project website at: https://hstteis.com/Documents/2017-Hawaii-Southern-California-Training-and-Testing-Draft-EIS-OEIS/Public-Comments.

The 2,241 comment submissions were reviewed and categorized according to topic. Longer comments were broken down into multiple separate categories in order to properly and fully capture all of the different points within the comment (i.e., a comment may contain more than one theme within it). Comments were initially categorized into 21 categories based on their content. As a result, the total number of comments the Navy responded to is much greater than the 2,241 comment submissions received. Appendix H (Public Comment Responses) contains a summary of the comments received on the HSTT Draft EIS/OEIS and the Navy's responses.

8.6 NOTIFICATION OF NATIONAL MARINE FISHERIES SERVICE PROPOSED RULE

National Marine Fisheries Service released its proposed rule and request for comment in the Federal Register on June 26, 2018. A copy of the Federal Register notice is included in Appendix G (Federal Register Notices).

REFERENCES

California Department of Transportation. (2005). *Guidance for Preparers of Cumulative Impact Analysis Approach and Guidance*. Sacramento, CA: California Department of Transportation. Retrieved from http://www.dot.ca.gov/ser/cumulative_guidance/purpose.htm.

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Appendix A: Navy Activity Descriptions

Final
Environmental Impact Statement/Overseas Environmental Impact Statement
Hawaii-Southern California Training and Testing

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APPENDIX A NAVY ACTIVITY DESCRIPTIONS

The Navy has been conducting military readiness activities throughout the in-water areas around the Hawaiian Islands and off the coast of Southern California for decades. The tempo and types of training and testing activities have fluctuated within the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area) due to changing requirements, the introduction of new technologies, the dynamic nature of international events, advances in warfighting doctrine and procedures, and force structure changes. Such developments have influenced the frequency, duration, intensity, and location of required training and testing.

A.1 DESCRIPTION OF SONAR, MUNITIONS, TARGETS, AND OTHER SYSTEMS EMPLOYED IN HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING EVENTS

The Navy uses a variety of sensors, platforms, weapons, and other devices, including ones used to ensure the safety of Sailors and Marines, to meet its mission. Training and testing with these systems may have the potential to introduce acoustic (sound) energy and expended materials into the environment. The environmental impact of these activities was analyzed in Chapter 3 (Affected Environment and Environmental Consequences) of this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS). This appendix presents and organizes sonar systems, munitions, targets, and other systems in a manner intended to facilitate understanding of both the activities that use them and the analysis of their environmental effects, described in Chapter 3 (Affected Environment and Environmental Consequences) of this EIS/OEIS.

A.1.1 SONAR SYSTEMS AND OTHER ACOUSTIC SOURCES

Sonar. Sonar, originally an acronym for "SOund Navigation And Ranging," is a technique that uses underwater sound to navigate, communicate, or detect underwater objects (the term sonar is also used for the equipment used to generate and receive sound). There are two basic types of sonar: active and passive.

Active sonar emits sound waves that travel through the water, reflect off objects, and return to a receiver. Sonar is used to determine the distance to an underwater object by calculating the speed of sound in water and the time for the sound wave to travel to the object and back. For example, active sonar systems are used to track targets or to aid in vessel navigation by identifying known ocean floor features. Some whales, dolphins, and bats use echolocation, a similar technique, to identify their surroundings and to locate prey.

Passive sonar uses listening equipment, such as underwater microphones (hydrophones) and receiving sensors on ships, submarines, aircraft, or autonomous vehicles, to pick up underwater sounds. The advantage of passive sonar is that it places no sound in the water, and thus does not reveal the location of the listening vessel. Passive sonar can indicate the presence, character, and direction noise-producing objects like ships and submarines; however, passive sonar is increasingly ineffective as modern submarines become quieter. Passive sonar has no potential acoustic impact on the environment, and therefore, is not discussed further or analyzed within this EIS/OEIS.

All sounds, including sonar, are categorized by frequency. For this EIS/OEIS, active sonar is categorized into four frequency ranges: low-frequency[1], mid-frequency, high-frequency, and very high-frequency.

- Low-frequency active sonar emits sounds at frequencies less than 1 kilohertz (kHz). Low-frequency active sonar is useful for detecting objects at great distances because low-frequency sounds do not dissipate as rapidly as higher frequency sounds.
- Mid-frequency active sonar emits sounds at frequencies from 1 to 10 kHz. Mid-frequency active sonar is the Navy's primary tool for detecting and identifying submarines. Active sonar in this frequency range provides a valuable combination of range and target accuracy.
- High-frequency active sonar emits sounds at frequencies greater than 10 kHz, up to 100 kHz. High-frequency sounds dissipate rapidly and have a small effective range; however, high-frequency sounds provide higher resolution of objects and are useful at detecting and identifying smaller objects such as sea mines.
- Very high-frequency sources are those that operate above 100 kHz but below 200 kHz.

Modern sonar technology includes a variety of sonar sensor and processing systems. In concept, the simplest active sonar emits sound waves, or "pings," sent out in multiple directions and the sound waves then reflect off of the target object in multiple directions (Figure A.1-1). The sonar source calculates the time it takes for reflected sound waves to return; this calculation determines the distance to the target object. More sophisticated active sonars emit a ping and then rapidly scan or listen to the sound waves in a specific area. This provides both distance to the target and directional information. Even more advanced sonars use multiple receivers to listen to echoes from several directions simultaneously and provide efficient detection of both direction and distance. It should be noted that active sonar is rarely used continuously throughout the listed activities. In addition, when sonar is in use, the sonar "pings" occur at intervals, referred to as a duty cycle, and the signals themselves are very short in duration. For example, a sonar that emits a 1-second ping every 10 seconds has a 10 percent duty cycle.

The Navy utilizes sonar systems and other acoustic sensors in support of a variety of mission requirements. Primary uses include detection of and defense against submarines (anti-submarine warfare) and mines (mine warfare), safe navigation and effective communications, and oceanographic surveys. Specific examples of how sonar systems are used for Navy activities are discussed in the following sections.

[1] Surveillance Towed Array Sensor System (SURTASS) Low-Frequency Active sonar, which may be used in the Study Area, is not among the sources analyzed in this document. The potential environmental impacts from use of SURTASS Low-Frequency Active sonar are analyzed in separate analyses under the National Environmental Policy Act.

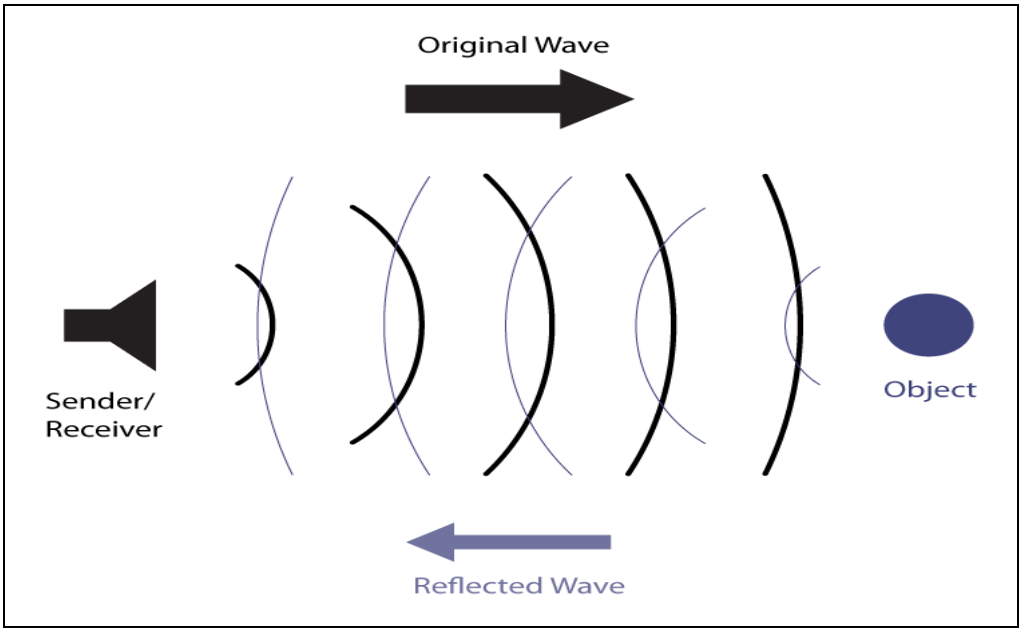


Figure A.1-1: Principle of an Active Sonar

Anti-Submarine Warfare. Systems used in anti-submarine warfare include sonars, torpedoes, and acoustic countermeasure devices. These systems are employed from a variety of platforms (surface ships, submarines, helicopters, and fixed-wing aircraft). Surface ships conducting anti-submarine warfare are typically equipped with hull-mounted sonar (passive and active) for the detection of submarines (or submarine targets during training and testing events). Helicopters use dipping sonar or sonobuoys (passive and active) to locate submarines (or targets). Fixed-wing aircraft deploy both active and passive expendable sonobuoys to assist in detecting and tracking submarines (or targets). Submarines are equipped with hull-mounted sonars to detect, localize, and track other submarines and surface ships. Submarines primarily use passive sonar; active sonar is used mostly for navigation. There are also unmanned vehicles currently being developed to deploy anti-submarine warfare systems.

Anti-submarine warfare activities often use mid-frequency (1 to 10 kHz) active sonar, though low-frequency and high-frequency active sonar systems are also used for specialized purposes. The Navy is currently developing and testing sonar systems that may utilize lower frequencies and longer duty cycles—albeit at lower source levels—than current systems. However, these new systems would only be operational if they significantly increase the Navy's ability to detect and identify quiet submarine threats.

Typical active sonar systems and acoustic sensors used during anti-submarine warfare sonar training and testing exercises include the following:

Surface Ship Sonar Systems: A variety of surface ships operate hull-mounted mid-frequency active sonar during training exercises and testing activities (Figure A.1-2). Typically, only cruisers and destroyers have surface ship sonar systems. Unmanned surface vessels can also include sonar systems, such as the variable depth sonar and mine hunting sonar.

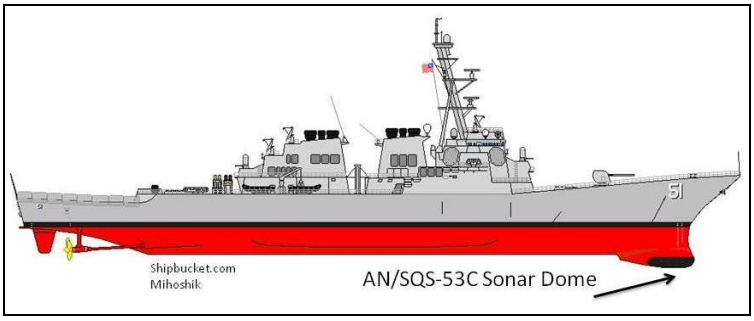


Figure A.1-2: Guided Missile Destroyer with an AN/SQS-53 Sonar

Submarine Sonar Systems: Submarines are equipped with hull-mounted mid-frequency and high-frequency active sonar (Figure A.1-3) used to detect and target enemy submarines and surface ships. A submarine's mission relies on its stealth; therefore, a submarine uses its active sonar sparingly because each sound emission gives away the submarine's location.

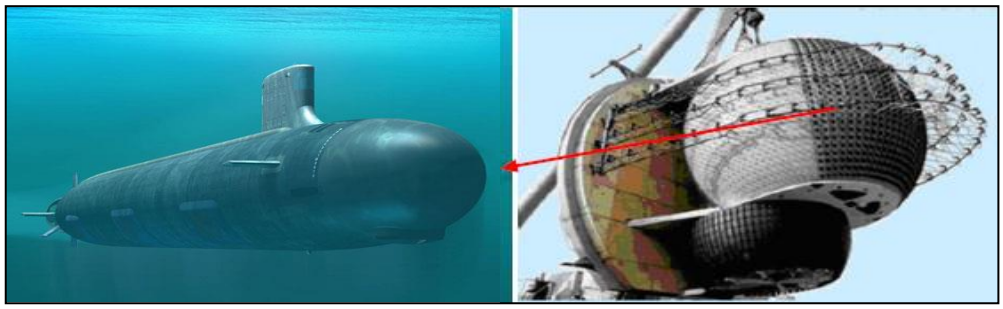


Figure A.1-3: Submarine AN/BQQ-10 Active Sonar Array

Aircraft Sonar Systems: Aircraft sonar systems include sonobuoys and dipping sonars.

- **Sonobuoys:** Active sonobuoys are expendable devices that contain a data transmitter and a hydrophone. The sounds collected by the sonobuoy are transmitted back to the operator (aboard ship or aircraft) for analysis. Sonobuoys allow for short and long-range detection of surface ships and submarines. These systems are deployed by ship, helicopter, and fixed-wing patrol aircraft (Figure A.1-4).



Figure A.1-4: Sonobuoy

- **Dipping Sonars:** Dipping sonars are recoverable devices lowered into the water via cable from manned and unmanned helicopters (Figure A.1-5). The sonar detects underwater targets and determines the distance and movement of the target relative to the position of the helicopter.



Figure A.1-5: Helicopter Deploys Dipping Sonar

Exercise Torpedoes: Some torpedoes used in training and testing activities may transmit active sonar signals. Surface ships, aircraft, and submarines primarily use torpedoes in anti-submarine warfare (Figure A.1-6). Recoverable, non-explosive torpedoes, categorized as either lightweight or heavyweight, are used during training and testing. Torpedoes operate autonomously, or in the case of heavyweight torpedoes, use a guidance system to operate the torpedo remotely through an attached wire (guidance wire). The autonomous guidance systems operate either passively (listening for sounds generated by the target) or actively (pinging to search for the target). Torpedo training in the Study Area is mostly simulated—solid masses that approximate the weight and shape of a torpedo are fired, rather than fully functional torpedoes. Testing in the Study Area mostly uses fully functional exercise torpedoes.

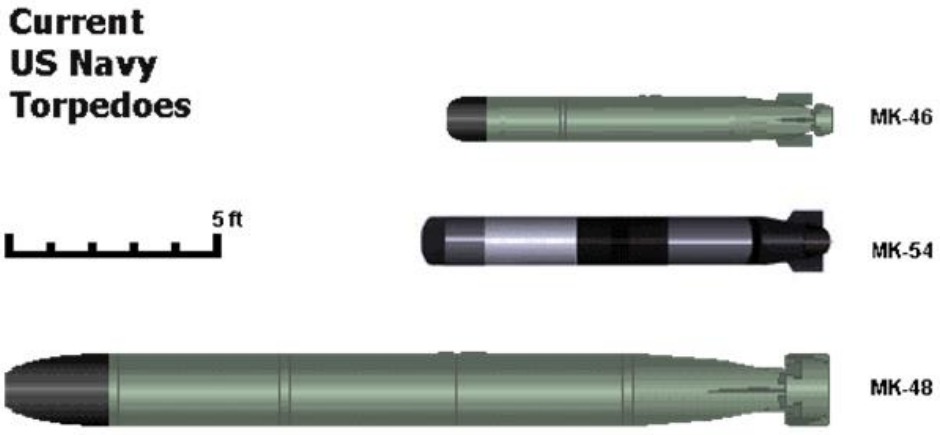


Figure A.1-6: Current United States Navy Torpedoes

Anti-Submarine Warfare Targets: Anti-submarine warfare training targets are autonomous undersea vehicles used to simulate target submarines (Figure A.1-7). The training targets are equipped with one

or more of the following devices: (1) acoustic projectors emitting sounds to simulate submarine acoustic signatures, (2) echo repeaters to simulate the characteristics of the echo of a sonar signal reflected from a submarine, and (3) magnetic sources that mimic those of a submarine.



Figure A.1-7: Anti-Submarine Warfare Targets

Mine Warfare. Mine warfare training and testing activities use a variety of different sonar systems that are typically high frequency (greater than 10 kHz) and very high frequency (greater than 100 kHz). These sonar systems are used to detect, locate, and characterize moored and bottom mines (Figure A.1-8). The majority of mine warfare sonar sensors can be deployed by more than one platform (e.g., helicopter, unmanned underwater vehicle, or surface ship) and may be interchangeable among platforms. Surface ships and submarines use sonar to detect mines and objects, while minesweeping ships use a specialized variable-depth mine detection and classification high-frequency active sonar system to detect mines.

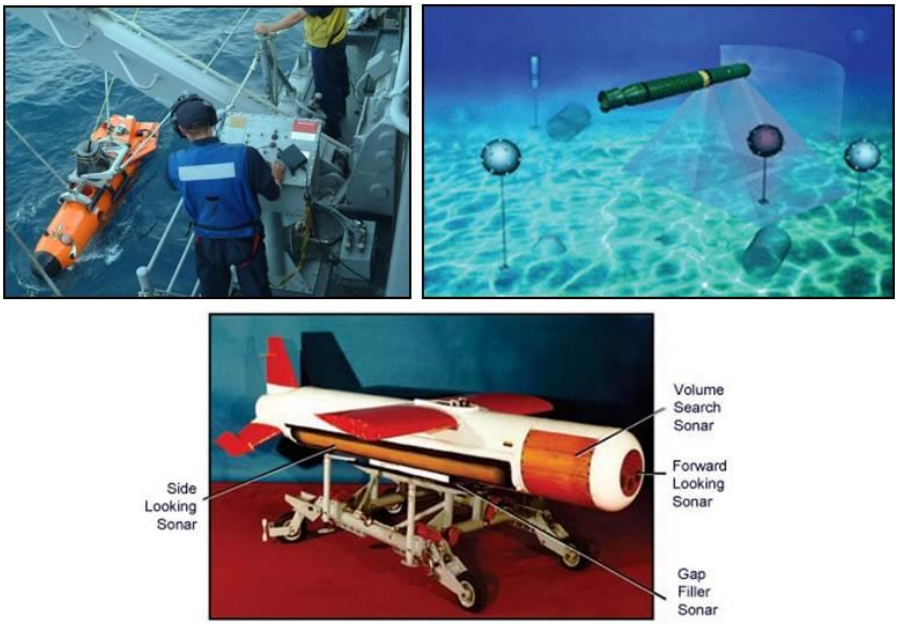


Figure A.1-8: Mine Warfare Systems

(Source: Graphic on right side from Lockheed Martin)

Safety, Navigation, Communications, and Oceanographic Systems. Naval ships, submarines, and unmanned surface and subsurface vehicles rely on equipment and instrumentation that use active sonar during both routine operations and training and testing events. Sonar systems are used to gauge water depth, detect and map objects, navigational hazards, and the ocean floor, and transmit communication signals.

Other Acoustic Systems. The Navy uses a variety of other acoustic sensors to protect ships anchored or at the pier, as well as shore facilities. These systems, both active and passive, detect potentially hostile swimmers, broadcast warnings to alert Navy divers of potential hazards, and gather information regarding ocean characteristics (ocean currents and wave measurements). They are generally stationary systems in Navy harbors and piers. Navy marine mammals (Atlantic bottlenose dolphins [*Tursiops truncatus*] and California sea lions [*Zalophus californianus*]) are also used to detect hostile swimmers around Navy facilities. A trained animal is deployed under behavioral control of a handler to find an intruding swimmer. Upon finding the "target" of the search, the animal returns to the boat and alerts the animal handlers, and the animals are given a localization marker or leg cuff that they attach to the intruder. Swimmers that have been marked with a leg cuff are reeled in by security support boat personnel via a line attached to the cuff. In addition, the Navy's research and acquisition community uses sensors for a variety of tests, including tracking during testing activities and collecting data for test analysis.

A.1.2 MUNITIONS

Most ordnance and munitions used during training and testing events fall into three basic categories: projectiles, missiles, and bombs. Ordnance can be further defined by their net explosive weight, which is the actual weight in pounds of the explosive substance without the packaging, casings, bullets, etc. Net explosive weight is also the trinitrotoluene (TNT) equivalent of energetic material, which is the standard measure of strength of bombs and other explosives. For example, a 2,000-pound (lb.) (907 kilogram [kg]) bomb may have anywhere from 600 to 1,000 lb. of net explosive weight.

Projectiles. Projectiles are fired during gunnery exercises and testing events from a variety of weapons, including pistols and rifles to large-caliber, turret-mounted guns on the decks of Navy ships. Projectiles can be either high-explosive munitions (e.g., certain gun shells), or non-explosive practice munitions (e.g., rifle/pistol bullets). Explosive rounds can be fused to either explode on impact or in the air (i.e., just prior to impact). Projectiles are broken down into three basic categories in this EIS/OEIS:

- **Small-Caliber Projectiles:** These projectiles are up to and including .50-caliber (approximately 1/2 inch [in.] diameter). Small-caliber projectiles (e.g., bullets), are primarily fired from pistols, rifles, and machine guns (i.e., small arms) and mostly during training events for an individual Sailor to become and remain proficient (Figure A.1-9).



Figure A.1-9: Shipboard Small Arms Training

- **Medium-Caliber Projectiles:** These projectiles are larger than .50-caliber, but smaller than 57 millimeter (mm) (approximately 2-1/4 in. diameter). The most common size medium-caliber projectiles are 20 mm, 25 mm, and 40 mm. Medium-caliber projectiles are fired from machine guns operated by one to two crewman and mounted on the deck of a ship, wing-mounted guns on aircraft, and fully automated guns mounted on ships for defense against missile attack (Figure A.1-10). Medium-caliber projectiles also include 40 mm grenades, which can be fired from hand-held grenade launchers or crew-served deck-mounted guns. Medium-caliber projectiles can be non-explosive practice munitions or high-explosive projectiles. High-explosive projectiles are usually fused to detonate on impact; however, advanced high-explosive projectiles can detonate based on time, distance, or proximity to a target.



Figure A.1-10: Shipboard Medium-Caliber Guns

- **Large-Caliber Projectiles:** These includes projectiles 57 mm and larger. The largest projectile currently in service has a 5 in. diameter, but larger weapons are under development. The most widely used large-caliber projectiles are 57 mm, and 5 in. (12.7 cm) (Figure A.1-11). The most common 5 in. projectile is approximately 26 in. (66 cm) long and weighs 70 lb. Large-caliber projectiles are fired exclusively from turret-mounted guns located on ship decks and can be used to fire on surface ships and boats, in defense against missiles and aircraft, and against land-based targets. Large-caliber projectiles can be non-explosive practice munitions or high-explosive munitions. High-explosive projectiles can detonate on impact or in the air.




Figure A.1-11: Shipboard Large-Caliber Gun and Projectiles

Missiles. Missiles are rocket or jet-propelled munitions used to attack ships, aircraft, and land-based targets, as well as defend ships against other missiles. Guidance systems and advanced fusing technology ensure that missiles reliably impact on or detonate near their intended target. Missiles are categorized according to their intended target, as described below, and can be further classified according to net explosive weight. Rockets are included within the category of missiles.

- **Air Missiles:** Air missiles are fired from ships and aircraft against enemy aircraft and incoming missiles (Figure A.1-12). Air missiles are configured to explode in the air near, or on impact with their intended target. Missiles are the primary ship-based defense against incoming missiles.




Figure A.1-12: Rolling Airframe Missile and Air-to-Air Missile

- **Surface Missiles:** Surface missiles are fired from aircraft, ships, and submarines against surface ships (Figure A.1-13). Surface missiles are typically configured to detonate on impact or just above the intended target.



Figure A.1-13: Surface Missile Fired from MH-60 Helicopter

- **Strike Missiles:** Strike missiles are fired from aircraft, ships, and submarines against land-based targets. Strike missiles are typically configured to detonate on impact or near their intended target. The AGM-88 High-Speed Anti-Radiation Missile, used to destroy enemy radar sites, is an example of a strike missile used during at-sea training, and is fired at a floating sea-borne target that replicates a land-based radar site.

Bombs. Bombs are unpowered munitions dropped from aircraft on land and water targets. The majority of bombs used during training and testing in the Study Area are non-explosive. However, explosive munitions are occasionally used for proficiency inspections and testing requirements. Bombs fall into two categories: general-purpose bombs and subscale practice bombs. Similar to missiles, bombs are further classified according to their net explosive weights.

- **General-Purpose Bombs:** General-purpose bombs consist of precision-guided and unguided full-scale bombs, ranging in size from 250 to 2,000 lb. (Figure A.1-14). Common bomb nomenclature used includes: MK 80 series, which is the Navy's standard model; Guided Bomb Units and Joint Direct Attack Munitions, which are precision guided (including laser guided) bombs; and the Joint Standoff weapon, which is a long-range "glider" precision weapon. General-purpose bombs can be either non-explosive practice munitions or high-explosive.



Figure A.1-14: F/A-18 Bomb Release and Loading General Purpose Bombs

- **Subscale Bombs:** Subscale bombs (Figure A.1-15) are non-explosive practice munitions containing a spotting (smoke) charge to aid in scoring the accuracy of hitting the target during

training and testing activities. Common subscale bombs are 25 lb. and less and are steel-constructed. Laser guided training rounds are another variation of a subscale practice bomb. They weigh approximately 100 lb. and are cost-effective non-explosive weapons used in training aircrew in laser-guided weapons employment.



Figure A.1-15: Subscale Bombs for Training

Other Munitions. There are other munitions used in naval at-sea training and testing events that do not fit into one of the above categories, and are discussed below:

- **Demolition Charges:** Divers place explosive charges in the marine environment during some training and testing activities. These activities may include the use of timed charges, in which the charge is placed, a timer is started, and the charge detonates at the set time. Munitions of up to 60-lb. blocks of composition 4 (C-4) plastic explosive, with the necessary detonators and cords, are used to support mine neutralization, demolition, and other warfare activities. All demolition charges are further classified according to the net explosive weight of the charge.
- **Torpedoes:** Explosive torpedoes are required in some training and testing events. Torpedoes are described as either lightweight or heavyweight and are further categorized according to the net explosive weight.
- **Extended Echo Ranging Sonobuoys:** Extended Echo Ranging sonobuoys include Improved Extended Echo Ranging sonobuoys and mini sound-source seeker sonobuoys that use explosive charges as the active sound source instead of electrically produced sounds.

A.1.3 TARGETS

Training and testing require an assortment of realistic and challenging targets. Targets vary from items as simple and ordinary as an empty steel drum used for small-caliber weapons training from the deck of a ship, to sophisticated, unmanned aerial drones used in air defense training. For this EIS/OEIS, targets are organized by warfare area.

Air Warfare Targets: Air warfare targets, tow target systems, and aerial targets, are used in training and testing events that involve detection, tracking, defending against, and attacking enemy missiles and aircraft. Aerial tow target systems include textile (nylon banner) and rigid (fiberglass shapes) towed targets used for gunnery events. Aerial targets include expendable rocket powered missiles and recoverable radio-controlled drones used for gunnery and missile exercises (Figure A.1-16). Parachute flares are used as air-to-air missile targets. Manned high-performance aircraft may be used as targets—to test ship and aircraft defensive systems and procedures—without the actual firing of munitions.



Figure A.1-16: Deployment and Recovery of Air Warfare Targets

Surface Warfare Targets: Stationary and towed targets are used as surface warfare targets during gunnery events. Targets include floating steel drums, inflatable shapes or target balloons (e.g., Killer Tomato™) (Figure A.1-17), and towed sleds. Remote-controlled, high-speed targets, such as jet skis and motorboats, are also used (Figure A.1-18).

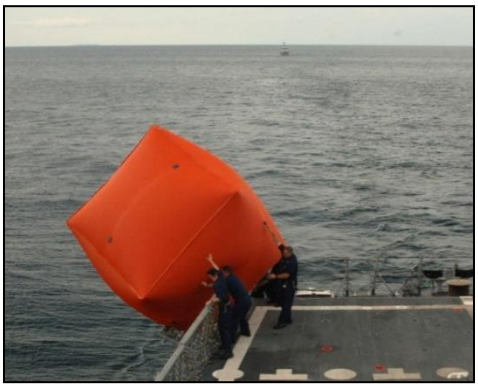


Figure A.1-17: Deploying a "Killer Tomato™" Floating Target

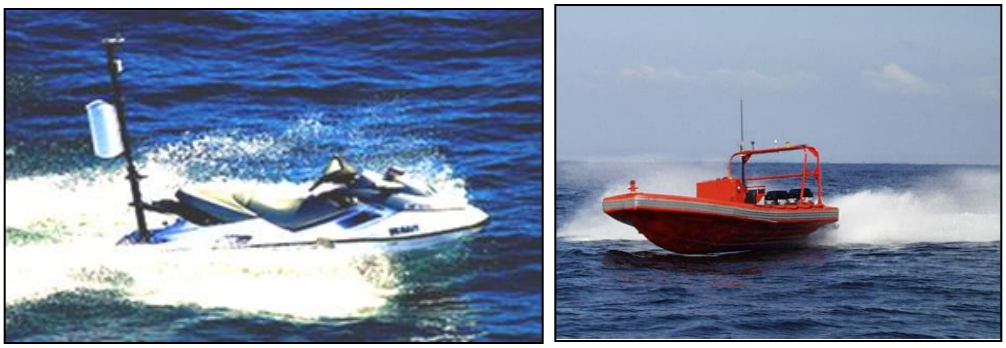


Figure A.1-18: Ship Deployable Surface Target and High-Speed Maneuverable Seaborne Target

Anti-Submarine Warfare Targets: Anti-submarine warfare uses multiple types of targets, including the following:

- **Submarines:** Submarines may act as tracking and detection targets during training and testing events.
- **Motorized Autonomous Targets:** Motorized autonomous targets simulate the acoustic and magnetic characteristics of a submarine, providing realism for exercises when a submarine is not available. These mobile targets resemble torpedoes, with some models designed for recovery and reuse, while other models are expendable.
- **Stationary Artificial Targets:** Stationary targets either resemble submarine hulls or are simulated systems with acoustic properties of enemy submarines. These targets either rest on the seafloor or are suspended at varying depths in the water column.

A.1.4 DEFENSIVE COUNTERMEASURES

Naval forces depend on effective defensive countermeasures to protect against missile and torpedo attack. Defensive countermeasures are devices designed to confuse, distract, and confound precision-guided munitions. Defensive countermeasures fall into five basic categories:

- **Chaff:** Chaff consists of reflective, aluminum-coated glass fibers used to obscure ships and aircraft from radar-guided systems. Chaff, which is stored in canisters, is either dispensed from aircraft or fired into the air from the decks of surface ships when an attack is imminent. The glass fibers create a radar cloud that masks the position of the ship or aircraft.
- **Flares:** Flares are pyrotechnic devices used to defend against heat-seeking missiles, where the missile seeks out the heat signature from the flare rather than the aircraft's engines. Similar to chaff, flares are also dispensed from aircraft and fired from ships.
- **Acoustic Countermeasures:** Acoustic countermeasures are used by surface ships and submarines to defend against torpedo attack (Figure A.1-19). Acoustic countermeasures are either released from ships and submarines or towed at a distance behind the ship.

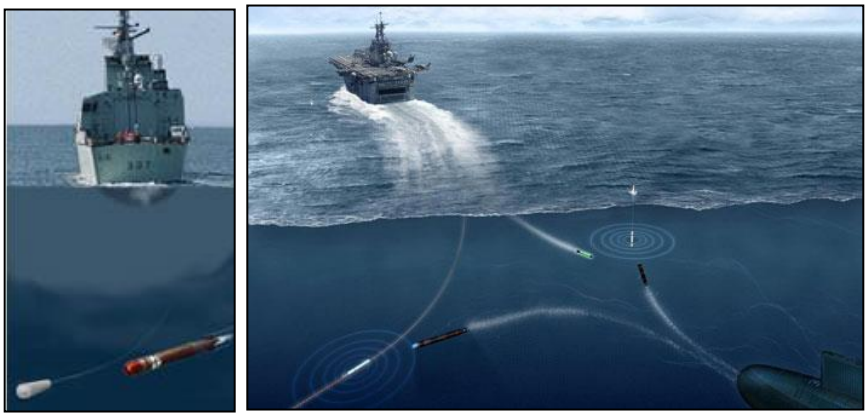


Figure A.1-19: Acoustic Countermeasures

- **Electromagnetic Countermeasures:** Electromagnetic countermeasures are used by surface ships and aircraft to defend against missile attacks. Electromagnetic countermeasures are also used in anti-submarine warfare activities.

- **Biodegradable Polymer:** Biodegradable polymer is a biodegradable vessel entanglement technology used to slow or stop specific maritime targets by entangling the propulsion mechanism.

A.1.5 Mine Warfare Systems

Mine warfare systems fall into two broad categories: mine detection and mine neutralization.

Mine Detection Systems. Mine detection systems are used to locate, classify, and map suspected mines. Once located, the mines can either be neutralized or avoided. These systems are specialized to either locate mines on the surface, in the water column, or on the seafloor.

- **Towed or Hull-Mounted Mine Detection Systems:** These detection systems use acoustic and laser or video sensors to locate and classify suspect mines. Helicopters, ships, and unmanned vehicles are used for towed systems, which can rapidly assess large areas (Figure A.1-20).



Figure A.1-20: Towed Mine Detection System

- **Airborne Laser Mine Detection Systems:** Airborne laser detection systems work in concert with neutralization systems. The detection system initially locates mines and a neutralization system is then used to relocate and neutralize the mine (Figure A.1-21).

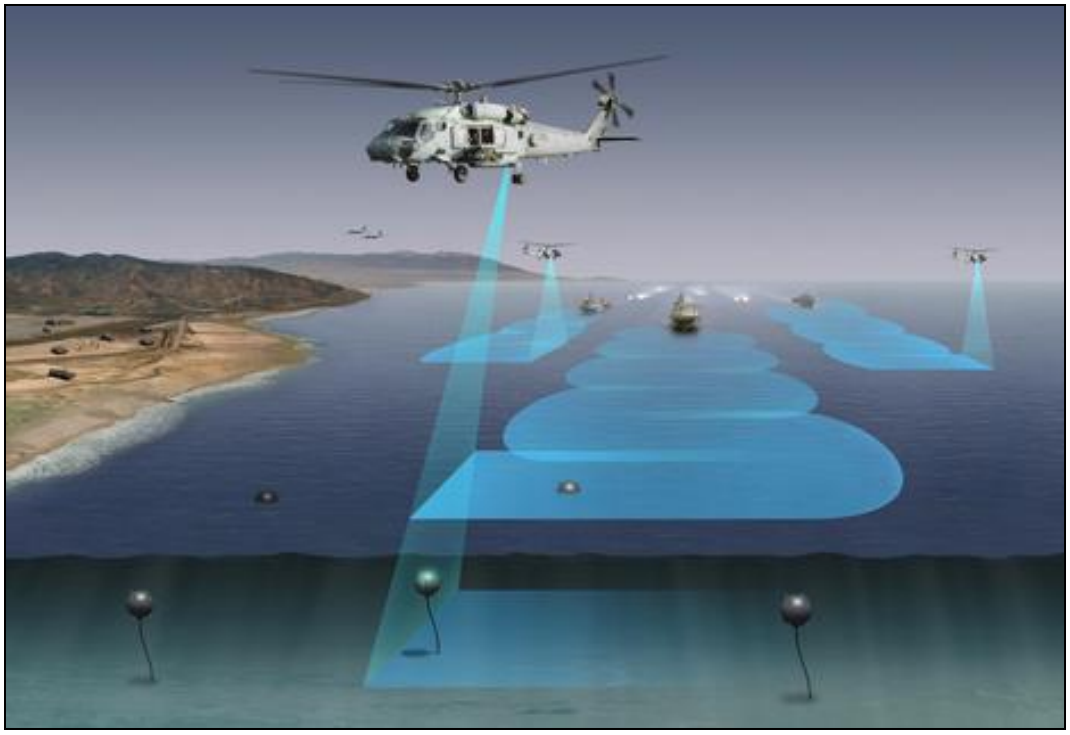


Figure A.1-21: AN/AES-1 Airborne Laser Mine Detection System

- **Unmanned/Remotely Operated Vehicles:** These vehicles use acoustic and video or lasers to locate and classify mines. Unmanned/remotely operated vehicles provide unique mine warfare capabilities in nearshore littoral areas, surf zones, ports, and channels.
- **Marine Mammal System:** Navy personnel and Navy marine mammals work together to detect specified underwater objects. The Navy deploys trained bottlenose dolphins and California sea lions as part of the marine mammal minehunting and object recovery system.

Mine Neutralization Systems. These systems disrupt, disable, or detonate mines to clear ports and shipping lanes, as well as littoral, surf, and beach areas in support of naval amphibious operations. Mine neutralization systems can clear individual mines or a large number of mines quickly.

- **Towed Influence Mine Sweep Systems:** These systems use towed equipment that mimic a particular ship's magnetic and acoustic signature triggering the mine and causing it to explode (Figure A.1-22).

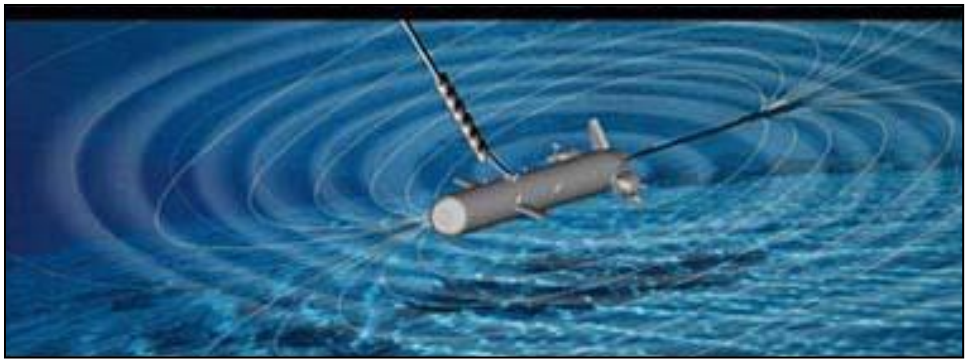


Figure A.1-22: Organic and Surface Influence Sweep

- **Towed Mechanical Mine Sweeping Systems:** These systems tow a sweep wire to snag the line that attaches a moored mine to its anchor and then uses a series of cables and cutters to sever those lines. Once these lines are cut, the mines float to the surface where explosive ordnance personnel can neutralize the mines.
- **Unmanned/Remotely Operated Mine Neutralization Systems:** Surface ship and helicopters operate these systems, which place explosive charges near or directly against mines to destroy the mine (Figure A.1-23).

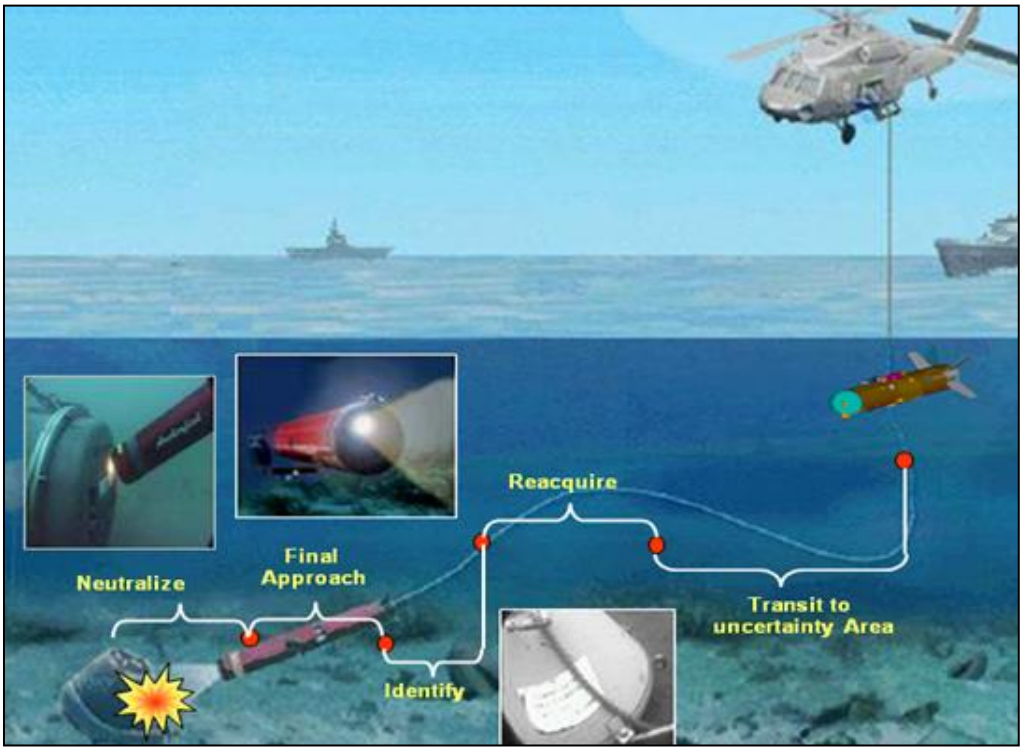


Figure A.1-23: Airborne Mine Neutralization System

- **Projectiles:** Small- and medium-caliber projectiles fired from surface ships or hovering helicopters are used to neutralize floating and near-surface mines.

- **Diver Emplaced Explosive Charges:** Operating from small craft, divers place explosive charges, which may use time delay fusing, near or on mines to destroy the mine or disrupt its ability to function.

A.1.6 MILITARY EXPENDED MATERIALS

Navy training and testing events may introduce or expend various items, such as non-explosive munitions and targets, into the marine environment as a direct result of using these items for their intended purpose. In addition to the items described below, some accessory materials—related to the carriage or release of these items—may be released. These materials, referred to as military expended materials, are not recovered, and potentially result in environmental impacts. These impacts are analyzed in detail in Chapter 3 (Affected Environment and Environmental Consequences) of this EIS/OEIS. This section includes descriptions of a representative sample of military expended materials. A more comprehensive discussion can be found in Chapter 3 (Affected Environment and Environmental Consequences).

Military expended materials analyzed in this document include the following:

- **Sonobuoys:** Sonobuoys consist of decelerators/parachutes, wires, and the sonobuoys themselves.
- **Bathythermographs:** Bathythermographs as used by the Navy are similar to sonobuoys in that they consist of decelerators/parachutes, wires, and the buoy themselves. In the case of bathythermographs, the buoys are used to measure temperature information of the water column and transmit that information to the platform (usually a ship or aircraft) that deployed the bathythermograph.
- **Torpedo Launch Accessories:** Torpedoes are usually recovered; however, materials such as decelerators/parachutes used with air-dropped torpedoes, guidance wire used with submarine-launched torpedoes, and ballast weights are expended. Explosive filled torpedoes expend torpedo fragments.
- **Projectiles and Bombs:** Non-explosive projectiles, non-explosive bombs, or fragments from explosive projectiles and bombs are expended during training and testing exercises. These items are primarily constructed of lead (most small-caliber projectiles) or steel (medium- and large-caliber projectiles and all bombs).
- **Blank Ammunition:** Blank ammunition is used in some training activities when the sound or flash of gunfire adds to the realism of the training activity but safety of personnel or nearby civilians is critical. Blank ammunition contains gunpowder, but no projectile is sent downrange upon firing the weapon. Casings are expended as a result of firing blank ammunition.
- **Missiles and Rockets:** Non-explosive missiles and missile fragments from explosive missiles are expended during training and testing events. Propellant, and any explosive material involved, is consumed during firing/detonation. Some missiles include a wire, which is also expended. Rockets are similar to missiles and both non-explosive and fragments may be expended.
- **Countermeasures:** Countermeasures (acoustic, chaff, flares, biodegradable polymer) are expended as a result of training exercises, with the exception of towed acoustic countermeasures. Chaff activities also include an expended canister, end caps, and pistons. Flares expend only end caps and pistons.

- **Targets:** Some targets are designed to be expended; other targets, such as aerial drones and remote-controlled boats, are recovered for re-use. Targets struck with ordnance will result in target fragments.

A.2 TRAINING ACTIVITIES

The Navy's training activities are organized generally into eight primary mission areas and a miscellaneous category (Other Training) that includes those activities that do not fall within a primary mission area, but are an essential part of Navy training. In addition, because the Navy conducts a number of activities within larger training exercises, descriptions of those larger exercises are also included here. It is important to note that these larger exercises are comprised entirely of individual activities described in the primary mission areas.

A.2.1 MAJOR TRAINING EXERCISES

A major training exercise is comprised of several "unit level" range exercises conducted by several units operating together while commanded and controlled by a single commander. These exercises typically employ an exercise scenario developed to train and evaluate the strike group in naval tactical tasks. In a major training exercise, most of the operations and activities being directed and coordinated by the strike group commander are identical in nature to the operations conducted during individual, crew, and smaller-unit training events. In a major training exercise, however, these disparate training tasks are conducted in concert, rather than in isolation.

Major training exercises are listed below.

A.2.1.1 Composite Training Unit Exercise

<table>
<tr><th colspan="4">Major Training Exercises—Large Integrated Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Composite Training Unit Exercise</th></tr>
<tr><td>Short Description</td><td colspan="2">Aircraft carrier and carrier air wing integrates with surface and submarine units in a challenging multi-threat operational environment that certifies them ready to deploy.</td><td>Typical Duration
21 days</td></tr>
<tr><td>Long Description</td><td colspan="3">Intermediate level carrier strike exercise designed to create a cohesive Strike Group prior to deployment or Joint Task Force Exercise. Typically, seven surface ships, fixed-wing and rotary-wing aircraft, two submarines, and various unmanned vehicles.

Each strike group performs a rehearsal called Composite Training Unit Exercise before deployment. Prior to the Composite Training Unit Exercise, each ship and aircraft in the strike group trains in their specialty. The Composite Training Unit Exercise is an intermediate-level strike group exercise designed to forge the group into a cohesive fighting team. Composite Training Unit Exercise normally consists of an 18-day schedule of event driven exercise, and a three-day Final Battle Problem.

The Composite Training Unit Exercise is an integration phase, at-sea, major training exercise. For the Carrier Strike Group, this exercise integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging operational environment. Special operations training may also be integrated with the exercise scenario.

For Composite Training Unit Exercise, only the anti-submarine warfare activities were analyzed as a Composite Training Unit Exercise. Other warfare area training conducted during the Composite Training Unit Exercise is analyzed elsewhere as unit-level training (e.g., gunnery exercise, missile exercise)</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Aircraft carrier, fixed-wing aircraft, rotary-wing aircraft, submarines, surface combatant
Targets: Sub-surface targets; surface targets
Systems being Trained/Tested: Low-frequency sonar, mid-frequency sonar, high-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Weapons firing safety
Unmanned aerial, surface, and subsurface vehicle safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex

Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise
Weapons noise

Explosive:
In-air explosives
In-water explosives</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials
Seafloor devices
Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-water electromagnetic devices
In-air electromagnetic devices

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
</table>

Major Training Exercises—Large Integrated Anti-Submarine Warfare				
Composite Training Unit Exercise				
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material		**Sediments and Water Quality:** Chemicals Metals	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike		**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Acoustic countermeasures, expendable bathythermograph, expendable bathythermographs wires, sonobuoys (non-explosive), sonobuoy wire		**Military Recoverable Material**	Sub-surface targets Surface targets
Sonar and Other Transducer Bins	**Low-Frequency:** LF6 **Mid-Frequency:** MF1 MF3 MF11 MF4 MF12 MF5 **High-Frequency:** HF1	**Anti-Submarine Warfare:** ASW1 ASW4 ASW2 ASW5 ASW3		
Explosive Bins	Analyzed in individual warfare events			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices			
Assumptions Used for Analysis	For Composite Training Unit Exercise, only the anti-submarine warfare activities were analyzed as a Composite Training Unit Exercise. Other warfare area training conducted during the Composite Training Unit Exercise is analyzed elsewhere as unit-level training (gunnery exercise, missile exercise, etc.) Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.			

A.2.1.2 Rim of the Pacific Exercise

<table>
<tr><th colspan="5">Major Training Exercises</th></tr>
<tr><th colspan="5">Rim of the Pacific Exercise</th></tr>
<tr><td>Short Description</td><td colspan="2">A biennial multinational training exercise in which navies from Pacific Rim nations and the United Kingdom assemble in Pearl Harbor, Hawaii, to conduct training in a number of warfare areas throughout the Hawaiian Islands. Marine mammal systems may be used during a Rim of the Pacific exercise. Components of Rim of the Pacific may be conducted in the Southern California Range Complex.</td><td colspan="2">Typical Duration
30 days</td></tr>
<tr><td>Long Description</td><td colspan="4">Rim of the Pacific is the world’s largest multinational maritime exercise, typically lasting four to five weeks. Hosted by Commander, Pacific Fleet, the exercise is scheduled in the summer on even years. Rim of the Pacific includes participation by multiple nations (in 2016 included 26 nations, 45 ships, 5 submarines, more than 200 aircraft, and 25,000 personnel). The exercise typically consists of three major phases. Phase I, the Harbor Phase, will consist of operational planning meetings, safety briefings, and sporting events. This phase is designed to make final preparations for the at-sea phases of the exercises, as well as build on professional and personal relationships between the participating countries. Phase II, the Operational Phase, is driven by a structured schedule of events. This portion may include live-fire gunnery and missile exercises, maritime interdiction and vessel boarding, surface warfare, undersea warfare, naval maneuvers, air defense exercises, as well as explosive ordnance disposal, diving and salvage operations, mine clearance operations, and an amphibious landing. This phase exercises the ability of each nation to conduct robust command and control operations with multinational players and enhances each unit's operational capabilities. Phase III, the Tactical Phase of the exercise, is scenario-driven. The intense training during this phase allows participating nations to further strengthen their maritime skills and capabilities and improve their ability to communicate and operate in simulated hostile scenarios. This phase concludes with the ships’ return to Pearl Harbor, where participating nations will reconvene to discuss the exercise and overall accomplishments.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Aircraft carrier, combat logistics, fixed-wing aircraft, mine warfare ship, rotary-wing aircraft, submarines, surface combatant, unmanned aerial systems, unmanned surface vehicle, unmanned underwater vehicle
Targets: Aerial targets; sub-surface targets; surface targets
Systems being Trained/Tested: Mid-frequency sonar, high-frequency sonar, acoustic modems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety
Weapons firing safety
Swimmer defense activity safety
Unmanned aerial, surface, and subsurface vehicle safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Silver Strand Training Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
Pearl Harbor
Kawaihae Harbor
San Diego Bay</td></tr>
</table>

Major Training Exercises			
Rim of the Pacific Exercise			
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise Weapons noise **Explosive:** In-air explosives In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-water electromagnetic devices In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Acoustic countermeasures, sonobuoys (non-explosive), sonobuoy wires	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF3 MF11 MF4 MF5 **High-Frequency:** HF1 HF3 HF4	**Anti-Submarine Warfare:** ASW2 ASW3 ASW4 **Acoustic Modems:** M3	
Explosive Bins	Analyzed in individual warfare events		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	All Military Expended Material, ordnance, explosives, and sonar use is included in individual events. Potential locations for this activity include Hawaii Range Complex (Hawaii Operating Area), Silver Strand Training Complex (amphibious beaching area), and Southern California Range Complex (Tanner Bank Minefield, Camp Pendleton Amphibious Assault Area, and Advanced Research Projects Agency Training Minefield).		

Major Training Exercises	
Rim of the Pacific Exercise	
	Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.

A.2.1.3 Fleet Exercise/Sustainment Exercise

Included in the Fleet Response Training Plan is a requirement to conduct post-deployment training, and maintenance. This ensures that the components of a strike group maintain an acceptable level of readiness after returning from deployment. A sustainment exercise is an exercise designed to challenge the strike group in all warfare areas. Marine mammal systems may be used during the exercise. This exercise is similar to a Composite Training Unit Exercise but is of shorter duration.

<table>
<tr><th colspan="4">Major Training Exercises—Medium Integrated Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Fleet Exercise/Sustainment Exercise</th></tr>
<tr><td>Short Description</td><td colspan="2">Aircraft carrier and carrier air wing integrates with surface and submarine units in a challenging multi-threat operational environment to maintain ability to deploy.</td><td>Typical Duration
Up to 10 days</td></tr>
<tr><td>Long Description</td><td colspan="3">Fleet Exercises and Sustainment Exercises are similar in scope to Composite Training Unit Exercises but shorter in duration and use fewer active sonar hours. Fleet Exercises are integrated joint and coalition training events designed to maintain proficiency across maritime warfare disciplines. Sustainment Exercises are conducted to ensure that Carrier Strike Group maintains an acceptable level of readiness after returning from deployment in order to maintain a surge capability. Marine mammal systems may be used during the exercise.

All military expended materials, ordnance, explosives, and sonar use for the Fleet Exercises and Sustainment Exercises are included in individual events.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Aircraft carrier, fixed-wing aircraft, rotary-wing aircraft, submarines, surface combatant
Targets: Sub-surface targets
Systems being Trained/Tested: Low-frequency sonar, mid-frequency sonar, high-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Weapons firing safety
Unmanned aerial, surface, and subsurface vehicle safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex

Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise
Weapons noise

Explosive:
In-air explosives
In-water explosives</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials
Seafloor devices

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-water electromagnetic devices
In-air electromagnetic devices

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
</table>

Major Training Exercises—Medium Integrated Anti-Submarine Warfare				
Fleet Exercise/Sustainment Exercise				
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Chemicals Metals		
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions	
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Acoustic countermeasures, sonobuoys (non-explosive), sonobuoy wires	**Military Recoverable Material**	Sub-surface targets	
Sonar and Other Transducer Bins	**Low-Frequency:** LF6 **Mid-Frequency:** MF1 MF3 MF11 MF4 MF12 MF5 **High-Frequency:** HF1	**Anti-Submarine Warfare:** ASW1 ASW4 ASW2 ASW3		
Explosive Bins	None (analyzed elsewhere)			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	**Explosive Stressors:** *(Section 5.3.3)* None (analyzed elsewhere)		
Assumptions Used for Analysis	All Military expended materials, ordnance, explosives, and sonar use are included in individual events. Potential locations for this activity include Hawaii Range Complex (Hawaii Operations Area) and Southern California Range Complex (Northern Air Operating Area, Tactical Maneuvering Areas, and Southern California Anti-Submarine Warfare Range). Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.			

A.2.1.4 Undersea Warfare Exercise

Major Training Exercises—Medium Integrated Anti-Submarine Warfare			
Undersea Warfare Exercise			
Short Description	Elements of the anti-submarine warfare tracking exercise are combined in this exercise, comprised of multiple air, surface, and subsurface units, over a period of several days. Sonobuoys are released from aircraft. Active and passive sonar used.	**Typical Duration**	4 days
Long Description	Elements of the anti-submarine warfare tracking exercise (described later in Sections A.2.5.5–2.5.8) are combined in this exercise, comprised of multiple air, surface, and subsurface units, over a period of several days. No explosive ordnance will be used. Sonobuoys are released from aircraft. Active and passive sonar is used. Undersea Warfare Exercise is an assessment-based anti-submarine warfare exercise conducted by Expeditionary Strike Groups and Carrier Strike Groups while in transit from the West Coast of the United States to the western Pacific Ocean. Undersea Warfare Exercise can involve more than one Carrier Strike Group or Expeditionary Strike Group formation and is conducted up to five times annually.		
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft, submarines, surface combatant **Targets:** Sub-surface targets **Systems being Trained/Tested:** Mid-frequency sonar, high-frequency sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex **Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Sub-surface targets, surface targets, sonobuoys (non-explosive), sonobuoy wires	**Military Recoverable Material**	Some sub-surface targets

Major Training Exercises—Medium Integrated Anti-Submarine Warfare	
Undersea Warfare Exercise	
Sonar and Other Transducer Bins	**Low-Frequency:** LF6 **Mid-Frequency:** MF1 MF5 MF3 MF11 MF4 MF12 **High-Frequency:** HF1 **Anti-Submarine Warfare:** ASW3 ASW4
Explosive Bins	None
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	All military expended materials, ordnance, explosives, and sonar use is included in individual events. Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.

A.2.2 INTEGRATED/COORDINATED TRAINING

Integrated or coordinated anti-submarine warfare training exercises are similar to major training exercises in that they are comprised of several basic, unit-level exercises, with training conducted by an individual unit, but are generally on a smaller scale, are of shorter duration, and use fewer hours of active sonar than a major training exercise.

A.2.2.1 Navy Undersea Warfare Training Assessment Course

<table>
<tr><th colspan="4">Small Integrated Anti-Submarine Warfare Training</th></tr>
<tr><th colspan="4">Navy Undersea Warfare Training Assessment Course</th></tr>
<tr><td>Short Description</td><td colspan="2">Multiple ships, aircraft, and submarines integrate the use of their sensors, including sonobuoys, to search for, detect, classify, localize, and track a threat submarine.</td><td>Typical Duration
2–5 days</td></tr>
<tr><td>Long Description</td><td colspan="3">The Navy Undersea Warfare Training Assessment Course is a tailored course of instruction designed to improve Sea Combat Commander and strike group integrated anti-submarine warfare warfighting skill sets. Navy Undersea Warfare Training Assessment Course is a coordinated training scenario that typically involves five surface ships, two to three embarked helicopters, a submarine, and one maritime patrol aircraft searching for, locating, and attacking one submarine. The scenario consists of two 12-hour events that occur five times per year. The submarine may practice simulated attacks against the ships while being tracked. Hull-mounted, towed array, and dipping sonar is employed by ships and helicopters. The submarine also periodically operates its sonar.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Rotary-wing aircraft, submarine, surface combatant
Targets: Sub-surface targets, surface targets
Systems being Trained/Tested: Mid-frequency sonar, high-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials
Seafloor devices

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material</td><td>Sediments and Water Quality:
Chemicals
Metals</td></tr>
</table>

<table>
<tr><th colspan="5">Small Integrated Anti-Submarine Warfare Training</th></tr>
<tr><th colspan="5">Navy Undersea Warfare Training Assessment Course</th></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
Sub-surface targets, surface targets, sonobuoys (non-explosive), sonobuoy wires</td><td>Military Recoverable Material</td><td>Some sub-surface targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">Mid-Frequency:
MF1
MF3
MF4
MF5

High-Frequency:
HF1

Anti-Submarine Warfare:
ASW3
ASW4
Torpedoes:
TORP1 TORP2</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Acoustic Stressors: (Section 5.3.2)
Active sonar

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Towed in-water devices</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Two MK-39 Expendable Mobile Anti-Submarine Warfare Training Targets may be used in place of an actual submarine target.
Air deployed sonobuoys will have a decelerator/parachute.
Potential locations for this activity include Hawaii Range Complex (Warning Area 188[B], and Warning Area 193) and Southern California Range Complex (Southern California Anti-Submarine Warfare Range).
Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.</td></tr>
</table>

A.2.2.2 Surface Warfare Advanced Tactical Training

<table>
<tr><th colspan="4">Small Integrated Anti-Submarine Warfare Training</th></tr>
<tr><th colspan="4">Surface Warfare Advanced Tactical Training</th></tr>
<tr><td>Short Description</td><td colspan="2">Multiple ships and aircraft coordinate the use of sensors, including sonobuoys, to search, detect, and track a threat submarine. Surface Warfare Advanced Tactical Training exercises are not dedicated Anti-Submarine Warfare events and involve multiple warfare areas.</td><td>Typical Duration
Up to 15 days</td></tr>
<tr><td>Long Description</td><td colspan="3">Surface Warfare Advanced Tactical Training (SWATT) is an intermediate training exercise designed primarily to increase operator proficiency and exercise combined force responses to surface warfare, anti-submarine warfare, air warfare and electromagnetic spectrum operations.

Surface Warfare Advanced Tactical Training is conducted after a carrier strike group's first Group Sail, and before Composite Training Unit Exercise, and consists of multiple surface warfare, anti-submarine, and air warfare live-fire events. Multiple ships and aircraft search for, locate, and track one submarine. Occurs once per carrier strike group training cycle.

All other warfare area training conducted during SWATT was analyzed as unit-level training (gunnery, missile exercise, etc.).</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Multiple Surface Combatants, fixed-wing aircraft, helicopters, unmanned vehicles, and submarines
Targets: All surface, air and anti-submarine warfare targets (e.g., MK-30s, MK-39 Expendable Mobile Training Targets, recoverable or expendable floating targets)
Systems being Trained/Tested: Mid-frequency sonar, high-frequency sonar, lightweight torpedoes, high-frequency acoustic modems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Weapons firing safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise
Weapons noise

Explosive:
In-air explosives</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material
Sediments and Water Quality:
Explosives Chemicals
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
</table>

<table>
<tr><th colspan="4">Small Integrated Anti-Submarine Warfare Training</th></tr>
<tr><th colspan="4">Surface Warfare Advanced Tactical Training</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Target fragments, small-caliber projectiles, small decelerators/parachutes
Non-Ingestible Material:
Sonobuoys, large and medium-caliber projectiles, acoustic countermeasures</td><td>Military Recoverable Material</td><td>Anti-submarine warfare targets
Air warfare targets
Surface warfare targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">Mid-Frequency:
MF1
MF1K
MF3
MF4
MF5
MF6
MF12

High-Frequency:
HF1

Anti-Submarine Warfare:
ASW2
ASW3
ASW4
Torpedoes:
TORP1 TORP2

Acoustic Modems:
Yes</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Active sonar

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Towed in-water devices</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">All other warfare area training conducted during SWATT was analyzed as unit-level training (gunnery, missile exercise, etc.). All military expended materials, munitions, explosives and sonar use is included in individual unit-level events.
Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.</td></tr>
</table>

A.2.2.3 Submarine Command Course

<table>
<tr><th colspan="6">Medium Coordinated Anti-Submarine Warfare</th></tr>
<tr><th colspan="6">Submarine Command Course</th></tr>
<tr><td>Short Description</td><td colspan="3">Train prospective submarine Commanding Officers to operate against surface, air, and subsurface threats.</td><td>Typical Duration</td><td>16 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">Training for prospective Commanding Officers on submarines to operate against each other to locate and conduct simulated attacks. Submarine Commanders Course Operations is a Commander, U.S. Submarine Forces requirement to provide training to prospective submarine commanders in rigorous and realistic scenarios. This training assesses prospective commanding officers' abilities to operate in numerous hostile environments, encompassing surface vessels, aircraft, and other submarines.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Fixed-wing aircraft, rotary-wing aircraft, submarines, surface combatant
Targets: None
Systems being Trained/Tested: Mid-frequency sonar, high-frequency sonar, non-explosive torpedoes</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety
Towed in-water device safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
Wires and cables
Parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material</td><td colspan="2">Sediments and Water Quality:
Chemicals
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
Sonobuoys, (non-explosive), sonobuoy wires, acoustic countermeasures</td><td>Military Recoverable Material</td><td colspan="2">None</td></tr>
</table>

Medium Coordinated Anti-Submarine Warfare		
Submarine Command Course		
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF3 MF4 MF5 **High-Frequency:** HF1	**Anti-Submarine Warfare:** ASW3 ASW4 **Torpedoes:** TORP1 TORP2
Explosive Bins	None	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	Torpedoes are recovered. Guidance wire is brittle and breaks easily. Weights sink rapidly. Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.	

A.2.2.4 Independent Deployer Certification Exercise/Tailored Anti-Submarine Warfare Training

<table>
<tr><th colspan="5">Small Coordinated Anti-Submarine Warfare</th></tr>
<tr><th colspan="5">Independent Deployer Certification Exercise/Tailored Anti-Submarine Warfare Training</th></tr>
<tr><td>Short Description</td><td colspan="2">Multiple ships and helicopters integrate the use of their sensors, including sonobuoys, to search for, detect, classify, localize, and track a threat submarine to launch a torpedo.</td><td colspan="2">Typical Duration
2–3 days</td></tr>
<tr><td>Long Description</td><td colspan="4">This event stresses planning, coordination, and communications during multiple warfare training scenarios. Two or more ships and up to two helicopters searching for, locating, and attacking one submarine. Typically, one ship and helicopter are actively prosecuting while the other ship and helicopter are repositioning. Simultaneously, the submarine may practice simulated attacks against the ships. Multiple acoustic sources may be active at one time.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Fixed-wing aircraft, rotary-wing aircraft, submarines, surface combatant
Targets: Sub-surface targets
Systems being Trained/Tested: Mid-frequency sonar, high-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Towed in-water device safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex;
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="4">Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise

Explosive:
None

Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions

Energy:
In-air electromagnetic devices

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material

Sediments and Water Quality:
Chemicals
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
Acoustic countermeasures, sonobuoys (non-explosive), sonobuoy wires</td><td>Military Recoverable Material</td><td>Sub-surface targets</td></tr>
</table>

Small Coordinated Anti-Submarine Warfare			
Independent Deployer Certification Exercise/Tailored Anti-Submarine Warfare Training			
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF3 MF4 MF5 MF11	**Anti-Submarine Warfare:** ASW2 ASW3 ASW4	**High-Frequency:** HF1
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	Potential locations for this activity in the Southern California Range Complex includes Southern California Anti-Submarine Warfare Range. Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.		

A.2.2.5 Group Sail

<table>
<tr><th colspan="4">Small Coordinated Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Group Sail</th></tr>
<tr><td>Short Description</td><td colspan="2">Surface ships and helicopters integrate to search for, detect, and track threat submarines. Group Sails are not dedicated anti-submarine warfare events and involve multiple warfare areas.</td><td>Typical Duration
2–3 days</td></tr>
<tr><td>Long Description</td><td colspan="3">Multiple ships and rotary-wing aircraft integrate the use of their sensors, including sonobuoys, to search for, detect, classify, localize, and track threat submarines.

Group Sail is not a dedicated anti-submarine warfare event and involves multiple warfare areas. Group Sail is an intermediate training exercise primarily intended to introduce coordinated operations after unit-level training and prior to integrated training. This event stresses planning, coordination, and communications during multiple warfare training scenarios.

Two or more ships and up to two rotary-wing aircraft search for, locate, and attack one submarine. Typically, one ship and rotary-wing aircraft are actively prosecuting while the other ship and rotary-wing aircraft are repositioning. Simultaneously, the submarine may practice simulated attacks against the ships. Multiple acoustic sources may be active at one time.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft, rotary-wing aircraft, surface combatant(s), submarine(s)
Targets: Sub-surface
Systems being Trained/Tested: Sonar systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel Safety
Aircraft safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex;
Southern California Range Complex

Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended material

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
None

Entanglement:
Parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material</td><td>Sediments and Water Quality:
Chemicals
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
</table>

<table>
<tr><th colspan="4">Small Coordinated Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Group Sail</th></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes

Non-Ingestible Material:
Acoustic countermeasures, sonobuoys (non-explosive), expendable bathythermograph, subsurface targets, missiles, rockets</td><td>Military Recoverable Material</td><td>Some subsurface targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">Mid-Frequency:
MF1 MF5 ASW2 ASW4
MF3 MF11 ASW3
MF4 MF12

High-Frequency:
HF1</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Acoustic Stressors: (Section 5.3.2)
Active sonar

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Non-explosive missiles and rockets</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">While preference will be to train against an actual submarine or MK 30 recoverable target, assume only MK 39 expendable targets will be used.
One MK 39 Expendable Mobile Anti-Submarine Warfare Training Target may be used in place of an actual submarine target.
Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.</td></tr>
</table>

A.2.3 AIR WARFARE TRAINING

Air warfare is the primary mission area that addresses combat operations by air and surface forces against hostile aircraft. Navy ships contain an array of modern anti-aircraft weapon systems, including naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled guns for close-in point defense. Strike/fighter aircraft carry anti-aircraft weapons, including air-to-air missiles and aircraft guns. Air warfare training encompasses events and exercises to train ship and aircraft crews in employment of these weapons systems against simulated threat aircraft or targets. Air warfare training includes surface-to-air gunnery, surface-to-air and air-to-air missile exercises, and aircraft force-on-force combat maneuvers.

A.2.3.1 Air Combat Maneuver

Air Warfare				
Air Combat Maneuver				
Short Description	Fixed-wing aircrews aggressively maneuver against threat aircraft to gain tactical advantage.	**Typical Duration**	1–2 hours	
Long Description	Basic flight maneuvers in which fixed-wing aircrew engage in offensive and defensive maneuvering against each other. During air combat maneuver engagements, no ordnance is fired, however countermeasures such as chaff and flares may be used. These maneuvers typically involve two aircraft; however, based upon the training requirement, air combat maneuver exercises may involve over a dozen aircraft.			
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** Air targets **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise	**Physical Disturbance and Strike:** Aircraft and aerial targets	**Energy:** In-air electromagnetic devices	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** Metals		
	Habitats: None			
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** None	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	None			

Air Warfare	
Air Combat Maneuver	
Assumptions Used for Analysis	No munitions fired. Flare and chaff may be used. All flare and chaff accounted for in flare exercise and chaff exercise events. Potential locations for this activity include: Hawaii Range Complex (Hawaii OPAREA), and Southern California Range Complex (Warning area 291 [Tactical Maneuvering Areas]). For air quality analysis: - 3 fixed-wing fighter aircraft per event - 1 manned high-performance aircraft per event - Average 1 hr. per event Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.

A.2.3.2 Air Defense Exercise

Air Warfare			
Air Defense Exercise			
Short Description	Aircrew and ship crews conduct defensive measures against threat aircraft or simulated missiles.	**Typical Duration**	1–4 hours
Long Description	Fixed-wing aircrew and ship personnel perform measures designed to defend against attacking threat aircraft or missiles or reduce the effectiveness of such attack. This exercise involves full detection through engagement sequence. Aircraft operate at varying altitudes and speeds. During this exercise, no ordnance is fired, however countermeasures such as chaff and flares may be used. This exercise may include air intercept control exercises where aircraft controllers on ships, in fixed-wing aircraft, or at land-based locations use search radars to track and direct friendly aircraft to intercept the threat aircraft, and to engage exercises where personnel on ships use search radars to detect, classify, and track enemy aircraft or missiles up to the point of engagement.		
Typical Components	**Platforms:** Fixed-wing aircraft, surface combatant **Targets:** Air targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Air Warfare	
Air Defense Exercise	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	No munitions are fired. Potential locations for this activity include Hawaii Range Complex (Warning Areas 188, 189, 190, 192, 193, and 194), and Southern California Range Complex (Warning Area 291). For air quality analysis: - 3 fixed-wing fighter aircraft per event - 1 manned high-performance aircraft per event - Average 1 hour per event

A.2.3.3 Gunnery Exercise Air-to-Air Medium-Caliber

Air Warfare			
Gunnery Exercise Air-to-Air Medium-Caliber			
Short Description	Fixed-wing aircrews fire medium-caliber guns at air targets.	**Typical Duration**	1–2 hours
Long Description	Fixed-wing aircrews maneuver aircraft in a gunnery pattern to achieve a weapons firing solution with integrated medium-caliber guns. Typically involves two or more fixed-wing aircraft and a target banner towed by a contract aircraft (e.g., Lear jet). The target banner is recovered after the event.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** Air targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Weapons firing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Weapons noise	**Physical Disturbance and Strike:** Aircraft and aerial targets Military expended materials	**Energy:** In-air electromagnetic devices
	Explosive: None	**Ingestion:** Military expended materials – munitions	**Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Medium-caliber projectiles **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Small-, medium-, and large-caliber non-explosive practice munitions		

Air Warfare	
Gunnery Exercise Air-to-Air Medium-Caliber	
Assumptions Used for Analysis	This activity is conducted at an altitude of 15,000 feet and above, during the daytime, and approximately 40 nautical miles from shore. A towed air target is a banner target and will be recovered. Only non-explosive munitions used. Potential locations for this activity include Warning Area 291. For air quality analysis: - One fixed-wing fighter aircraft per event - Average 2 hours per event

A.2.3.4 Gunnery Exercise Surface-to-Air Large-Caliber

<table>
<tr><th colspan="6">Air Warfare</th></tr>
<tr><th colspan="6">Gunnery Exercise Surface-to-Air Large-Caliber</th></tr>
<tr><td>Short Description</td><td colspan="3">Surface ship crews fire large-caliber guns at air targets.</td><td>Typical Duration</td><td>1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">Surface ship crews defend against threat aircraft or missiles with large-caliber guns to disable or destroy the threat.

An event involves one ship and a simulated threat aircraft or missile that is detected by the ship's radar. Large-caliber guns fire non-explosive projectiles at the threat before it reaches the ship. The target is towed by a contract air services jet.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Aircraft carrier, amphibious warfare ship, fixed-wing aircraft, surface combatant
Targets: Air targets
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety
Weapons firing safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Aircraft noise
Vessel noise
Weapons noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material
Sediments and Water Quality:
Explosives Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Large-caliber projectile fragments
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
</table>

Air Warfare	
Gunnery Exercise Surface-to-Air Large-Caliber	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	The target is a fiberglass finned target that is towed approximately 3 nautical miles behind the towing aircraft. All projectiles are assumed to be non-explosive. Potential locations for this activity include Hawaii Range Complex (Warning Areas 188, 192, 193, 194, and Mela South) and Southern California Range Complex (Warning Area 291).

A.2.3.5 Gunnery Exercise Surface-to-Air Medium-Caliber

Air Warfare			
Gunnery Exercise Surface-to-Air Medium-Caliber			
Short Description	Surface ship crews fire medium-caliber guns at air targets.	**Typical Duration**	1–2 hours
Long Description	Surface ship crews defend against threat aircraft or missiles with medium-caliber guns to disable or destroy the threat. An event involves one ship and a simulated threat aircraft or anti-ship missile that is detected by the ship's radar. Medium-caliber guns fire non-explosive projectiles to disable or destroy the threat before it reaches the ship. The target is towed by a contract air services jet.		
Typical Components	**Platforms:** Aircraft carrier, amphibious warfare ship, fixed-wing aircraft, surface combatant **Targets:** Air targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex Hawaii-Southern California Training and Testing Transit Corridor	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** In-air explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Medium-caliber projectile fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Air Warfare	
Gunnery Exercise Surface-to-Air Medium-Caliber	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	The target is a fiberglass finned target that is towed approximately 3 nautical miles behind the towing aircraft. Potential locations for this activity include Hawaii Range Complex (Warning Areas 188, 192, and Mela South) and Southern California Range Complex (Warning Area 291).

A.2.3.6 Missile Exercise Air-to-Air

<table>
<tr><td colspan="6">Air Warfare</td></tr>
<tr><td colspan="6">Missile Exercise Air-to-Air</td></tr>
<tr><td>Short Description</td><td colspan="3">Fixed-wing aircrews fire air-to-air missiles at air targets.</td><td>Typical Duration</td><td>1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">An event involves two or more fixed-wing aircraft and a target. Missiles are either high-explosive warheads or non-explosive practice munitions. The target is an unmanned aerial target drone, a tactical air-launched decoy, or a parachute suspended illumination flare. Target drones deploy parachutes and are recovered by small boat or rotary-wing aircraft; tactical air-launched decoys and illumination flares are expended and not recovered. These events typically occur at high altitudes.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Fixed-wing aircraft; rotary-wing aircraft; small boat
Targets: Air targets, flares
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety
Weapons firing safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Aircraft noise
Vessel noise
Weapons noise

Explosive:
In-air explosives</td><td colspan="2">Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material
Sediments and Water Quality:
Explosives Chemicals
Metals Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Target and missile (explosive) fragments
Non-Ingestible Material:
Medium parachutes (from illumination flares)</td><td>Military Recoverable Material</td><td colspan="2">Undamaged targets, large or extra-large parachutes (recovered with drones)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
</table>

Air Warfare	
Missile Exercise Air-to-Air	
Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement **Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets
Assumptions Used for Analysis	Assumes that all missiles are explosive, although non-explosive practice munitions may be used. All missiles explode at high altitude. All propellant and explosives are consumed. Assume 1.5 flares per Missile Exercise event. Potential specific locations for this activity include: Hawaii OPAREA



Figure A.2-1: BQM-74 (Aerial Target)



Figure A.2-2: LUU-2B/B Illuminating Flare (Aerial Target)



Figure A.2-3: Tactical Air-Launched Decoy (Aerial Target)

A.2.3.7 Missile Exercise—Man Portable Air Defense System

Air Warfare			
Missile Exercise –Man-Portable Air Defense System			
Short Description	Personnel employ a shoulder-fired surface-to-air missile at air targets.	**Typical Duration**	Varies
Long Description	Personnel employ the man-portable air defense systems, a shoulder-fired surface-to-air missile, against threat missiles or aircraft. An event involves personnel firing the man-portable air defense system at remote piloted or ballistic aerial targets. Activity is typically conducted by combat forces firing from shore locations at targets over the water.		
Typical Components	**Platforms:** None **Targets:** Air Targets **Systems being Trained/Tested:** Man Portable Defense Systems		
Standard Operating Procedures *(Section 2.3.3)*	Weapons firing safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Weapons noise **Explosive:** In-air explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Explosives Chemicals Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Target and missile (explosive) fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Air Warfare		
Missile Exercise –Man-Portable Air Defense System		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive missiles and rockets	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets
Assumptions Used for Analysis	For analysis, all missiles are assumed to be explosive, although non-explosive practice munitions may be used. All missiles explode in-air at low altitude. All propellant and explosives are consumed. Potential locations for this activity include Shore Bombardment Area.	

A.2.3.8 Missile Exercise Surface-to-Air

Air Warfare			
Missile Exercise Surface-to-Air			
Short Description	Surface ship crews fire surface-to-air missiles at air targets.	**Typical Duration**	1–2 hours
Long Description	Surface ship crews defend against threat missiles and aircraft with ship-launched surface-to-air missiles. The event involves a simulated threat aircraft, anti-ship missile, or land attack missile, which is detected by the ship's radar. Ship-launched surface-to-air missiles are fired (high-explosive) to disable or destroy the threat. The target typically is a remote-controlled drone. Target drones deploy parachutes and are recovered by small boat or rotary-wing aircraft; when used, tactical air-launched decoys are not recovered.		
Typical Components	**Platforms:** Aircraft carrier, amphibious warfare ship, surface combatant **Targets:** Air targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** In-air explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Target and missile (explosive) fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	Undamaged targets, large or extra-large parachutes (recovered with drones)
Sonar and Other Transducer Bins	None		

Air Warfare		
Missile Exercise Surface-to-Air		
Explosive Bins	None	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets
Assumptions Used for Analysis	Assumes that all surface-to-air missiles are high-explosive. Missile explodes well above surface. All explosive and propellant are consumed. Potential locations for this activity include Hawaii Range Complex (Warning Area 188), and Southern California Range Complex (Warning Area 291).	

A.2.4 AMPHIBIOUS WARFARE TRAINING

Amphibious warfare is a type of naval warfare involving the utilization of naval firepower, logistics, and Marine Corps landing forces to project military power ashore. Amphibious warfare encompasses a broad spectrum of activities involving maneuver from the sea to objectives ashore, ranging from reconnaissance or raid missions involving a small unit, to large-scale amphibious operations involving over one thousand Marines and Sailors, and multiple ships and aircraft embarked in a strike group.

Amphibious warfare training includes tasks at increasing levels of complexity, from individual, crew, and small unit events to large task force exercises. Individual and crew training include the operation of amphibious vehicles and naval gunfire support training. Small-unit training activities include shore assaults, boat raids, airfield or port seizures, and reconnaissance. Larger-scale amphibious exercises involve ship-to-shore maneuver, shore bombardment and other naval fire support, and air strike and close air support training.

A.2.4.1 Amphibious Assault

<table>
<tr><th colspan="5">Amphibious Warfare</th></tr>
<tr><th colspan="5">Amphibious Assault</th></tr>
<tr><td>Short Description</td><td colspan="2">Large unit forces move ashore from amphibious ships at sea for the immediate execution of inland objectives.</td><td colspan="2">Typical Duration
Up to 2 weeks</td></tr>
<tr><td>Long Description</td><td colspan="4">Large unit forces move ashore from amphibious ships at sea for the immediate execution of inland objectives. Amphibious assault is conducted for the purposes of prosecuting further combat operations, obtaining a site for an advanced naval or airbase, or denying the enemy use of an area.

Unit-Level Training exercises involve one or more amphibious ships, and their associated watercraft and aircraft, to move personnel and equipment from ship to shore without the command and control and supporting elements involved in a full-scale event. The goal is to practice loading, unloading, and movement, and to develop the timing required for a full-scale exercise.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Amphibious warfare ship, fixed-wing aircraft, rotary-wing aircraft, small boat, tilt-rotor aircraft
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Silver Strand Training Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise
Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Ingestion:
None</td><td>Energy:
In-air electromagnetic devices
Entanglement:
None</td><td></td></tr>
</table>

<table>
<tr><th colspan="5">Amphibious Warfare</th></tr>
<tr><th colspan="5">Amphibious Assault</th></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Air Quality:
Criteria air pollutants
Habitats:
None
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Typical event: 1–3 amphibious ships (e.g., LHA or LHD, LPD, LSD); 2-8 landing craft (landing craft, air cushioned; landing craft, utility); 4–14 amphibious assault vehicles; up to 22 aircraft (e.g., MH-53, H-46/MV-22, AH-1, UH-1, AV-8); a Marine Expeditionary Unit (2,200 Marines). Potential locations for this activity include Pacific Missile Range Facility (Main Base), Kawaihae Harbor, Marine Corps Training Area Bellows, Marine Corps Base Hawaii, San Clemente Island, Shore Bombardment Area, Shallow Water Training Range (nearshore), Eel Cove, West Cove, Wilson Cove, Camp Pendleton Amphibious Assault Area, and Silver Strand Training Complex Boat Lanes 11–14.
For air quality analysis:
- 4 fixed-wing strike aircraft
- 10 rotary-wing aircraft
- 12 small surface craft
- 4 V-22 Osprey aircraft
- Average 1 hour per event</td></tr>
</table>

A.2.4.2 Amphibious Assault—Battalion Landing

Amphibious Warfare			
Amphibious Assault—Battalion Landing			
Short Description	Marine Corps Battalion Landing Team forces launch an attack from sea to a hostile shore for the immediate execution of inland maneuvers.	**Typical Duration**	3 days
Long Description	Marine Corps Battalion Landing Team moves from amphibious ships at sea, into hostile territory, establishes a beachhead, then occupies the area or moves further inland for an extended period. Battalion Landing Team is a task organization composed of an infantry battalion reinforced by combat support and Combat Service Support units for amphibious assaults. The Battalion Landing Team is the ground force element of a Marine Expeditionary Unit when formed into a Marine Air-Ground Task Force.		
Typical Components	**Platforms:** Amphibious warfare ship, fleet support ship **Targets:** Land targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel	**Typical Locations**	
		Range Complexes/Testing Ranges: Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise	**Physical Disturbance and Strike:** Vessels and in-water devices	**Energy:** In-air electromagnetic devices
	Explosive: None	**Ingestion:** None	**Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None	
	Habitats: None		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	Impacts from land based targeting are not analyzed. Only the at-sea components of this activity are analyzed in this document. Potential locations for this activity include Camp Pendleton Amphibious Assault Area, San Clemente Island, Shore Bombardment Area, Shallow Water Training Range (Nearshore), Eel Cove, West Cove, and Wilson Cove.		

A.2.4.3 Amphibious Marine Expeditionary Unit Exercise

<table>
<tr><th colspan="6">Amphibious Warfare</th></tr>
<tr><th colspan="6">Amphibious Marine Expeditionary Unit Exercise</th></tr>
<tr><td>Short Description</td><td colspan="3">Navy and Marine Corps forces conduct unit level training at sea in preparation for deployment.</td><td>Typical Duration</td><td>5–7 days</td></tr>
<tr><td>Long Description</td><td colspan="5">Amphibious ships and embarked Marine Expeditionary Units train to a multitude of scenarios to test the capabilities of the amphibious force. Operations include ship to shore movement with tiltrotor aircraft and Landing Craft Air Cushion vessels. Marine Corps forces conduct more advanced amphibious operations to include small boat raids; visit, board, search, and seizure training; helicopter and mechanized amphibious raids; and non-combatant evacuation operations. This exercise generally occurs during an Expeditionary Strike Group Composite Training Unit Exercise. All military expended materials, explosives, and use of other munitions in Amphibious Ready Group Marine Expeditionary Unite Exercise are included in unit-level events.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Amphibious warfare ships, fixed-wing aircraft, rotary-wing aircraft, small boats, surface combatants, tiltrotor aircraft
Targets: None
Systems Being Trained/Tested: Sonar systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety
Towed in-water device safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise

Explosives:
None</td><td colspan="2">Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices
In-water electromagnetic devices

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants

Habitats:
Physical disturbance and strike – military expended material</td><td colspan="2">Sediments and Water Quality:
Metals
Chemicals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility</td><td colspan="2">Public Health and Safety:
None</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes

Non-Ingestible Material:
Sonobuoys, acoustic countermeasures</td><td>Military Recoverable Material</td><td colspan="2">Anti-submarine warfare targets</td></tr>
</table>

Amphibious Warfare		
Amphibious Marine Expeditionary Unit Exercise		
Sonar and Other Transducer Bins	**Low-Frequency:** LF6 **Mid-Frequency:** MF1 MF11 MF3 MF12	**High-Frequency:** HF1 **Anti-Submarine Warfare:** ASW1
In-Water Explosive Bins	Analyzed in individual unit-level training events.	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	Sonar is not used during every exercise. Stressors to human resources were not analyzed for this activity since it occurs greater than 12 NM from shore.	

A.2.4.4 Amphibious Marine Expeditionary Unit Integration Exercise

Amphibious Warfare				
Amphibious Marine Expeditionary Unit Integration Exercise				
Short Description	Navy and Marine Corps forces conduct integration training at sea in preparation for deployment.	**Typical Duration**	Up to 3 weeks	
Long Description	Amphibious ships and Marine Expeditionary Unit integrate for the first time at sea to practice amphibious tactics, techniques, and procedures. Navy and Marine Corps forces conduct basic amphibious operations to include small boat raids; visit, board, search, and seizure training; helicopter and mechanized amphibious raids.			
Typical Components	**Platforms:** Amphibious warfare ships, fixed-wing aircraft, rotary-wing aircraft, small boats, tiltrotor aircraft **Targets:** None **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices	**Energy:** In-air electromagnetic devices	
	Explosives: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None		
	Habitats: None			
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions In-air energy	
Military Expended Material	**Ingestible Material:** None	**Military Recoverable Material**	None	
	Non-Ingestible Material: None			
Sonar and Other Transducer Bins	None			
In-Water Explosive Bins	None			
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement			
Assumptions Used for Analysis	Weapons firing during this exercise is discussed under descriptions of appropriate unit-level exercises (e.g., surface-to-surface and air-to-surface small-caliber gunnery exercises).			

A.2.4.5 Amphibious Raid

Amphibious Warfare				
Amphibious Raid				
Short Description	Small unit forces move from amphibious ships at sea for a specific short-term mission. These are quick operations with as few personnel as possible.	**Typical Duration**	4–8 hours	
Long Description	Small unit forces swiftly move from amphibious vessels at sea into hostile territory for a specific mission, including a planned withdrawal. Raids are conducted to inflict loss or damage, secure information, create a diversion, confuse the enemy, or capture or evacuate individuals or material. Amphibious raid forces are kept as small as possible to maximize stealth and speed of the operation. An event may employ assault amphibian vehicle units, small boats, small unit live-fire and non-live-fire operations. Surveillance or reconnaissance unmanned surface and aerial vehicles may be used during this event.			
Typical Components	**Platforms:** Amphibious warfare ship, small boats, unmanned aerial system **Targets:** Land Targets **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Southern California Range Complex Silver Strand Training Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices	**Energy:** In-air electromagnetic devices	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None		
	Habitats: None			
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			

Amphibious Warfare	
Amphibious Raid	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Weapons firing during this event is discussed in appropriate activity descriptions (e.g., surface-to-surface and air-to-surface small-caliber gunnery exercises). Potential locations for this activity include Southern California Range Complex (West Cove, Horse Beach, Northwest Harbor, Pyramid Cove, Camp Pendleton Amphibious Assault Area), and Silver Strand Training Complex (Boat Lanes 1–8, 11–14 [Bravo, Delta I, II, III, Echo, Eel Point, Foxtrot, Golf, Hotel]). For air quality analysis: - 1 small boat - Average 8 hours per event

A.2.4.6 Amphibious Ready Group/Marine Expeditionary Unit Certification Exercise

Amphibious Warfare			
Amphibious Ready Group/Marine Expeditionary Unit Certification Exercise			
Short Description	Navy and Marine Corps forces conduct advanced training at sea in preparation for deployment.	**Typical Duration**	Up to 3 weeks
Long Description	Amphibious ships and embarked Marine Expeditionary Unit train to a multitude of scenarios to test the capabilities of the amphibious force. Operations include ship to shore movement with tilt-rotor aircraft and Landing Craft Air Cushion vessels. Marine Corps forces conduct more advanced amphibious operations to include small boat raids; visit, board, search, and seizure training; helicopter and mechanized amphibious raids; and non-combatant evacuation operations. This exercise generally occurs during a composite training unit exercise.		
Typical Components	**Platforms:** Amphibious warfare ship, combat logistics ship, rotary-wing aircraft, small boat, submarines, surface combatant, tilt-rotor aircraft **Targets:** None **Systems being Trained/Tested:** Mid-frequency sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex (including Point Mugu portion of Study Area)	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1		
Explosive Bins	None		

Amphibious Warfare		
Amphibious Ready Group/Marine Expeditionary Unit Certification Exercise		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	For air quality analysis: - 8 rotary-wing aircraft - 15 small surface craft - 5 V-22 Osprey aircraft - Average 24 hours per event Additional activities utilizing sources not listed in the Sonar and Other Transducer Bins section above may occur during this exercise. All acoustic sources which may be used during training and testing activities have been accounted for in the modeling and analysis presented in this EIS/OEIS.	

A.2.4.7 Expeditionary Fires Exercise/Supporting Arms Coordination Exercise

Amphibious Warfare				
Expeditionary Fires Exercise/Supporting Arms Coordination Exercise				
Short Description	Military units provide integrated and effective close air support, Naval Surface Fire Support fire, and Marine Corps artillery fire in support of amphibious operations.	**Typical Duration**	8–12 days	
Long Description	Military units provide integrated and effective close air support, Naval Surface Fire Support fire, and Marine Corps artillery fire in support of amphibious operations. The mission of the exercise is to achieve effective integration of Naval gunfire, close air support, and Marine Corps artillery fire support.			
Typical Components	**Platforms:** Amphibious warfare ship, fixed-wing aircraft, rotary-wing aircraft **Targets:** Land targets **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Aircraft and aerial target strike **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Weapons firing noise	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		

Amphibious Warfare	
Expeditionary Fires Exercise/Supporting Arms Coordination Exercise	
Assumptions Used for Analysis	Impacts from land based targeting are not analyzed. Only the at-sea components of this activity are analyzed in this document. Potential locations for this activity include Shore Bombardment Area

A.2.4.8 Humanitarian Assistance Operations

Amphibious Warfare				
Humanitarian Assistance Operations				
Short Description	Military units evacuate noncombatants from hostile or unsafe areas or provide humanitarian assistance in times of disaster.	**Typical Duration**	12 hours	
Long Description	Military units evacuate noncombatants from hostile or unsafe areas to safe havens or to provide humanitarian assistance in times of disaster. Non-Combatant Evacuation Operation is conducted by military units (generally Marine Corps) usually operating in conjunction with Navy ships and aircraft. Non-combatants are evacuated when their lives are endangered by war, civil unrest, or natural disaster. Marine Corps Marine expeditionary units train for evacuations in hostile environments that require the use of force, though usually there is no opposition to evacuation from the host country. Helicopters and landing crafts could be expected to participate in this operation during day or night.			
Typical Components	**Platforms:** Amphibious warfare ship, rotary-wing aircraft, tilt-rotor aircraft **Targets:** None **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Silver Strand Training Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement			

Amphibious Warfare	
Humanitarian Assistance Operations	
Assumptions Used for Analysis	Potential locations for this activity in the Hawaii Range Complex include Pacific Missile Range Facility). For air quality analysis: - 1 rotary-wing aircraft - 1 V-22 Osprey aircraft - Average 12 hours per event

A.2.4.9 Naval Surface Fire Support Exercise—At Sea

<table>
<tr><td colspan="5">Amphibious Warfare</td></tr>
<tr><td colspan="5">Naval Surface Fire Support Exercise—At Sea</td></tr>
<tr><td>Short Description</td><td colspan="2">Surface ship crews fire large-caliber guns at a passive acoustic hydrophone scoring system.</td><td>Typical Duration</td><td>1–2 hours of firing, 8 hours total</td></tr>
<tr><td>Long Description</td><td colspan="4">Surface ship crews use large-caliber guns to support forces ashore; however, the land target is simulated at sea. Rounds are scored by passive acoustic buoys located at or near the target area.
The scoring system is comprised of hydrophones permanently installed on the ocean floor as part of the Barking Sands Tactical Underwater Range west of Kauai. A scoring system provides a realistic presentation, such as a land mass with topography, to the vessel's combat system. This virtual land target area overlays the hydrophone array. The vessel fires its ordnance into the target area and the acoustic noise resulting from the impact of the round landing in the water is detected by the hydrophones. The scoring system triangulates the exact point of impact of the round, allowing the exercise to be conducted as if the vessel were firing at an actual land target. Surface ship crews use large-caliber (main battery) guns to support forces ashore.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Surface combatant
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Weapons firing safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="4">Acoustic:
Vessel noise
Weapons noise

Explosive:
In-water explosives

Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material

Sediments and Water Quality:
Explosives Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
Explosives
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Large-caliber shell fragments
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">E5</td></tr>
</table>

Amphibious Warfare		
Naval Surface Fire Support Exercise—At Sea		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Weapons firing noise **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions	**Explosive Stressors:** *(Section 5.3.3)* Explosive medium-caliber and large-caliber projectiles
Assumptions Used for Analysis	Events occur greater than 12 nautical miles from shore. Non-explosive practice munitions may be used when acoustic sensors can detect projectile splash. High explosives may be used during all other events. Assume all explosive rounds detonate on impact with water surface. Potential locations for this activity include Warning Area-188 (including Barking Sands Underwater Range Extension and Barking Sands Tactical Underwater Range).	

A.2.4.10 Naval Surface Fire Support Exercise—Land-Based Target

Amphibious Warfare				
Naval Surface Fire Support Exercise—Land-Based Target				
Short Description	Surface ship crews fire large-caliber guns at land-based targets in support of forces ashore.	**Typical Duration** 1–2 hours		
Long Description	Surface ship crews use large-caliber guns to support forces ashore. One or more ships position themselves up to six nautical miles from the target area and a land-based spotter relays type and exact location of the target. After observing the fall of the shot, the spotter relays any adjustments needed to reach the target. Once the rounds are on target, the spotter requests a sufficient number to effectively destroy the target. This exercise occurs on land ranges where high-explosive and non-explosive practice ordnance is authorized and is often supported by target shapes such as tanks, trucks, trains, or aircraft on the ground.			
Typical Components	**Platforms:** Surface combatant **Targets:** Land Targets **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended material **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Military expended material	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Large-caliber projectiles (casings only)	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Weapons firing noise	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions		

Amphibious Warfare	
Naval Surface Fire Support Exercise—Land-Based Target	
Assumptions Used for Analysis	Projectile impact is on land and is not further analyzed. No land based impacts are included in this document. Potential locations for this activity include Shore Bombardment Area

A.2.5 ANTI-SUBMARINE WARFARE TRAINING

Anti-submarine warfare involves helicopter and maritime patrol aircraft, ships, and submarines. These units operate alone or in combination to locate, track, and neutralize submarines. Controlling the undersea battlespace is a unique naval capability and a vital aspect of sea control. Undersea battlespace dominance requires proficiency in anti-submarine warfare. Every deploying strike group and individual surface combatant must possess this capability.

Various types of active and passive sonar are used by the Navy to determine water depth, and identify, track, and target submarines. Passive sonar "listens" for sound waves by using underwater microphones, called hydrophones, which receive, amplify, and process underwater sounds. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character, and movement of submarines. However, passive sonar provides only a bearing (direction) to a sound-emitting source; it does not provide an accurate range (distance) to the source. Active sonar is needed to locate objects because active sonar provides both bearing and range to the detected contact (such as an enemy submarine).

The Navy's anti-submarine warfare training plan, including the use of active sonar in at-sea training scenarios, includes multiple levels of training. Individual-level anti-submarine warfare training addresses basic skills such as detection and classification of contacts, distinguishing discrete acoustic signatures including those of ships, submarines, and marine life, and identifying the characteristics, functions, and effects of controlled jamming and evasion devices.

More advanced, integrated anti-submarine warfare training exercises involving active sonar are conducted in coordinated, at-sea operations during training events involving submarines, ships, aircraft, and helicopters. This training integrates the full anti-submarine warfare continuum from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises against "enemy" submarine contacts; torpedo employment exercises against the target; and exercising command and control tasks in a multi-dimensional battlespace.

A.2.5.1 Torpedo Exercise—Helicopter

Anti-Submarine Warfare			
Anti-Submarine Warfare Torpedo Exercise - Helicopter			
Short Description	Helicopter crews search for, track, and detect submarines. Recoverable air launched torpedoes are employed against submarine targets.	**Typical Duration**	2–5 hours
Long Description	Helicopters using sonobuoys and dipping sonar search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys (both passive and active) are typically employed by a helicopter operating at altitudes below 3,000 feet (ft.). Dipping sonar (both passive and active) is employed from an altitude of about 50 ft. after the search area has been narrowed based on the sonobuoy search. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or occur during a coordinated larger exercise involving multiple aircraft and ships, including a major range event. Unmanned aerial systems, such as the MQ-8 Fire Scout, may also be used. The exercise torpedo is recovered by a special recovery helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other areas within the Study Area depending on training requirements and available assets.		
Typical Components	**Platforms:** Rotary-wing aircraft, unmanned aerial system, small boat **Targets:** Sub-surface targets **Systems being Trained/Tested:** Mid-frequency sonar, torpedoes		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Anti-Submarine Warfare Torpedo Exercise - Helicopter</th></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Recoverable Anti-Submarine Warfare Training Targets, Exercise Torpedoes</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">Mid-Frequency:
MF4 MF5
Torpedoes:
TORP1</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td colspan="2">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Potential locations for this activity in the Hawaii Range Complex include Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, and Shallow Water Training Range. Locations within the Southern California Range Complex include Southern California Anti-Submarine Warfare Range, and Shallow Water Training Range.
For air quality analysis:
- 1 rotary-wing aircraft per event
- 1 target per event
- Average 2 hours per event</td></tr>
</table>

A.2.5.2 Torpedo Exercise—Maritime Patrol Aircraft

Anti-Submarine Warfare			
Anti-Submarine Warfare Torpedo Exercise—Maritime Patrol Aircraft			
Short Description	Maritime patrol aircraft crews search for, track, and detect submarines. Recoverable air launched torpedoes are employed against submarine targets.	**Typical Duration**	2–8 hours
Long Description	Fixed-wing maritime patrol aircraft employ sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys (both passive and active) are typically employed by a maritime patrol aircraft operating at altitudes below 3,000 feet. However, sonobuoys may be released at higher altitudes. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. Depending on these two factors, these patterns will cover many different size areas. For certain sonobuoys, tactical parameters of use may be classified. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event. The exercise torpedo is recovered by helicopter or small boat. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other Operations Areas depending on training requirements and available assets.		
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft, small boats **Targets:** Sub-surface targets **Systems being Trained/Tested:** Mid-frequency sonar, torpedoes		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Vessel safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessel & in-water device Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

Anti-Submarine Warfare			
Anti-Submarine Warfare Torpedo Exercise—Maritime Patrol Aircraft			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Lightweight torpedo accessories, sonobuoys (non-explosive), sonobuoy wires, expendable sub-surface targets	**Military Recoverable Material**	Recoverable sub-surface targets, lightweight torpedoes (non-explosive)
Sonar and Other Transducer Bins	**Mid-Frequency:** MF5	**Torpedoes:** TORP1	
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Submarine may provide service as the target. If target is air-dropped, one parachute per target. Potential locations for this activity in the Hawaii Range Complex include Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, and Shallow Water Training Range. Locations within the Southern California Range Complex include Southern California Anti-Submarine Warfare Range, and Shallow Water Training Range (offshore and nearshore). For air quality analysis: - 1 fixed-wing patrol aircraft per event - Average 6 hours per event		

A.2.5.3 Torpedo Exercise—Ship

Anti-Submarine Warfare			
Anti-Submarine Warfare Torpedo Exercise—Ship			
Short Description	Surface ship crews search for, track, and detect submarines. Exercise torpedoes are used during this event.	**Typical Duration**	2–5 hours
Long Description	Surface ships search for, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine. A surface ship operates at slow speeds while employing hull mounted or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The anti-submarine warfare target used for this exercise is a MK-39 Expendable Mobile Anti-Submarine Warfare (ASW) Training Target, MK-30 Target, or live submarine. This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other range complexes depending on training requirements and available assets.		
Typical Components	**Platforms:** Rotary-wing aircraft, small boat, surface combatant **Targets:** Sub-surface targets **Systems being Trained/Tested:** Mid-frequency sonar, torpedoes		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex Point Mugu Sea Range Overlap	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

Anti-Submarine Warfare			
Anti-Submarine Warfare Torpedo Exercise—Ship			
Military Expended Material	**Ingestible Material:** Lightweight Torpedo Accessories **Non-Ingestible Material:** Expendable Bathythermograph, Lightweight Torpedo Accessories, Expendable ASW Training Targets	**Military Recoverable Material**	Recoverable ASW Training Targets, Exercise Torpedoes
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1	**Anti-Submarine Warfare:** ASW3 **Torpedoes:** TORP1	
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices		
Assumptions Used for Analysis	Submarines may provide service as the target. Torpedoes are recovered. Potential locations for this activity in the Hawaii Range Complex include Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, and Shallow Water Training Range; and in the Southern California Range Complex include Southern California Anti-Submarine Warfare Range.		

A.2.5.4 Torpedo Exercise—Submarine

Anti-Submarine Warfare			
Anti-Submarine Warfare Torpedo Exercise—Submarine			
Short Description	Submarine crews search for, track, and detect submarines. Exercise torpedoes are used during this event.	**Typical Duration**	8 hours
Long Description	Submarine crews search for, detect and track a threat submarine to develop firing position to launch a torpedo. A single submerged submarine operates at slow speeds and various depths while using its hull mounted or towed array sonar to track a threat submarine. While passive sonar is most typically used for this training event, some active sonar may be used on occasion. Non-explosive exercise torpedoes may also be fired during training. This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other areas within the Study Area depending on training requirements and available assets.		
Typical Components	**Platforms:** Rotary-wing aircraft, small boat, submarines **Targets:** Sub-surface targets **Systems being Trained/Tested:** Mid-frequency and high-frequency sonar, torpedoes		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and Aerial target Vessel and in-water device Military expended materials **Ingestion:** None	**Energy:** None **Entanglement:** Wires and cables
Stressors to Physical Resources	**Air Quality:** Criteria pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Guidance Wires	**Military Recoverable Material**	Anti-Submarine Warfare Training Targets, Exercise Torpedoes

Anti-Submarine Warfare		
Anti-Submarine Warfare Torpedo Exercise—Submarine		
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3 **High-Frequency:** HF1	**Anti-Submarine Warfare:** ASW4 **Torpedoes:** TORP2
Explosive Bins	None	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	Torpedoes are recovered. Guidance wire has a low breaking strength and breaks easily. Weights and flex tubing sink rapidly. Potential locations for this activity include Southern California Anti-Submarine Warfare Range, and Hawaii Operations Area, (including Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, Shallow Water Training Range, and Hawaii Area Tracking System).	

A.2.5.5 Tracking Exercise—Helicopter

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Exercise - Helicopter			
Short Description	Helicopter crews search for, track, and detect submarines.	**Typical Duration**	2–4 hours
Long Description	Helicopters using sonobuoys and dipping sonar search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys (both passive and active) are typically employed by a helicopter operating at altitudes below 3,000 ft. Dipping sonar (both passive and active) is employed from an altitude of about 50 ft. after the search area has been narrowed based on the sonobuoy search. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or occur during a coordinated larger exercise involving multiple aircraft and ships, including a major range event. Unmanned aerial systems, such as the MQ-8 Fire Scout, may also be used. The preferred range for this exercise is an instrumented range, but it may be conducted in other range complexes depending on training requirements and available assets.		
Typical Components	**Platforms:** Rotary-wing aircraft, unmanned aerial system **Targets:** Sub-surface targets **Systems being Trained/Tested:** Sonar systems, sonobuoys		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Hawaii-Southern California Training and Testing Transit Corridor Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Exercise - Helicopter			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Sonobuoys (non-explosive), sonobuoy wires, expendable sub-surface targets, marine marker	**Military Recoverable Material**	Recoverable sub-surface targets
Sonar and Other Transducer Bins	**Mid-Frequency:** MF4 MF5		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Submarines may provide service as the target. Tracking exercise can occur anywhere within the Study Area; however, potential locations for this activity in the Hawaii Range Complex include Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, and Shallow Water Training Range. For air quality analysis: - 1 rotary-wing aircraft per event - Average 2 hours per event		

A.2.5.6 Tracking Exercise—Maritime Patrol Aircraft

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Exercise—Maritime Patrol Aircraft			
Short Description	Maritime patrol aircraft crews search for, track, and detect submarines.	**Typical Duration**	2–8 hours
Long Description	Fixed-wing maritime patrol aircraft employ sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. Sonobuoys (both passive and active) are typically employed by a maritime patrol aircraft operating at altitudes below 3,000 feet. However, sonobuoys may be released at higher altitudes. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. Depending on these two factors, these patterns will cover many different size areas. For certain sonobuoys, tactical parameters of use may be classified. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare (ASW) Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** Sub-surface targets **Systems being Trained/Tested:** Mid-frequency sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Sonobuoys, Expendable ASW Training Targets	**Military Recoverable Material**	Recoverable ASW Training Targets

Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Exercise—Maritime Patrol Aircraft	
Sonar and Other Transducer Bins	**Mid-Frequency:** MF5
Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Submarine may provide service as the target. If target is air-dropped, one parachute per target. Tracking exercise can occur anywhere within the Study Area; however, Potential locations for this activity in the Hawaii Range Complex include Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, and Shallow Water Training Range; and in Southern California Range Complex include Southern California Anti-Submarine Warfare Range Shallow Water Training Range (offshore and nearshore). For air quality analysis: - 1 fixed-wing patrol aircraft per event - Average 6 hours per event

A.2.5.7 Tracking Exercise—Submarine

<table>
<tr><th colspan="6">Anti-Submarine Warfare</th></tr>
<tr><th colspan="6">Anti-Submarine Warfare Tracking Exercise—Submarine</th></tr>
<tr><td>Short Description</td><td colspan="3">Submarine crews search for, track, and detect submarines.</td><td>Typical Duration
8 hours</td><td></td></tr>
<tr><td>Long Description</td><td colspan="5">Submarine crews search for, detect and track a threat submarine to develop firing position to launch a torpedo.

A single submerged submarine operates at slow speeds and various depths while using its hull mounted sonar to track a threat submarine. Passive sonar is used almost exclusively. The target for this exercise is either an MK 39 expendable mobile anti-submarine warfare training target, MK 30 recoverable training target, or live submarine.

This exercise could occur anywhere throughout the HSTT Study Area. This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Submarines
Targets: Sub-surface targets
Systems being Trained/Tested: Sonar systems, acoustic countermeasures</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
HSTT Transit Corridor
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Vessel noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials

Ingestion:
None</td><td>Energy:
None

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
None
Habitats:
Physical disturbance and strike – military expended material</td><td colspan="2">Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="3">Ingestible Material:
None
Non-Ingestible Material:
Expendable sub-surface targets, expended bathythermograph, expended bathythermograph wire, acoustic countermeasures</td><td>Military Recoverable Material</td><td colspan="2">Recoverable sub-surface targets</td></tr>
</table>

Anti-Submarine Warfare		
Anti-Submarine Warfare Tracking Exercise—Submarine		
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3 **High-Frequency:** HF1 HF3	**Anti-Submarine Warfare:** ASW4
Explosive Bins	None	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Tracking exercise can occur anywhere within the Study Area; however, potential locations for this activity in the Hawaii Range Complex include Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, Shallow Water Training Range, and Hawaii Area Tracking System; and in the Southern California Range Complex include Southern California Anti-Submarine Warfare Range, Shallow Water Training Range (offshore and nearshore).	

A.2.5.8 Tracking Exercise—Ship

<table>
<tr><th colspan="6">Anti-Submarine Warfare</th></tr>
<tr><th colspan="6">Anti-Submarine Warfare Tracking Exercise—Ship</th></tr>
<tr><td>Short Description</td><td colspan="3">Surface ship crews search for, track, and detect submarines.</td><td>Typical Duration</td><td>2–4 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">Surface ships search for, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine.

A surface ship operates at slow speeds while employing sonobuoys, hull mounted sonar, or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The target for this exercise is either a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, or live submarine.

Anti-Submarine Warfare (ASW) Tracking exercise—Ship could occur anywhere throughout the HSTT Study Area. This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Surface combatant
Targets: Sub-surface targets
Systems being Trained/Tested: Sonar systems, acoustic countermeasures</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel
Towed in-water device safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Vessel noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials

Ingestion:
None</td><td>Energy:
In-water electromagnetic devices

Entanglement:
Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material</td><td colspan="3">Sediments and Water Quality:
Metals
Chemicals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
Expendable sub-surface targets, expendable bathythermographs, expendable bathythermograph wires. Sonobuoy (non-explosive), sonobuoy wires</td><td>Military Recoverable Material</td><td colspan="2">Recoverable ASW Training Targets</td></tr>
</table>

Anti-Submarine Warfare		
Anti-Submarine Warfare Tracking Exercise—Ship		
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF11 MF12	**Anti-Submarine Warfare:** ASW3
Explosive Bins	None	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	A Submarine may provide service as the target. Hawaii-Southern California Training and Testing Study Area events typically refer to those events that occur while vessels are in transit. Potential locations for this activity in the Hawaii Range Complex include Barking Sands Underwater Range Extension, Barking Sands Tactical Underwater Range, and Shallow Water Training Range; and the Southern California Range Complex include Southern California Anti-Submarine Warfare Range and Warning Area 291.	

A.2.5.9 Service Weapons Test

Anti-Submarine Warfare			
Service Weapons Test			
Short Description	Air, surface, or submarine crews employ explosive torpedoes against virtual targets.	**Typical Duration**	8 hours
Long Description	Non-explosive and explosive torpedoes (carrying a warhead) would be launched at a suspended target by a submarine and fixed- or rotary-wing aircraft or surface combatants. Torpedoes would detonate on an artificial target located at a depth between 200 and 700 feet below the water's surface. Event duration is 1–2 days during daylight hours. Only one heavyweight torpedo test could occur in 1 day; two heavyweight torpedo tests could occur on consecutive days. Two lightweight torpedo tests could occur in a single day.		
Typical Components	**Platforms:** Fixed-wing aircraft, submarines, support craft **Targets:** Sub-surface targets; surface targets **Systems being Trained/Tested:** Mid-frequency and high-frequency sonar, torpedoes		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety Towed in-water device safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions	**Energy:** In-water electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Explosives Metals	Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Torpedo Fragments **Non-Ingestible Material:** Guidance Wires	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3 MF6 **High-Frequency:** HF1	**Torpedoes:** TORP2	
Explosive Bins	E11		

Anti-Submarine Warfare		
Service Weapons Test		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	**Explosive Stressors:** *(Section 5.3.3)* Torpedo (Explosive) Testing
Assumptions Used for Analysis	Potential locations for this activity in the Hawaii Range Complex include Warning Area 188(A); and within the Southern California Range complex include Southern California Anti-Submarine Warfare Range. For air quality analysis: - 1 fixed-wing aircraft - 1 support craft - Average 8 hours per event	

A.2.6 ELECTRONIC WARFARE

Electronic warfare is the mission area of naval warfare that aims to control use of the electromagnetic spectrum and to deny its use by an adversary. Typical electronic warfare activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices to defeat tracking systems.

A.2.6.1 Counter Targeting Chaff Exercise—Aircraft

<table>
<tr><th colspan="4">Electronic Warfare</th></tr>
<tr><th colspan="4">Counter Targeting Chaff Exercise—Aircraft</th></tr>
<tr><td>Short Description</td><td colspan="2">Fixed-wing aircraft and helicopter aircrews deploy chaff to disrupt threat targeting and missile guidance radars.</td><td>Typical Duration
1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Fixed-wing aircraft and helicopter aircrews deploy chaff to disrupt threat targeting and missile guidance radars.

Fixed-wing aircraft and helicopter aircrews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the aircraft clears away from the threat.

Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed to create a target that will lure enemy radar and weapons system away from the actual friendly platform.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Fixed-wing aircraft, rotary-wing aircraft
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Aircraft noise

Explosive:
None

Physical Disturbance and Strike:
Aircraft and aerial target

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material

Sediments and Water Quality:
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics</td><td>Public Health and Safety:
Physical interactions</td></tr>
</table>

Electronic Warfare			
Counter Targeting Chaff Exercise—Aircraft			
Military Expended Material	**Ingestible Material:** Per chaff: one chaff plastic endcap, one compression pad; OR one plastic piston, one plastic endcap **Non-Ingestible Material:** Chaff fibers	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*		
Assumptions Used for Analysis	Chaff is usually expended while conducting other training activities, such as air combat maneuvering. Potential locations for air quality analysis: - 1 fixed-wing strike aircraft - Average 2 hours per event		

A.2.6.2 Counter Targeting Chaff Exercise—Ship

Electronic Warfare			
Counter Targeting Chaff Exercise—Ship			
Short Description	Surface ship crews deploy chaff to disrupt threat targeting and missile guidance radars.	**Typical Duration**	1–2 hours
Long Description	Surface ship crews deploy chaff to disrupt threat targeting and missile guidance radars to defend against an attack. Surface ship crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the vessel clears away from the threat. The typical event duration is approximately one and one-half hours. Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed to create a target that will lure enemy radar and weapons system away from the actual friendly platform. Ships may also train with advanced countermeasure systems, such as the MK 53 Decoy Launching System (Nulka).		
Typical Components	**Platforms:** Surface combatants, amphibious warfare ships **Targets:** None **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Other materials	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Expended components of chaff-ship (chaff-ship fibers) **Non-Ingestible Material:** MK 53 decoy, chaff-ship cartridges	**Military Recoverable Material**	None

Electronic Warfare	
Counter Targeting Chaff Exercise—Ship	
Sonar and Other Transducer Bins	None
Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Stressors to human resources were not analyzed for this activity since it occurs greater than 12 nautical miles from shore.

A.2.6.3 Counter Targeting Flare Exercise

<table>
<tr><th colspan="6">Electronic Warfare</th></tr>
<tr><th colspan="6">Counter Targeting—Flare Exercise</th></tr>
<tr><td>Short Description</td><td colspan="3">Fixed-wing aircraft and helicopter aircrews deploy flares to disrupt threat infrared missile guidance systems.</td><td colspan="2">Typical Duration
1–2 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">Fixed-wing aircraft and helicopter aircrews deploy flares to disrupt threat infrared missile guidance systems. Range personnel acting as opposition forces may use pyrotechnics to simulate missile launch.

Aircraft detect electronic targeting signals from threat radars or missiles, or a threat missile plume, when launched and dispense flares and immediately maneuver to defeat the threat. This exercise trains aircraft personnel in the use of defensive flares designed to confuse infrared sensors or infrared homing missiles, thereby causing the sensor or missile to lock onto the flares instead of the real aircraft. Typically, an aircraft will expend five flares in an exercise while operating above 3,000 feet. Flare exercises are often conducted with chaff exercises, rather than as a stand-alone exercise.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Fixed-wing aircraft, rotary-wing aircraft
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Aircraft safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Aircraft noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Aircraft and aerial target

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material</td><td colspan="3">Sediments and Water Quality:
Metals
Chemicals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics</td><td colspan="2">Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Per flare cartridge: one silicone rubber compression pad OR one plastic piston
Non-Ingestible Material:
Per flare cartridge: flare (typically consumed), one plastic endcap, O-ring (rubber, nitrile)</td><td>Military Recoverable Material</td><td colspan="2">None</td></tr>
</table>

Electronic Warfare	
Counter Targeting—Flare Exercise	
Sonar and Other Transducer Bins	None
Explosive Bins	None
Procedural Mitigation Measures	None
Assumptions Used for Analysis	Approximately five flares per aircraft. Potential locations for air quality analysis: - 1 fixed-wing strike aircraft - Average 2 hours per event

A.2.6.4 Electronic Warfare Operations

Electronic Warfare			
Electronic Warfare Operations			
Short Description	Aircraft and surface ship crews control portions of the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions.	**Typical Duration**	1–2 hours
Long Description	Aircraft and surface ship crews control the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions. Electronic Warfare Operations can be active or passive, offensive or defensive. Fixed-wing aircraft employ active jamming and deception against enemy search radars to mask the friendly inbound strike aircraft mission. Surface ships detect and evaluate enemy electronic signals from enemy aircraft or missile radars, evaluate courses of action concerning the use of passive or active countermeasures, then use ship maneuvers and either chaff, flares, active electronic countermeasures, or a combination of them to defeat the threat.		
Typical Components	**Platforms:** Fixed-wing aircraft, surface combatant **Targets:** Air targets, electronic warfare targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions In-air energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Electronic Warfare	
Electronic Warfare Operations	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	The majority of these events occur in the Southern California Range Complex at the Electronic Warfare Range. All chaff and flares involved in this event are covered under chaff exercise and flare exercises, respectively. For air quality analysis: - 1 contract air services aircraft - 1 fixed-wing electronic warfare aircraft - 1 fixed-wing strike aircraft - Average 2 hours per event

A.2.7 EXPEDITIONARY WARFARE

A.2.7.1 Dive and Salvage Operations

Expeditionary Warfare				
Dive and Salvage Operations				
Short Description	Navy divers perform dive operations and salvage training.	**Typical Duration**	1–5 days	
Long Description	Navy divers will conduct a variety of salvage training to include debeaching operations, underwater repairs to ships, underwater survey operations, aircraft recovery, and other underwater training as required.			
Typical Components	**Platforms:** Support craft **Targets:** Sub-surface targets **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex	**Bays/Estuaries/Pierside:** Pearl Harbor	
Stressors to Biological Resources	**Acoustic:** Vessel noise	**Physical Disturbance and Strike:** Vessels and in-water devices	**Energy:** None	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None		
	Habitats: Physical disturbance and strike – seafloor devices			
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement			
Assumptions Used for Analysis	Potential locations for this activity include Puuloa Underwater Range, Naval Defensive Sea Area, Keehi Lagoon, and Pearl Harbor. The practice salvage platform can be sunk and then refloated and removed. For air quality analysis: - 1 support craft - Average 12 hours per event			

A.2.7.2 Personnel Insertion/Extraction—Surface and Subsurface

Expeditionary Warfare			
Personnel Insertion/Extraction—Surface and Subsurface			
Short Description	Personnel are inserted into and extracted from an objective area by small boats or subsurface platforms.	**Typical Duration**	2–4 hours
Long Description	Utilizing both small surface and subsurface platforms, personnel are inserted in the water. They will conduct an infiltration to an objective (harbor, beach, moored vessel, etc.) and conduct a variety of tasks. The insertion/extraction activities are confined to in-water training.		
Typical Components	**Platforms:** Small boat, manned underwater vehicle **Targets:** None **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Silver Strand Training Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** Pearl Harbor San Diego Bay
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	Events are typically conducted in waters near land. This activity can occur anywhere within the Study Area; however, potential locations for this activity include Hawaii Range Complex (Lima Landing, Naval Defense Sea Area, Puuloa Underwater Range) and Southern California Range Complex (Delta I, II, III, Echo). For air quality analysis: - 1 small boat - Average 8 hours per event		

A.2.7.3 Personnel Insertion/Extraction Training—Swimmer/Diver

Expeditionary Warfare			
Personnel Insertion/Extraction Training—Swimmer/Diver			
Short Description	Divers and swimmer infiltrate harbors, beaches, or moored vessels and conduct a variety of tasks.	**Typical Duration**	Up to 12 hours
Long Description	Divers and swimmer infiltrate harbors, beaches, or moored vessels and conduct a variety of tasks. Activity may include Navy personnel learning advanced self-contained underwater breathing apparatus (SCUBA) diving, to include tactics, techniques, and procedures and emergency procedures. Small boats are used for safety.		
Typical Components	**Platforms:** Small boat **Targets:** None **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex Silver Strand Training Complex	**Bays/Estuaries/Pierside:** Pearl Harbor San Diego Bay
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** None **Entanglement:** None
"Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	For air quality analysis: - 1 small boat - Average 8 hours per event		

A.2.7.4 Small Boat Attack

<table>
<tr><td colspan="6">Expeditionary Warfare</td></tr>
<tr><td colspan="6">Small Boat Attack</td></tr>
<tr><td>Short Description</td><td colspan="3">Afloat units defend against attacking watercraft. For this activity, one or two small boats or personal watercraft conduct attack activities on units afloat.</td><td colspan="2">Typical Duration
6 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">Small attacks are conducted on boats, usually within anchorages or boat lanes. For this activity, one or two small boats or personal watercraft conduct attack activities on units afloat, firing munitions or blank small-caliber rounds. The activity will usually include observers.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Small boat
Targets: Surface targets
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety</td><td colspan="4">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Silver Strand Training Complex:
Boat Lanes 1-10
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="5">Acoustic:
Vessel noise
Weapons noise
Explosive:
None
Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
Military expended materials – munitions
Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material
Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="5">Cultural Resources:
None
Socioeconomic Resources:
Accessibility
Public Health and Safety:
None</td></tr>
<tr><td>Military Expended Material</td><td colspan="3">Ingestible Material:
Projectiles, projectile casings
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Stationary surface target</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
</table>

Expeditionary Warfare	
Small Boat Attack	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	Assume for Southern California events per year: 5.56mm: 3,540 7.62mm: 27,300 50 Cal: 13,650 40mm: 1,195 40mm Para Flares: 38 Sim Grenades: 25 Silver Strand Training Complex: Non-explosive practice munitions only For air quality analysis: - 1 small boat - Average 6 hours per event

A.2.8 MINE WARFARE

Mine warfare is the naval warfare area involving the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained explosive device placed in water to destroy ships or submarines. Naval mines are deposited and left in place until triggered by the approach of an enemy ship, or are destroyed or removed. Naval mines can be laid by purpose-built minelayers, other ships, submarines, or airplanes. Mine warfare training includes mine countermeasures exercises and mine laying exercises.

A.2.8.1 Airborne Mine Countermeasure—Mine Detection

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Airborne Mine Countermeasures—Mine Detection</th></tr>
<tr><td>Short Description</td><td colspan="2">Helicopter aircrews detect mines using towed or laser mine detection systems.</td><td>Typical Duration
2 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Helicopter aircrews use towed and airborne devices to detect, locate, and classify potential mines. Towed devices employ active acoustic sources, such as high-frequency and side scanning sonar. These devices are similar in function to systems used to map the seafloor or locate submerged structures/items. Airborne devices utilize laser systems to locate mines located below the surface.

Devices used include the AN/AQS-20/A, towed mine-hunting sonar used to detect and classify bottom and floating/moored mines in deep and shallow water, and the Airborne Laser Mine Detection System, developed to detect and classify floating and near-surface, moored mines.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Rotary-wing aircraft
Targets: Sub-surface targets
Systems being Trained/Tested: Mine detection systems (e.g., AN/AQS-24 Airborne Mine Hunting System, AN/AQS-20 Airborne Sonar Mine Detection System, AN/AES-1 Airborne Laser Mine Detection System)</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Sonar and other transducers
Aircraft noise

Explosive:
None

Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices
Seafloor devices

Ingestion:
None

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – seafloor devices

Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
</table>

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Airborne Mine Countermeasures—Mine Detection</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">High-Frequency:
HF4</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td>Physical Disturbance and Strike: (Section 5.3.4)
Towed in-water devices</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Sonar mine detection systems towed from helicopters.
Airborne laser systems used to detect mine shapes.
Laser systems are similar to commercial Light Detection And Ranging systems. The in-air low energy laser stressor was used in analysis of potential impacts on human resources.
Mine shapes may be deployed via ship and will be recovered.
Potential locations for this activity in the Southern California Range Complex include Pyramid Cove, Northwest Harbor, Imperial Beach Minefield, Boat Lanes 1-14 (greater than 40 ft. depth), Advanced Research Projects Agency Training Minefield, Pyramid Head, and Safety Zone A.
For air quality analysis:
- 1 rotary-wing aircraft
- Average 1.5 hours per event</td></tr>
</table>

A.2.8.2 Civilian Port Defense—Homeland Security Anti-Terrorism/Force Protection Exercise

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Civilian Port Defense—Homeland Security Anti-Terrorism/Force Protection Exercises</th></tr>
<tr><td>Short Description</td><td colspan="2">Maritime security personnel train to protect civilian ports and harbors against enemy efforts to interfere with access to those ports.</td><td>Typical Duration
Multiple days</td></tr>
<tr><td>Long Description</td><td colspan="3">Naval forces provide Mine Warfare capabilities to support Department of Homeland Security sponsored events. The three pillars of mine warfare, airborne (helicopter), surface (surface ships), and undersea (divers, marine mammals, and unmanned vehicles) mine countermeasures will be brought to bear in order to ensure strategic U.S. ports remain free of mine threats. Various mine warfare sensors, which utilize active acoustics, will be employed in the detection, classification, and neutralization of mines. Along with traditional mine warfare techniques, such as helicopter towed mine countermeasures, new technologies (unmanned vehicles) will be utilized. Marine mammal systems may be used during this exercise.

Event locations and scenarios will vary according to Department of Homeland Security strategic goals and evolving world events.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Moored platform, rotary-wing aircraft, support craft, surface combatant, unmanned underwater vehicle
Targets: Sub-surface targets (mine shapes)
Systems being Trained/Tested: Mine detection systems, towed mine neutralization systems, airborne mine neutralization system</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Unmanned aerial, surface, and subsurface vehicle safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Pearl Harbor, Hawaii,
San Diego Bay, California,
Silver Strand Training Complex

Bays/Estuaries/Pierside:
Pearl Harbor
San Diego Bay</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Sonar and other transducers
Aircraft noise
Vessel noise

Explosive:
In-water explosives

Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices
Seafloor devices

Ingestion:
None

Energy:
In-water electromagnetic devices
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Habitats:
Physical disturbance and strike – military expended materials
Physical disturbance and strike – seafloor devices
In-water explosives

Air Quality:
Criteria air pollutants

Sediments and Water Quality:
Explosives</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Explosives
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
</table>

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Civilian Port Defense—Homeland Security Anti-Terrorism/Force Protection Exercises</th></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">High-Frequency:
HF4
Synthetic Aperture Sonars:
SAS2</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">E2
E4</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Acoustic Stressors: (Section 5.3.2)
Active sonar

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Towed in-water devices

Explosive Stressors: (Section 5.3.3)
Explosive Ordnance Disposal</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Non-permanent mine shapes will be laid in various places on the bottom and will be retrieved
Shapes are varied, from about 1 m circular to about 2.5 meters long by 1 meter wide. They will be recovered using normal assets, with diver involvement.
Explosives may be used if required for scheduled mine neutralization events.
While goal is to conduct once per year, alternating east/west coast, assume that a west coast event will occur every other year with a total of three per 5-year period.
For air quality analysis:
- 1 rotary-wing aircraft (12 hours)
- 1 Mine Countermeasures-class ship (24 hours)
- 1 Rigid Hull Inflatable Boat (24 hours)</td></tr>
</table>

A.2.8.3 Limpet Mine Neutralization System

<table>
<tr><th colspan="6">Mine Warfare</th></tr>
<tr><th colspan="6">Limpet Mine Neutralization System</th></tr>
<tr><td>Short Description</td><td colspan="3">Navy Explosive Ordnance Disposal divers place a small charge on a simulated underwater mine.</td><td>Typical Duration
2 hours</td><td></td></tr>
<tr><td>Long Description</td><td colspan="5">A metal sheet containing a non-explosive limpet mine is lowered into the water, sometimes from the side of a small vessel, such as an LCM- 8 craft. Navy Explosive Ordnance Divers place a single shock wave generator of Limpet Mine Neutralizing Systems on the mine that is located mid-water column, within water depths of 10 to 20 feet. A bag is placed over the mine to catch falling debris.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Support craft
Targets: Sub-surface target (metal sheet)
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Silver Strand Training Complex
Bays/Estuaries/Pierside:
San Diego Bay (Echo)</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Vessel noise

Explosive:
In-water explosives</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices

Ingestion:
None</td><td>Energy:
None

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Habitats:
Physical disturbance and strike – military expended material</td><td colspan="3">Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives Chemicals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
None</td><td>Public Health and Safety:
None</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">Sub-surface target (metal sheet)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">De minimis</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="5">Physical Disturbance and Strike:
(Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="5">De minimis small explosive charges would be used during this activity and not quantitatively analyzed and therefore are not included under munitions.
Potential locations for this activity include Silver Strand Training Complex (Boat Lanes 1–14, San Diego Bay-Echo)
For air quality analysis:
- 2 Rigid Hull Inflatable Boats (2 hours each)</td></tr>
</table>

A.2.8.4 Marine Mammal System

<table>
<tr><th colspan="6">Mine Warfare</th></tr>
<tr><th colspan="6">Marine Mammal System</th></tr>
<tr><td>Short Description</td><td colspan="3">The Navy deploys trained bottlenose dolphins (Tursiops truncatus) and California sea lions (Zalophus californianus) as part of the marine mammal mine-hunting and object-recovery system.</td><td colspan="2">Typical Duration
Varies</td></tr>
<tr><td>Long Description</td><td colspan="5">The Navy deploys trained bottlenose dolphins (Tursiops truncatus) and California sea lions (Zalophus californianus) as part of the marine mammal mine-hunting and object-recovery system. Each system consists of a motorized small craft, several crewmembers and a trained dolphin or sea lion. Self-Contained Underwater Breathing Apparatus (SCUBA) assisted personnel and Navy marine mammals work together to detect specified underwater objects. Personnel work with the help of marine mammals to detect underwater objects. Approximately 10 percent of training involves the setting of a 13 or 29 pound Net Explosive Weight charge to detonate the objects.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: In-water structure, small boat
Targets: Sub-surface targets (mine shapes)
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Silver Strand Training Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="5">Acoustic:
None
Physical Disturbance and Strike:
Seafloor devices
Energy:
None
Explosive:
In-water explosives
Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives Metals
Habitats:
Physical disturbance and strike – military expended material
Physical disturbance and strike – seafloor devices
In-water explosives</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="5">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Target Fragments</td><td>Military Recoverable Material</td><td colspan="2">Recoverable Training Targets (mine shapes)</td></tr>
</table>

Mine Warfare		
Marine Mammal System		
Sonar and Other Transducer Bins	None	
Explosive Bins	E7	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	**Explosive Stressors:** *(Section 5.3.3)* Explosive Ordnance Disposal
Assumptions Used for Analysis	Sequential detonations at water depths of 10–72 feet (ft.) and are bottom laid. Single charges are laid within water depths of 24–72 ft., 20 ft. from the surface or below. Potential locations for this activity in the Hawaii Range Complex include Kingfisher and Naval Defense Sea Area; and in the Southern California Range Complex include Silver Strand Training Complex: Boat Lanes 1–14, Imperial Beach Minefield, and Breakers Beach. For air quality analysis: - 1 Rigid Hull Inflatable Boat (4 hours)	

A.2.8.5 Mine Countermeasure Exercise—Ship Sonar

<table>
<tr><th colspan="6">Mine Warfare</th></tr>
<tr><th colspan="6">Mine Countermeasure Exercise—Ship Sonar</th></tr>
<tr><td>Short Description</td><td colspan="3">Ship crews detect and avoid mines while navigating restricted areas or channels using active sonar.</td><td>Typical Duration</td><td>Up to 15 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">Surface ship crews detect and avoid mines or other underwater hazardous objects while navigating restricted areas or channels using active sonar. A Littoral Combat Ship utilizes unmanned surface vehicles and remotely operated vehicles to tow mine detection (hunting) equipment. Systems will operate from a shallow zone greater than 40 feet (ft.) to deep water. Events could be embedded within major training exercises.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Surface combatant, unmanned surface vehicle
Targets: Sub-surface targets (mine shapes), targets of opportunity (buoys, fish aggregating devices)
Systems being Trained/Tested: High-frequency sonar, mid-frequency sonar, towed sonar systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Unmanned aerial, surface, and subsurface vehicle safety
Towed in-water device safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Vessel noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Seafloor devices

Ingestion:
No</td><td>Energy:
In-air electromagnetic devices
In-water electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – seafloor devices
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Physical disturbance and strike</td><td colspan="2">Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">Recoverable Training Targets (mine shapes)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">Mid-Frequency:
MF1K
High-Frequency:
HF4 HF8</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
</table>

Mine Warfare		
Mine Countermeasure Exercise—Ship Sonar		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	No explosives are used. Constraints: Assume system will be operated in areas free of obstructions, and will be towed well above the seafloor. Towed system will be operated in a manner to avoid entanglement and damage. Events will take place in water depths 40 ft. and greater. Existing placed mine shapes to be used. There is the potential for temporary placement of mine shapes. Potential locations for this activity include Hawaii Range Complex (Hawaii Operations Area, Kingfisher, Shallow- water Minefield Sonar Training Area), and Southern California Range Complex (Airborne Mine Countermeasure, Camp Pendleton Amphibious Assault Area, Imperial Beach Minefield, Pyramid Cove, Tanner Bank Minefield).	

A.2.8.6 Mine Countermeasure Exercise – Surface

<table>
<tr><th colspan="6">Mine Warfare</th></tr>
<tr><th colspan="6">Mine Countermeasure Exercise—Surface</th></tr>
<tr><td>Short Description</td><td colspan="3">Mine countermeasure ship crews detect, locate, identify, and avoid mines while navigating restricted areas or channels, such as while entering or leaving port.</td><td colspan="2">Typical Duration
Up to 15 hours</td></tr>
<tr><td>Long Description</td><td colspan="5">This event trains mine countermeasure ship crews to detect mines for future neutralization or to alert other ships. Training utilizes simulated minefields constructed of moored or bottom mines, or instrumented mines that can record effectiveness of mine detection efforts.
Ships will accurately fix their position while navigating through the restricted mine threat area at slow speeds of about 5 to 10 knots or less, while using active sonar to search the area ahead of the ship for moored mines or other hazards of navigation.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Surface combatant
Targets: Sub-surface targets (mine shapes)
Systems being Trained/Tested: Mid-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Vessel noise
Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Seafloor devices
Ingestion:
No</td><td>Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
None</td><td colspan="3">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">Recoverable Training Targets (mine shapes)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">High-Frequency:
HF4</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td colspan="3">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
</table>

Mine Warfare	
Mine Countermeasure Exercise—Surface	
Assumptions Used for Analysis	Existing placed mine shapes to be used. There is potential for temporarily placed mine shapes. Potential locations for this activity include Southern California Range Complex (Kingfisher, Shallow Water Training Range-Offshore, Shallow Water Minefield, Silver Strand Training Complex, Camp Pendleton Amphibious Assault Area).

A.2.8.7 Mine Countermeasures—Mine Neutralization: Remotely Operated Vehicle

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Mine Countermeasures—Mine Neutralization—Remotely Operated Vehicles</th></tr>
<tr><td>Short Description</td><td colspan="2">Ship, small boat, and helicopter crews locate and disable mines using remotely operated underwater vehicles.</td><td>Typical Duration
1½–4 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Ship, small boat, and helicopter crews utilize remotely operated vehicles to neutralize potential mines. Remotely operated vehicles will use sonar and optical systems to locate and target mine shapes. Explosive mine neutralizers may be used during live-fire events.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Rotary-wing aircraft, small boat, surface combatant
Targets: Sub-surface targets (mine shapes)
Systems being Trained/Tested: Towed sonar systems, In-water explosives</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Towed in-water device safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Silver Strand Training Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
San Diego Bay (Echo)</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Aircraft noise
Vessel noise
Sonar and other transducers

Explosive:
In-water explosives

Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices
Military expended materials
Seafloor devices

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions

Energy:
In-air electromagnetic devices
In-water electromagnetic devices

Entanglement:
Wires and cables</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Habitats:
Physical disturbance and strike – military expended material
Physical disturbance and strike – seafloor devices
In-water explosives

Air Quality:
Criteria air pollutants

Sediments and Water Quality:
Explosives
Chemicals
Metals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="3">Cultural Resources:
Explosives
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Neutralizer fragments
Non-Ingestible Material:
Fiber optic cables</td><td>Military Recoverable Material
Recoverable Training Targets (mine shapes)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">High-Frequency:
HF4</td></tr>
</table>

Mine Warfare		
Mine Countermeasures—Mine Neutralization—Remotely Operated Vehicles		
Explosive Bins	E4	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Puuloa Underwater Range), Silver Strand Training Complex (Boat Lanes 1-14, Echo), Southern California Range Complex (Airborne Mine Countermeasure, Camp Pendleton Amphibious Assault Area, Imperial Beach Minefield, Tanner Bank Minefield). For air quality analysis: - 2 rotary-wing aircraft - Average 2 hours per event	

A.2.8.8 Mine Countermeasure—Towed Mine Neutralization

Mine Warfare			
Mine Countermeasures—Towed Mine Neutralization			
Short Description	Helicopter aircrews and unmanned vehicles tow systems through the water which are designed to disable or trigger mines.	**Typical Duration**	Up to 12 hours
Long Description	Helicopter vehicle operators and unmanned vehicles use towed devices to trigger mines that are designed to detonate when they detect ships/submarines by engine/propeller sounds or magnetic (steel construction) signature. Towed devices can also employ cable cutters to detach floating moored mines. Training will be conducted either with non-explosive training mine shapes. Devices used include the following: Mk 105 sled, which creates a magnetic field used to trigger mines, and can be used in conjunction with the MK 103 cable cutter system and the Mk 104 acoustic countermeasure, AN/SPU-1/W (Magnetic Orange Pipe), a magnetic pipe that is used to trigger magnetically influenced mines.		
Typical Components	**Platforms:** Rotary-wing aircraft, unmanned surface vehicles **Targets:** Sub-surface targets (mine shapes) **Systems being Trained/Tested:** Electromagnetic devices		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety	**Typical Locations** **Range Complexes/Testing Ranges:** Silver Strand Training Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Seafloor devices **Ingestion:** No	**Energy:** In-water electromagnetic devices In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – seafloor devices	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	Recoverable Training Targets (mine shapes)
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Mine Warfare		
Mine Countermeasures—Towed Mine Neutralization		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices
Assumptions Used for Analysis	Mechanical sweeping (cable cutting), acoustic and magnetic influence sweeping devices are towed from helicopters. Cable cutters utilize an insignificant charge (similar to a shotgun shell). Acoustic sweeps generate ship type noise via a mechanical system. Towing systems though minefields (or without mines, to train to deploy, tow, and recover) may involve instrumented mines. Mine shapes would be recovered. Potential locations for this activity include Silver Strand Training Complex Boat Lanes 1-14, and Southern California Range Complex (Airborne Mine Countermeasures, Imperial Beach Minefield, Pyramid Head, Safety Zone A, and SWAT 2). For air quality analysis: - 1 rotary-wing aircraft - Average 1 hour per event	

A.2.8.9 Mine Laying

<table>
<tr><th colspan="6">Mine Warfare</th></tr>
<tr><th colspan="6">Mine Laying</th></tr>
<tr><td>Short Description</td><td colspan="3">Fixed-wing aircraft drop non-explosive mine shapes.</td><td>Typical Duration
1 hour</td><td></td></tr>
<tr><td>Long Description</td><td colspan="5">Fixed-wing aircraft lay offensive or defensive mines for a tactical advantage for friendly forces. Fixed-wing aircraft lay a precise minefield pattern for specific tactical situations. The aircrew typically makes multiple passes in the same flight pattern, and drop one or more training shapes per pass (four shapes total). Training shapes are non-explosive.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Fixed-wing aircraft
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="4">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="5">Acoustic:
Aircraft noise

Explosive:
None

Physical Disturbance and Strike:
Aircraft and aerial target
Military expended materials
Seafloor devices

Ingestion:
No

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Habitats:
Physical disturbance and strike – seafloor devices

Air Quality:
Criteria air pollutants

Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="5">Cultural Resources:
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Physical disturbance and strike

Public Health and Safety:
Physical interactions
In-air energy</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
Non-recovered mine shapes</td><td>Military Recoverable Material</td><td colspan="2">Recoverable mine shapes</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="5">Physical Disturbance and Strike: (Section 5.3.4)
Non-explosive bombs and mine shapes</td></tr>
</table>

Mine Warfare	
Mine Laying	
Assumptions Used for Analysis	Mine laying is similar to a non-explosive bombing exercise. These events primarily occur during major training exercises. Mine laying will typically take place in waters less than 100 feet in depth. Assume 12 mine shapes are used per event. Potential locations for this activity include Hawaii Range Complex (R3101) and Southern California Range Complex (China Point, Pyramid Head, Tanner Bank Minefield). For air quality analysis: - 2 fixed-wing strike aircraft - Average 1 hour per event

A.2.8.10 Mine Neutralization—Explosive Ordnance Disposal

Mine Warfare			
Mine Neutralization Explosive Ordnance Disposal			
Short Description	Personnel disable threat mines using explosive charges.	**Typical Duration**	Up to 4 hours
Long Description	Navy divers, typically explosive ordnance disposal personnel, disable threat mines with explosive charges to create a safe channel for friendly vessels to transit. Personnel detect, identify, evaluate, and neutralize mines in the water with an explosive device and may involve detonation of one or more explosive charges from 4 to 60 pounds (lb.) of trinitrotoluene (TNT) equivalent. These operations are normally conducted during daylight hours for safety reasons. Time delay fuses may be used for these events.		
Typical Components	**Platforms:** Small Boat **Targets:** Sub-surface targets (mine shapes) **Systems being Trained/Tested:** In-water explosives		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Silver Strand Training Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** Pearl Harbor (Naval Inactive Ship Maintenance Facility, Lima Landing)
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Target fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	Recoverable Training Targets (mine shapes)

Mine Warfare				
Mine Neutralization Explosive Ordnance Disposal				
Sonar and Other Transducer Bins	None			
Explosive Bins	E4	E5	E6	E7
Procedural Mitigation Measures	**Explosive Stressors:** *(Section 5.3.3)* Explosive Ordnance Disposal		**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Time delayed fuses may be used (up to 10 minutes) for charges up to 29 lb. net explosive weight in some locations (Silver Strand Training Complex only). Charge placed anywhere in water column, including bottom. Some mine shapes will be recovered. Potential locations for this activity include Hawaii Range Complex (Puuloa Underwater Range, Marine Corps Base Hawaii, Marine Corps Training Area Bellows, Barbers Point Underwater Range, Naval Inactive Ship Maintenance Facility, Lima Landing, Ewa Training Minefield), Southern California Range Complex (including designated San Clemente Island areas near Northwest Harbor: SWAT2, TAR2, TAR3), Imperial Beach Minefield, and Silver Strand Range Complex (Boat Lanes 1-14). For air quality analysis: - 3 small boats - Average 2 hours per event			

A.2.8.11 Submarine Launched Mobile Mine Exercise

Mine Warfare			
Submarine Launched Mobile Mine Exercise			
Short Description	Submarine crews practice deploying submarine launched mobile mines.	**Typical Duration**	6 hours
Long Description	The submarine launched mine exercise-submarine involves a submarine deploying mines. During this event, passive sonar is used almost exclusively, active sonar use is restricted because it would reveal the submarine's presence. This exercise typically would involve only a single submarine, (but it may include more). Mine training exercises may have a range support vessel (surface craft or a support helicopter) to recover mines. The exercise mine is recovered by helicopter or small craft.		
Typical Components	**Platforms:** Rotary-wing aircraft, support craft, submarines **Targets:** None **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Seafloor devices **Ingestion:** No	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Air Quality:** None **Habitats:** Physical disturbance and strike – seafloor devices	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Airborne acoustics	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Guidance wires	**Military Recoverable Material**	Recoverable Training Targets (mine shapes)
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Barking Sands Tactical Underwater Range, Kahoolawe Sub Training Range, Shallow Weapons Testing Range), and Southern California Range Complex (Pyramid Head, Tanner Bank Minefield).		

A.2.8.12 Submarine Mine Exercise

<table>
<tr><td colspan="6">Mine Warfare</td></tr>
<tr><td colspan="6">Submarine Mine Exercise</td></tr>
<tr><td>Short Description</td><td colspan="3">Submarine crews practice detecting mines in a designated area.</td><td>Typical Duration
6 hours</td><td></td></tr>
<tr><td>Long Description</td><td colspan="5">Submarine crews use active sonar to detect and avoid mines or other underwater hazardous objects, while navigating restricted areas or channels, such as while entering or leaving port. This event trains submarine crews to detect and avoid mines. Training utilizes simulated minefields constructed of moored or bottom mines, or instrumented mines that can record effectiveness of mine detection efforts. In a typical training exercise, submarine crews will use high-frequency sonar to locate and avoid the mine shapes. Each mine avoidance exercise involves one submarine operating the high-frequency sonar for 6 hours to navigate through the training minefield. During mine warfare exercises submarines will expend several submarine-launched expendable bathythermographs to determine water conditions affecting sonar performance.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Submarines
Targets: Sub-surface targets (mine shapes)
Systems being Trained/Tested: High-frequency sonar (hull mounted)</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
None</td><td>Energy:
None
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
None
Habitats:
Physical disturbance and strike – seafloor devices</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
None</td><td>Public Health and Safety:
None</td></tr>
<tr><td>Military Expended Material</td><td colspan="3">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">High-Frequency:
HF1</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
</table>

Mine Warfare		
Submarine Mine Exercise		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Kahoolawe Submarine Training Minefield), and Southern California Range Complex (Advanced Research Project Agency Training Minefield, Tanner Bank Minefield).	

A.2.8.13 Surface Ship Object Detection

Mine Warfare			
Surface Ship Object Detection			
Short Description	Ship crews detect and avoid mines while navigating restricted areas or channels using active sonar.	**Typical Duration**	Up to 15 hours
Long Description	Surface ship crews detect and avoid mines or other underwater hazardous objects while navigating restricted areas or channels using active sonar. A Littoral Combat Ship utilizes unmanned surface vehicles and remotely operated vehicles to tow mine detection (hunting) equipment. Systems will operate from a shallow zone greater than 40 feet (ft.) to deep water. Events could be embedded within major training exercises.		
Typical Components	**Platforms:** Surface combatant, unmanned surface vehicle **Targets:** Sub-surface targets (mine shapes), targets of opportunity (buoys, fish aggregating devices) **Systems being Trained/Tested:** High-frequency sonar, mid-frequency sonar, towed sonar systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Unmanned aerial, surface, and subsurface vehicle safety Towed in-water device safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex; Silver Strand Training Complex; Southern California Range Complex	**Bays/Estuaries/Pierside:** Pearl Harbor San Diego Harbor
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Seafloor devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – seafloor devices	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	Mine shapes (non-explosive)
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1K	**High-Frequency:** HF8	
Explosive Bins	None		

Mine Warfare		
Surface Ship Object Detection		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	No explosives are used. Constraints: Assume system will be operated in areas free of obstructions, and will be towed well above the seafloor. Towed system will be operated in a manner to avoid entanglement and damage. Events will take place in water depths 40 ft. and greater. Existing placed mine shapes to be used. There is the potential for temporary placement of mine shapes. Potential locations for this activity include Hawaii Range Complex (Hawaii Operations Area, Kingfisher, Shallow- water Minefield Sonar Training Area), and Southern California Range Complex (Airborne Mine Countermeasure, Camp Pendleton Amphibious Assault Area, Imperial Beach Minefield, Pyramid Cove, Tanner Bank Minefield).	

A.2.8.14 Underwater Demolition Multiple Charge—Mat Weave and Obstacle Loading

Mine Warfare			
Underwater Demolitions Multiple Charge - Mat Weave and Obstacle Loading			
Short Description	Military personnel use explosive charges to destroy barriers or obstacles to amphibious vehicle access to beach areas.	**Typical Duration**	4 hours
Long Description	Navy personnel train to construct, place, and safely detonate multiple charges laid in a pattern for underwater obstacle clearance. Explosive Ordnance Disposal personnel locate barriers or obstacles designed to block amphibious vehicle access to beach areas, then use explosive charges to destroy them. Pattern charges (mat weaves) may use as much as 650 pounds of high explosive. Time delay fuses may be used for these events.		
Typical Components	**Platforms:** Support craft **Targets:** Sub-surface targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Underwater detonation safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Southern California Range Complex	**Bays/Estuaries/Pierside:** San Clemente Island (Northwest Harbor)
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Sediments and Water Quality:** Explosives	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Target fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	E10 E13		

Mine Warfare		
Underwater Demolitions Multiple Charge - Mat Weave and Obstacle Loading		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	**Explosive Stressors:** *(Section 5.3.3)* Underwater Demolitions Multiple Charge – Mat Weave and Obstacle Loading
Assumptions Used for Analysis	Potential locations for this activity include Northwest Harbor (Training Areas and Ranges 2 and 3), Special Warfare Training Areas.	

A.2.8.15 Underwater Demolition Qualification and Certification

Mine Warfare			
Underwater Demolition Qualification and Certification			
Short Description	Navy divers conduct various levels of training and certification in placing underwater demolition charges.	**Typical Duration**	Varies
Long Description	Demolition requalification and training provides teams with experience in underwater detonations by conducting detonations on metal plates near the shoreline. At water depths of 10 to 72 feet (ft.), two sequential 12.5 to 13.75 pounds (lb.) Net Explosive Weight charges are placed on the bottom or a single 25.5 lb. charge is placed from a depth of 20 ft. to the bottom.		
Typical Components	**Platforms:** Support craft **Targets:** Sub-surface target (metal sheet) **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Underwater detonation safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Silver Strand Training Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Chemicals	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** Target fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	E6 E7		
Procedural Mitigation Measures	**Explosive Stressors:** *(Section 5.3.3)* Explosive Ordnance Disposal	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	

Mine Warfare	
Underwater Demolition Qualification and Certification	
Assumptions Used for Analysis	Potential locations for this activity include Southern California Range Complex (SAR 2), and Silver Strand Training Complex (Boat and Beach Lanes 1–14).

A.2.9 SURFACE WARFARE TRAINING

Surface warfare is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons and sensors in operations directed against enemy surface ships or small boats. Aircraft-to-surface Surface warfare is conducted by long-range attacks using air-launched cruise missiles, precision guided munitions, or aircraft guns. Surface warfare also is conducted by warships employing torpedoes, naval guns, and surface-to-surface missiles. Submarines attack surface ships using torpedoes or submarine-launched, anti-ship cruise missiles. Training in surface warfare includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or torpedo launch events. Gunnery and missile training generally involves expenditure of ordnance against a towed target. A sinking exercise is a specialized training event that provides an opportunity for ship, submarine, and aircraft crews to use multiple weapons systems to deliver high-explosive ordnance on a deactivated vessel, which is deliberately sunk.

Surface warfare also encompasses maritime security, that is, the interception of a suspect surface ship by a Navy ship for the purpose of boarding-party inspection or the seizure of the suspect ship. Training in these tasks is conducted in visit, board, search and seizure exercises.

A.2.9.1 Bombing Exercise Air-to-Surface

Surface Warfare			
Bombing Exercise Air-to-Surface			
Short Description	Fixed-wing aircrews deliver bombs against surface targets.	**Typical Duration**	1 hour
Long Description	Fixed-wing aircraft conduct bombing exercises against stationary floating targets (e.g., MK-58 smoke buoy), towed targets, or maneuvering targets. An aircraft clears the area, deploys a smoke buoy, and then delivers high-explosive or non-explosive practice munitions bombs on the target. A range boat may be used to deploy towed or maneuvering targets for an aircraft to attack. Exercises for strike fighters typically involve a flight of two aircraft delivering unguided or guided munitions that may be either high-explosive or non-explosive. The following munitions may be employed by strike fighter aircraft in the course of bombing exercise: Unguided munitions include non-explosive subscale bombs (MK-76 and BDU-45), explosive and non-explosive general purpose bombs (MK-80 series), MK-20 cluster bomb (explosive, non-explosive). Precision-guided munitions include laser-guided bombs (explosive, non-explosive), laser-guided training rounds (non-explosive), Joint Direct Attack Munition (explosive, non-explosive).		
Typical Components	**Platforms:** Fixed-wing aircraft, support craft **Targets:** Surface targets **Systems being Trained/Tested:** Aircraft platforms, bombs, non-explosive practice munitions		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Hawaii-Southern California Transit Corridor Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Explosives Metals	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions

Surface Warfare			
Bombing Exercise Air-to-Surface			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, target fragments, bomb fragments **Non-Ingestible Material:** Mark 58 marine marker	**Military Recoverable Material**	Surface targets (mobile)
Sonar and Other Transducer Bins	None		
Explosive Bins	E9 E10 E12		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* **Explosive Stressors:** *(Section 5.3.3)* Explosive bombs		**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Non-explosive bombs and mine shapes
Assumptions Used for Analysis	Approximately 90 percent of non-explosive bombs are the sub-scale bombs such as the MK-76 and BDU-48. Potential locations for this activity include Hawaii Operations Area, and Warning Area 191. For air quality analysis: - 2 fixed-wing strike aircraft (1 hour)		

A.2.9.2 Gunnery Exercise Air-to-Surface Medium-Caliber

Surface Warfare				
Gunnery Exercise Air-to-Surface Medium-Caliber				
Short Description	Fixed-wing and helicopter aircrews fire medium-caliber guns at surface targets.	**Typical Duration**	1 hour	
Long Description	Fighter and helicopter aircrew, engage surface targets with medium-caliber guns. Targets simulate enemy ships, boats, swimmers, and floating/near- surface mines. Fighter aircraft descend on a target firing high-explosive or non-explosive practice munitions medium-caliber projectiles. Helicopters will fly a racetrack pattern around an at-sea target. Aircrew will engage the target with medium-caliber weapons. Targets range from a smoke float, or an empty steel drum, to high speed remote controlled boats and jet-skis.			
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft **Targets:** Surface targets (e.g., MK 58 marine marker, empty steel drum, high speed remote controlled boats and jet-skis **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, Projectiles, projectile casings, target fragments **Non-Ingestible Material:** MK 58 marine marker, surface target (stationary)	**Military Recoverable Material**	Surface targets (mobile)	

Surface Warfare	
Gunnery Exercise Air-to-Surface Medium-Caliber	
Sonar and Other Transducer Bins	None
Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	Most medium-caliber air-to-surface gunnery exercises will be with non-explosive training projectiles. High-explosive rounds will supplement when non-explosive training projectiles are not available. Fixed-wing casings remain with aircraft, and helicopter shell casings are expended into the water. Two fixed-wing aircraft (400 rounds each) or one helicopter (400 rounds) per activity. One target used per event: expendable smoke float (50 percent), stationary target (45 percent), or remote-controlled target (5 percent). Any sources used during this activity would be *de minimis* and not quantitatively analyzed and, therefore, are not included under munitions. Potential locations for this activity include Hawaii Range Complex (Warning Areas 188, 191, 192, 193, 194, 196, and Mela South) and Southern California Range Complex (Southern California Anti-Submarine Warfare Range, [T-3, T-4, T-5, Mine Training Range-2], and Warning Area 291). For air quality analysis: - 1 fixed-wing strike aircraft - 1 rotary-wing aircraft - Average 1 hour per event

A.2.10 GUNNERY EXERCISE AIR-TO-SURFACE SMALL-CALIBER

Surface Warfare			
Gunnery Exercise Air-to-Surface Small-Caliber			
Short Description	Helicopter and tilt-rotor aircrews, use small-caliber guns to engage surface targets.	**Typical Duration**	1 hour
Long Description	Helicopters and tilt-rotor aircraft, fly a racetrack pattern around an at-sea target. Targets simulate enemy ships, boats, and floating/near-surface mines. Each gunner will engage the target with small-caliber weapons. Targets range from a smoke float, an empty steel drum, to high speed remote controlled boats and jet-skis.		
Typical Components	**Platforms:** Rotary-wing aircraft, tilt-rotor aircraft **Targets:** Surface targets (e.g., MK 58 marine marker, empty steel drum, high speed remote controlled boats and jet-skis **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, Projectiles, projectile casings, target fragments **Non-Ingestible Material:** MK 58 marine marker	**Military Recoverable Material**	Surface targets (mobile)
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Surface Warfare	
Gunnery Exercise Air-to-Surface Small-Caliber	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	Most events will occur proximate to Naval Stations where MH-60 helicopters are home based and target services are available. Potential locations for this activity include Hawaii Range Complex (Warning Areas 188, 191, 192, 193, 194, 196, and Mela South). For air quality analysis: - 1 rotary-wing aircraft - Average 1 hour per event

A.2.10.1 Gunnery Exercise Surface-to-Surface Boat Medium-Caliber

Surface Warfare			
Gunnery Exercise Surface-to-Surface Boat Medium-Caliber			
Short Description	Small boat crews fire medium-caliber guns at surface targets.	**Typical Duration**	1 hour
Long Description	Small boat crews fire medium-caliber guns at surface targets. Boat crews may use high or low speeds to approach and engage targets simulating other boats, floating mines, or near shore land targets with medium-caliber (up to and including 40 millimeter [mm]) weapons. A commonly used target is an empty steel drum. This event also includes use of anti-swimmer grenades, which may be employed within harbors. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include small unit river craft, combat rubber raiding craft, rigid-hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.		
Typical Components	**Platforms:** Small boat **Targets:** Surface targets (e.g., empty steel drum) **Systems being Trained/Tested:** Medium-caliber gun systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Bays/Estuaries/Pierside:** Pearl Harbor San Diego Harbor	
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended materials In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Medium-caliber shell fragments, target fragments **Non-Ingestible Material:** Surface targets (stationary)	**Military Recoverable Material**	Surface target (mobile)

Surface Warfare		
Gunnery Exercise Surface-to-Surface Boat Medium-Caliber		
Sonar and Other Transducer Bins	None	
Explosive Bins	E1 E2	
Procedural Mitigation Measures	**Explosive Stressors:** *(Section 5.3.3)* Explosive medium-caliber and large-caliber projectiles Maritime security operations – anti swimmer grenades	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	Assume all events include the use of some explosive rounds. Most events will involve boat crews training with MK 203 40 mm grenade launcher. Most events will occur proximate to naval stations. One target used per event, typically a stationary target such as a 50-liter steel drum. Potential locations for this activity include Hawaii Operating Area For air quality analysis: - 1 small boat - Average 1 hour per event	

A.2.10.2 Gunnery Exercise Surface-to-Surface Boat Small-Caliber

Surface Warfare				
Gunnery Exercise Surface-to-Surface Boat Small-Caliber				
Short Description	Small boat crews fire small-caliber guns at surface targets.	**Typical Duration**	1 hour	
Long Description	Small boat crews fire small-caliber guns at surface targets. Boat crews may use high or low speeds to approach and engage targets simulating other boats, swimmers, floating mines, or near shore land targets with small-caliber (up to and including .50-caliber) weapons. A commonly used target is an empty steel drum. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include small unit river craft, combat rubber raiding craft, rigid-hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.			
Typical Components	**Platforms:** Small boat **Targets:** Surface targets (e.g., empty steel drum) **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** None **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** Projectile casings, small-caliber (non-explosive) projectiles **Non-Ingestible Material:** Surface target (stationary)	**Military Recoverable Material**	Surface target (mobile)	

Surface Warfare	
Gunnery Exercise Surface-to-Surface Boat Small-Caliber	
Sonar and Other Transducer Bins	None
Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	The majority of events will occur proximate to naval stations. Events will occur relatively nearshore due to short range of boats and safety concerns. Events mostly occur within 3 nautical miles of the shoreline, but can occur further from shore. Potential locations for this activity include Warning Area 291, Southern California Anti-Submarine Warfare Range, and Shore Bombardment Area. For air quality analysis: - 1 small boat - Average 1 hour per event

A.2.10.3 Gunnery Exercise Surface-to-Surface Ship Large-Caliber

Surface Warfare			
Gunnery Exercise Surface-to-Surface Ship—Large-Caliber			
Short Description	Surface ship crews fire large-caliber guns at surface targets.	**Typical Duration**	Up to 3 hours
Long Description	This exercise involves ships' gun crews engaging surface targets at sea with their main battery large-caliber (typically 57 millimeter [mm], 76 mm, and 5-inch) guns. Targets include the QST-35 seaborne powered target, high speed maneuverable surface target, or a specially configured remote controlled water craft. Some targets are expended during the exercise and are not recovered. The exercise proceeds with the target boat approaching from about 10 nautical miles distance. The target is tracked by radar and when within a predetermined range, it is engaged first with large-caliber "warning shots." As threats get closer all weapons may be used to disable the threat. This exercise may involve a single firing ship, or be undertaken in the context of a coordinated larger exercise involving multiple ships, including a major training exercise. Large-caliber guns will also be fired during weapon certification events and in conjunction with weapon maintenance. During all events, either high-explosive or non-explosive rounds may be used. High-explosive rounds can either be fused for detonation on impact (with water surface or target), or for proximity to the target (in air detonation).		
Typical Components	**Platforms:** Surface combatant **Targets:** Surface targets (e.g., QST-35 seaborne powered target, high speed maneuverable surface target, or a specially configured remote controlled water craft) **Systems being Trained/Tested:** Large-caliber gun systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Hawaii-Southern California Transit Corridor Southern California Range Complex **Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended materials In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Chemicals Metals Other materials	

<table>
<tr><th colspan="5">Surface Warfare</th></tr>
<tr><th colspan="5">Gunnery Exercise Surface-to-Surface Ship—Large-Caliber</th></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Explosives
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Target fragments, projectile fragments
Non-Ingestible Material:
Large-caliber projectiles (non-explosive), large-caliber casings</td><td>Military Recoverable Material</td><td colspan="2">Surface targets (mobile)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">E5</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Weapons firing noise

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Small-, medium-, and large-caliber non-explosive practice munitions</td><td colspan="2">Explosive Stressors: (Section 5.3.3)
Explosive medium-caliber and large-caliber projectiles</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="5">Activity always occurs beyond 3 nautical miles of the shoreline.
For analytical purposes assume all high explosive rounds are fused to detonate upon impact with water surface or target.
After impacting the water, the high explosive rounds are expected to detonate within three feet of the surface.
Potential locations for this activity include Southern California Range Complex (Warning Area 291, Southern California Anti-Submarine Warfare Range, and Shore Bombardment Area).</td></tr>
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A.2.10.4 Gunnery Exercise Surface-to-Surface Ship Medium-Caliber

Surface Warfare			
Gunnery Exercise Surface-to-Surface Ship Medium-Caliber			
Short Description	Surface ship crews fire medium-caliber guns at surface targets.	**Typical Duration**	2–3 hours
Long Description	Surface ship crews fire medium-caliber guns at surface targets. Ships use medium-caliber weapons to practice defensive marksmanship, typically against a stationary floating target (a 10-foot-diameter red balloon [Killer Tomato]) and high-speed mobile targets. Some targets are expended during the exercise and are not recovered. Shipboard protection systems (Close-In Weapon System) utilizing medium-caliber projectiles would train against high speed mobile targets.		
Typical Components	**Platforms:** Patrol combatant, surface combatant **Targets:** Surface targets (e.g., stationary floating target, high-speed mobile target) **Systems being Trained/Tested:** Medium-caliber gun systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Transit Corridor Southern California Range Complex **Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Chemicals Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Target fragments, projectile fragments, medium-caliber casings **Non-Ingestible Material:** None	**Military Recoverable Material**	Surface targets (mobile)
Sonar and Other Transducer Bins	None		

Surface Warfare	
Gunnery Exercise Surface-to-Surface Ship Medium-Caliber	
Explosive Bins	E1 E2
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Weapons firing noise **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions **Explosive Stressors:** *(Section 5.3.3)* Explosive medium-caliber and large-caliber projectiles
Assumptions Used for Analysis	One target used per event. Approximately 50 percent of targets are "Killer Tomatoes" (usually recovered). Approximately 35 percent are high-speed maneuvering targets, which are recovered. Approximately 15 percent of targets are other stationary targets such as a steel drum. Potential locations for this activity include Hawaii Range Complex (Warning Areas-188, 191, 192, 193, 194, 196, and Mela South), Southern California Range Complex (Warning Area-291, Southern California Anti-Submarine Warfare Range, and Shore Bombardment Area). For air quality analysis: - 1 surface combatant - 1 patrol combatant - Average 2 hours per event

A.2.10.5 Gunnery Exercise Surface-to-Surface Ship Small-Caliber

<table>
<tr><th colspan="5">Surface Warfare</th></tr>
<tr><th colspan="5">Gunnery Exercise Surface-to-Surface Ship Small-Caliber</th></tr>
<tr><td>Short Description</td><td colspan="2">Surface ship crews fire small-caliber guns at surface targets.</td><td>Typical Duration</td><td>2–3 hours</td></tr>
<tr><td>Long Description</td><td colspan="4">Surface ship crews fire small-caliber guns at surface targets.

Ships use small-caliber weapons to practice defensive marksmanship, typically against stationary floating targets. The target may be a 10 foot diameter red balloon (Killer Tomato, see Figure A.1-17), a 50 gallon steel drum, or other available target, such as a cardboard box. Some targets are expended during the exercise and are not recovered.

Ship crew qualifications conducted at sea employ stationary targets on deck. Small-caliber projectiles fired during these events will be expended in the water.

Shipboard protection systems utilizing small-caliber projectiles will train against high speed mobile targets.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Navy ships
Targets: Surface targets (e.g., Killer Tomato, 50 gallon steel drum, cardboard box)
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Weapons firing safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Hawaii-Southern California Training and Testing Transit Corridor
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Vessel noise
Weapons noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Habitats:
Physical disturbance and strike – military expended material</td><td colspan="2">Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Metals Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Projectiles, projectile casings, target fragments
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Surface target (mobile)</td></tr>
</table>

Surface Warfare	
Gunnery Exercise Surface-to-Surface Ship Small-Caliber	
Sonar and Other Transducer Bins	None
Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	Small-caliber gun rounds per event: 1,000 to 3,000 non-explosive practice munitions. Majority of events will occur proximate to Naval stations. Potential locations for this activity include Hawaii Range Complex (Warning Areas 188, 191, 192, 193, 194, 196, and Mela South) Southern California Range Complex (Warning Area-291, Southern California Anti-Submarine Warfare Range, and Shore Bombardment Area). For air quality analysis: - 1 surface combatant - Average 1 hour per event

A.2.10.6 Independent Deployer Certification Exercise/Tailored Surface Warfare Training

<table>
<tr><th colspan="4">Surface Warfare</th></tr>
<tr><th colspan="4">Independent Deployer Certification Exercise/Tailored Surface Warfare Training</th></tr>
<tr><td>Short Description</td><td colspan="2">Multiple ships, aircraft and submarines conduct integrated multi-warfare training with a surface warfare emphasis. Serves as a ready-to-deploy certification for individual surface ships tasked with surface warfare missions.</td><td>Typical Duration
15 days</td></tr>
<tr><td>Long Description</td><td colspan="3">The Independent Deployer Certification Exercise (IDCERTEX) Tailored Surface Warfare (SUW) Training is a certification exercise for individual ships deploying by themselves or in small groups. IDCERTEX/SUW emphasizes mission planning and effective execution of surface warfare missions associated with LCS, and meets the integrated training requirement with other fleet assets prior to deployment. IDCERTEX/SUW is normally 15 days long and is the final at-sea exercise with the SUW mission module. Occurs 2–3 times per year.

Due to the surface warfare-focus of the certification, all warfare area training conducted during IDCERTEX/SUW was analyzed as unit level training (gunnery, missile exercise, etc.). Any anti-submarine warfare training would also be unit level training.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Multiple Surface Combatants, fixed-wing aircraft, helicopters, unmanned vehicles, and submarines
Targets: All surface, air and anti-submarine warfare targets (e.g. MK-39 Expendable Mobile Training Targets, recoverable or expendable floating
Systems being Trained/Tested: Sonar systems, lightweight torpedoes, acoustic modems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
Weapons firing safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="3">Acoustic:
Sonar and other transducers
Aircraft Noise
Vessel Noise
Weapons noise

Explosive:
In-air explosives
In-water explosives

Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military Expended Materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions

Energy:
In-air Electromagnetic Devices

Entanglement:
Wires and cables
Decelerators/Parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
Physical disturbance and strike – military expended material

Sediments and Water Quality:
Explosives Chemicals
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Explosives
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
</table>

Surface Warfare			
Independent Deployer Certification Exercise/Tailored Surface Warfare Training			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, target remnants, chaff, flares, small-caliber projectiles, weapons fragments **Non-Ingestible Material:** Sonobuoys, large and medium caliber projectiles, bombs, missiles, rockets, expendable acoustic countermeasures, MK-39 expendable mobile ASW target	**Military Recoverable Material**	MK-30 ASW target, recoverable floating targets
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF5 MF1K MF6 MF3 MF12 MF4 **High-Frequency:** HF1	**Anti-Submarine Warfare:** ASW2 ASW4 ASW3 **Torpedoes:** TORP1	
Explosive Bins	E1 E3 E6 E10		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Low Frequency and Hull-Mounted Mid-Frequency Active sonar High Frequency and Non-Hull Mounted Mid-Frequency Active sonar Large Caliber Weapons Firing **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices Non-Explosive Gunnery Non-explosive missiles and rockets Non-explosive bombs and mine shapes	**Explosive Stressors:** *(Section 5.3.3)* Explosive Small- and Medium-Caliber Munitions Explosive Large-Caliber Munitions Explosive missiles and rockets Explosive bombs	
Assumptions Used for Analysis	All warfare area training conducted during IDCERTEX/SUW was analyzed as unit level training (gunnery, missile exercise, etc.). All Military expended materials, ordnance, and explosives and sonar use is included in individual events.		

A.2.10.7 Integrated Live Fire

Surface Warfare			
Integrated Live Fire			
Short Description	Naval Forces defend against multiple surface threats (ships or small boats) with bombs, missiles, rockets, and small-, medium- and large-caliber guns.	**Typical Duration**	6–8 hours
Long Description	Naval Forces use coordinated tactics and deliver high-explosive ordnance against a swarm of surface maritime threats. Events within this activity include exercises for strike fighters typically involve a flight of two to four aircraft delivering unguided or guided munitions that may be either high-explosive or non-explosive bombs against surface targets. The bombs may be surface detonating or designed to detonate as an air-burst bomb; strike fighter aircraft, helicopter aircrews, and ship crews fire high-explosive precision-guided missiles against surface targets. If explosive, helicopter launched missiles (including rockets) typically detonate at or just below the water's surface; fighter and helicopter aircrew engage surface targets with small- and medium-caliber guns. Ships' gun crews engage surface targets with large-caliber (typically 57 millimeter and 5-inch) guns; this exercise may involve a single firing ship or be undertaken in the context of a coordinated larger exercise involving multiple ships, including a major training exercise.		
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft, surface combatant, support craft **Targets:** Surface targets (e.g., remote controlled surface targets, towed surface target) **Systems being Trained/Tested:** Aircraft platforms, in-air low-energy laser, medium- and large-caliber gun systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** In-air explosives In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Chemicals	 Metals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

Surface Warfare			
Integrated Live Fire			
Military Expended Material	**Ingestible Material:** Bomb fragments, missile fragments, projectiles, projectile casings, projectile fragments, rocket fragments, target fragments **Non-Ingestible Material:** Non-explosive bombs, mine shapes, large-caliber casings	**Military Recoverable Material**	Surface targets (mobile)
Sonar and Other Transducer Bins	None		
Explosive Bins	E1 E3 E6 E10		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Weapons firing noise **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions Non-explosive missiles and rockets Non-explosive bombs and mine shapes	**Explosive Stressors:** *(Section 5.3.3)* Explosive medium-caliber and large-caliber projectiles Explosive missiles and rockets Explosive bombs	
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Warning Area 188) and Southern California Range Complex (Southern California Anti-Submarine Range). For air quality analysis: - 12 fixed-wing strike aircraft - 4 rotary-wing aircraft - 4 surface combatant - Average 1 hour per event		

A.2.10.8 Laser Targeting—Aircraft

Surface Warfare				
Laser Targeting—Aircraft				
Short Description	Fixed-wing and helicopter aircrews illuminate enemy targets with lasers.	**Typical Duration**	1–2 hours	
Long Description	Fixed-wing and helicopter aircrew illuminate enemy targets with lasers for engagement by aircraft with laser guided bombs or missiles. This exercise may be conducted alone or in conjunction with other events utilizing precision guided munitions, such as surface missiles and guided rockets. Events where weapons are fired are addressed in the appropriate activity (e.g., air-to-surface missile exercise). Lower powered lasers may also be used as non-lethal deterrents during maritime security operations (force protection). Lower powered lasers may also be used as non-lethal deterrents during maritime security operations (force protection).			
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft, unmanned aerial system **Targets:** Surface targets **Systems being Trained/Tested:** Aircraft platforms			
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise	**Physical Disturbance and Strike:** Aircraft and aerial target Vessel and in-water device	**Energy:** In-air electromagnetic devices	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None		
	Habitats: None			
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions In-air energy	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*			

Surface Warfare	
Laser Targeting—Aircraft	
Assumptions Used for Analysis	Use of lasers as force protection non-lethal deterrents will primarily occur proximate to Navy homeports. Land target impacts are not analyzed within this Environmental Impact Statement/Oversea Environmental Impact Statement. Potential locations for this activity include Hawaii Range Complex (Warning Area 188), and Southern California Range Complex (Southern California Anti-Submarine Warfare Range, and Shore Bombardment Area, [Laser Training Ranges 1 and 2]). For air quality analysis: - 1 fixed-wing strike aircraft - 1 rotary-wing aircraft - Average 2 hours per event

A.2.10.9 Maritime Security Operations

<table>
<tr><td colspan="4">Surface Warfare</td></tr>
<tr><td colspan="4">Maritime Security Operations</td></tr>
<tr><td>Short Description</td><td colspan="2">Helicopter, surface ship, and small boat crews conduct a suite of maritime security operations at sea, to include visit, board, search and seizure, maritime interdiction operations, force protection, and anti-piracy operations.</td><td>Typical Duration
Up to 3 hours</td></tr>
<tr><td>Long Description</td><td colspan="3">Helicopter and surface ship crews conduct a suite of maritime security operations (e.g., visit, board, search and seizure, maritime interdiction operations, force protection, and anti-piracy operations). These activities involve training of boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed and may include small arms with non-explosive blanks and surveillance or reconnaissance unmanned surface and aerial vehicles. The entire exercise may last 2–3 hours.

Vessel Visit, Board, Search, and Seizure: Military personnel from ships and aircraft board suspect vessels, potentially under hostile conditions.

Maritime Interdiction Operations: Ships and aircraft train in pursuing, intercepting, and ultimately detaining suspect vessels.

Maritime Infrastructure Protection and Harbor Defense: Naval personnel train to defend oil platforms, similar at sea structures, harbors, piers, and other infrastructure.

Warning Shot/Disabling Fire: Naval personnel train in the use of weapons to force fleeing or threatening small boats (typically operating at high speeds) to come to a stop.

Ship Force Protection: Ship crews train in tracking multiple approaching, circling small craft, assessing threat potential, and communicating amongst crewmates and other vessels to ensure ships are protected against attack.

Anti-Piracy Training: Naval personnel train in deterring and interrupting piracy activity. Training includes large vessels (pirate “mother ships”), and multiple small, maneuverable, and fast craft.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Amphibious warfare ship, rotary-wing aircraft, surface combatant, small boat
Targets: Surface targets
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Silver Strand Training Complex
Bays/Estuaries/Pierside:
Pearl Harbor
San Diego Harbor</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise
Weapons noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial target
Vessels and in-water devices
Military expended materials
Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
</table>

<table>
<tr><th colspan="5">Surface Warfare</th></tr>
<tr><th colspan="5">Maritime Security Operations</th></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Habitats:
Military expended materials
Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Metals Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small caliber projectile (casing only), compression pad or plastic piston, endcap, flare o-ring
Non-Ingestible Material:
Marine marker</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)</td><td colspan="2">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Maritime Security Operations is a broad term used to describe activities intended train naval forces in the skills necessary to protect naval vessels from small boat attack, counter piracy and drug operations (maritime interdiction operations and visit, board, search, and seizure), and protect key infrastructure (e.g., oil platforms). Maritime security operations need to remain broad as naval forces need to be able to tailor training events to respond to emergent threats. Maritime Security Operations events typically do not involve live fire of weapons. All maritime security operations events involve vessel movement, sometimes at high rates of speed (naval vessels maneuvering to overtake suspect vessel or small boats (targets) closing in and maneuvering around naval vessels), and some event involve helicopters and boarding parties. Maritime security operations training events are conducted proximate to naval homeports (San Diego, California and Pearl Harbor, Hawaii) including during times of transit in and out of port, as well as during major training exercises.
Potential locations for this activity include Hawaii Range Complex (Hawaii Operating area), W-291, Southern California Anti-Submarine Warfare Range, OPAREA 3803, and Silver Strand Training Complex Boat Lanes 1–10.
For air quality analysis:
- 1 fixed-wing strike aircraft
- 1 rotary-wing aircraft
- Average 2 hours per event</td></tr>
</table>

A.2.10.10 Missile Exercise Air-to-Surface

<table>
<tr><td colspan="5">Surface Warfare</td></tr>
<tr><td colspan="5">Missile Exercise Air-to-Surface</td></tr>
<tr><td>Short Description</td><td colspan="2">Fixed-wing and helicopter aircrews fire air-to-surface missiles at surface targets.</td><td colspan="2">Typical Duration
1 hour</td></tr>
<tr><td>Long Description</td><td colspan="4">Fighter, maritime patrol aircraft, and helicopter aircrews fire precision-guided missiles against surface targets. Aircraft involved may be unmanned.

Fixed-wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude, and launch high-explosive precision guided missiles.

Helicopters designate at-sea surface targets with a laser or optics for a precision guided high-explosive or non-explosive practice munitions missile. Helicopter launched missiles typically pass through the target's "sail," and, if explosive, detonate at or just below, the water's surface.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Fixed-wing aircraft, rotary-wing aircraft
Targets: Surface targets
Systems being Trained/Tested: Air-to-surface missile systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Aircraft safety
Vessel safety
Weapons firing safety
Unmanned aerial, surface, and subsurface vehicle safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Bays/Estuaries/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Weapons noise
Vessel noise

Explosive:
In-water explosives</td><td>Physical Disturbance and Strike:
Aircraft and aerial target
Military expended materials
Vessel and in-water device

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td colspan="2">Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Habitats:
Physical disturbance and strike – military expended material
In-water explosives</td><td colspan="2">Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives
Metals
Chemicals
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Explosives
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td colspan="2">Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Missile fragments, target fragments
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Surface targets (mobile)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
</table>

Surface Warfare		
Missile Exercise Air-to-Surface		
Explosive Bins	E6 E8 E10	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive missiles and rockets Vessel movement	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets
Assumptions Used for Analysis	Assume one missile and one target per event. While missiles could explode above the water's surface after contacting targets, analysis assumes all warheads explode at or just below the water's surface. Potential locations for this activity include Pacific Missile Range Facility, Shore Bombardment Area, Laser Training Ranges 1 and 2, and Southern California Anti-Submarine Warfare Range. For air quality analysis: - 4 fixed-wing strike aircraft - 3 rotary-wing aircraft - Average 1 hour per event	

A.2.10.11 Missile Exercise Air-to-Surface—Rocket

Surface Warfare			
Missile Exercise Air-to-Surface—Rocket			
Short Description	Helicopter aircrews fire both precision-guided and unguided rockets at surface targets.	**Typical Duration**	1 hour
Long Description	Helicopters designate an at-sea surface target with a laser or optics for precision-guided high explosive or non-explosive practice munitions rockets.		
Typical Components	**Platforms:** Rotary-wing aircraft, unmanned aerial system **Targets:** Surface targets **Systems being Trained/Tested:** Air-to-surface missile systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Weapons firing safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives In-air explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Rocket fragments, target fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	Surface targets (mobile)
Sonar and Other Transducer Bins	None		
Explosive Bins	E3		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive missiles and rockets	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets	

Surface Warfare	
Missile Exercise Air-to-Surface—Rocket	
Assumptions Used for Analysis	Assume all explosive rockets detonate in water. Rockets may be used in conjunction with force protection events. The in-air low energy laser stressor was used in analysis of potential impacts on human resources. Potential locations for this activity include W-188 and W-189 in Hawaii, and W-291 in Southern California. For air quality analysis: - 1 rotary-wing aircraft - Average 1 hour per event

A.2.10.12 Missile Exercise Surface-to-Surface

Surface Warfare			
Missile Exercise Surface-to-Surface			
Short Description	Surface ship crews defend against surface threats (ships or small boats) and engage them with missiles.	**Typical Duration**	2–5 hours
Long Description	Surface ships launch missiles at surface maritime targets with the goal of destroying or disabling enemy ships or boats. After detecting and confirming a surface threat, the ship will fire a precision guided surface missile. Events with destroyers and cruisers will involve long range (over the horizon) Harpoon (or similar) surface missiles. While past Harpoon events occurred during sinking exercises, the requirement exists for non-sinking exercise events to certify ship crews. If a sinking exercise target is unavailable, a towed sled would likely be used. Events with littoral combat and patrol combatant ships will involve shorter range surface missiles, such as Hellfire and Griffin. Events with littoral combat and patrol combatant ships would be to certify ship's crew to defend against "close-in" (less than 10 miles) surface threats. These exercises are live fire, meaning that a missile is fired down range. Surface missiles could be equipped with either high-explosive or non-explosive warheads.		
Typical Components	**Platforms:** Surface combatant **Targets:** Surface targets **Systems being Trained/Tested:** Surface-to-surface missile systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals Chemicals Other materials	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

Surface Warfare			
Missile Exercise Surface-to-Surface			
Military Expended Material	**Ingestible Material:** Missile fragments, target fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	Surface targets (mobile)
Sonar and Other Transducer Bins	None		
Explosive Bins	E6 E10		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Non-explosive missiles and rockets	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets	
Assumptions Used for Analysis	Assume one missile and one target used per event. While missile could explode above water's surface after contacting target, analysis assumes all warheads explode at or just below surface. Potential locations for this activity include Hawaii Range Complex (Warning Area 188) and Southern California Range Complex (Warning Area 291).		

A.2.10.13 Sinking Exercise

Surface Warfare			
Sinking Exercise			
Short Description	Aircraft, ship, and submarine crews deliberately sink a seaborne target, usually a decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards, with a variety of ordnance.	**Typical Duration** 4–8 hours, possibly over 1–2 days	
Long Description	Ship personnel and aircrew deliver high-explosive ordnance on a seaborne target, (large deactivated vessel), which is deliberately sunk using multiple weapon systems. A sinking exercise is typically conducted by aircraft, surface vessels, and submarines in order to take advantage of the ability to fire high-explosive ordnance on a full size ship target. The target is typically a decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards. The location is greater than 50 nautical miles from shore and in water depths greater than 6,000 feet (ft.). Ship, aircraft, and submarine crews attack with coordinated tactics and deliver a variety of high-explosive ordnance. Sinking exercises may also be conducted for the singular purpose of evaluating weapon effectiveness. Targets will typically be fitted with generator powered signal emitters to support use of certain precision weapons. Typically, the exercise lasts for 4 to 8 hours and possibly over 1 to 2 days, however it is unpredictable and ultimately ends when the ship sinks.		
Typical Components	**Platforms:** Fixed-wing aircraft, submarines, surface combatant **Targets:** Ship hulk **Systems being Trained/Tested:** Large-caliber gun systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety Sinking exercise safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended materials In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

<table>
<tr><th colspan="5">Surface Warfare</th></tr>
<tr><th colspan="5">Sinking Exercise</th></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Bomb fragments, missile fragments, projectiles, projectile casings, projectile fragments, torpedo fragments
Non-Ingestible Material:
Ship hulk, large-caliber casings, guidance wire</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">Torpedoes:
TORP2</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">E5 E8 E10 E11 E12</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Weapons firing noise

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Small-, medium-, and large-caliber non-explosive practice munitions
Non-explosive missiles and rockets
Non-explosive bombs and mine shapes</td><td colspan="2">Explosive Stressors: (Section 5.3.3)
Explosive medium-caliber and large-caliber projectiles
Explosive missiles and rockets
Explosive bombs
Sinking Exercises</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Events occur greater than 50 nautical miles from shore and in water depths greater than 6,000 ft. during daylight hours only.
Potential locations for this activity include Southern California Range Complex (Warning Area 291).
The participants and assets typically include:
• 1 full-size target ship hulk
• 1-5 CG, DDG, or LCS ships
• 1-10 F/A-18, or maritime patrol aircraft
• 1 or 2 MH-60 helicopters
• 1 E-2 aircraft for Command and Control
• 1 submarine
• 1-3 range clearance aircraft
• 1-2 Harpoon surface-to-surface or air-to-surface missiles
• 2-4 Maverick or Hellfire air-to-surface missiles
• 2-12 MK-80 series general purpose bombs
• 200 rounds large-caliber projectiles
• 1-2 MK-48 heavyweight submarine-launched torpedo
• 2-10,000 rounds .50-caliber and 7.62 millimeter
• Assume 2 guidance wires expended per event
For air quality analysis:
- 1 fixed-wing strike aircraft
- Average four hours per event
Acoustic effects modeling assumed only a percentage of munitions missed target and exploded in water. Precision guided munitions are assumed to impact target well above waterline and are not modeled (or reported) as in water explosions.</td></tr>
</table>

A.2.11 OTHER TRAINING EXERCISES

A.2.11.1 Elevated Causeway System

Other Training Exercises				
Elevated Causeway System				
Short Description	A temporary pier is constructed off the beach. Support pilings are driven into the sand and then later removed.	**Typical Duration**	Up to 30 days	
Long Description	A temporary pier is constructed off of the beach. The pier is designed to allow for offloading materials and equipment from supply ships. Support pilings are driven into the sand with an impact hammer. Causeway platforms are then hoisted and secured onto the piles with hydraulic jacks and cranes. It is assembled by joining standard causeway sections together and can be assembled in 10 days. The pier, including associated piles, is removed at the conclusion of training.			
Typical Components	**Platforms:** Combat logistics ship, fleet support ship, support craft **Targets:** None **Systems being Trained/Tested:** Pile driving system, vibration removal system			
Standard Operating Procedures *(Section 2.3.3)*	Pile driving safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Silver Strand Training Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Vessel noise Pile driving **Explosive:** None	**Physical Disturbance and Strike:** Pile driving **Ingestion:** None	**Energy:** None **Entanglement:** None	
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – pile driving	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics	**Public Health and Safety:** In-water energy	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	Pile driving and removal			
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Pile driving			

Other Training Exercises	
Elevated Causeway System	
Assumptions Used for Analysis	Programmatic analysis is only assessing acoustic impacts from the pile driving. Potential locations for this activity include Silver Strand Training Complex (Boat Lanes 1–10), Southern California Range Complex (Camp Pendleton Amphibious Assault Area). For air quality analysis: - 1 combat logistics craft - 1 fleet support craft - 1 support craft - Average 10 hours per event

A.2.11.2 Kilo Dip

Other Training Exercises			
Kilo Dip			
Short Description	Functional check of the dipping sonar prior to conducting a full test or training event on the dipping sonar.	**Typical Duration**	1½ hours
Long Description	A kilo dip is the operational term used to describe a functional check of a helicopter deployed dipping sonar system. During a functional check, a single MH-60 helicopter would transit to an area designated for dipping sonar testing (i.e. a dip point usually close to shore) and would deploy the AN-AQS-22 sonar transducer assembly via a reel mechanism to a predetermined depth or series of depths while the helicopter hovers over the dip point. Once at the desired depth, the AN-AQS-22 sonar transducer would be activated and would transmit a pulsed, acoustic signal (i.e., ping) for approximately one minute (enough time to check that all systems are functioning properly). After the check is completed, the AN-AQS-22 sonar transducer assembly would be reeled in, and in some instances the helicopter would transit to a second dip point before the procedure is repeated. A kilo dip is the precursor to more comprehensive testing.		
Typical Components	**Platforms:** Rotary-wing aircraft **Targets:** None **Systems being Trained/Tested:** Mid-frequency sonar		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF4		
Explosive Bins	None		

Other Training Exercises	
Kilo Dip	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Barking Sands Tactical Underwater Range, and Helo Quickdraw), and Southern California Range Complex (Helicopter Offshore Training Areas). For air quality analysis: - 1 rotary-wing aircraft - Average 0.3 hours per event

A.2.11.3 Offshore Petroleum Discharge

Other Training Exercises				
Offshore Petroleum Discharge				
Short Description	This activity trains personnel in the transfer of petroleum (though only sea water is used during training) from ship to shore.	**Typical Duration**	12 hours	
Long Description	Offshore petroleum discharge system training consists of five training subcomponents including the beach termination unit, operation utility boat technicians, boat coxswain, dive boat operation technician, and single anchor leg moor training. This activity trains personnel in the transfer of petroleum (though only sea water is used during training) from ship to shore. From approximately one mile offshore, technicians and underwater construction team divers roll out conduit from a ship offshore, deploy the single anchor leg mooring which sinks to and settles on the ocean floor, and use anchors at various points along the conduit to secure it to the seafloor. The conduit terminates at the shore location of the termination unit manifold. The current training at Silver Strand Training Complex consists of rolling out a four mile fluid-transfer conduit from the beach out to approximately one mile offshore and anchoring it to the seafloor with a Single Anchor Leg Moor. The improved offshore petroleum discharge system would have a self-sinking hose that could extend up to eight miles offshore, but like the current system, would still be rolled out to approximately one mile offshore during training activities at Silver Strand Training Complex.			
Typical Components	**Platforms:** Support craft **Targets:** None **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Silver Strand Training Complex	**Bays/Estuaries/Pierside:** San Diego Bay (Bravo)	
Stressors to Biological Resources	**Acoustic:** None	**Physical Disturbance and Strike:** Seafloor devices	**Energy:** None	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** None	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			

Other Training Exercises	
Offshore Petroleum Discharge	
Procedural Mitigation Measures	None
Assumptions Used for Analysis	Potential locations for this activity include Silver Strand Training Complex (Boat Lanes 1–10, Bravo, and waters outside of boat lanes). For air quality analysis: - 1 support craft - Average 12 hours per event

A.2.11.4 Precision Anchoring

Other Training Exercises				
Precision Anchoring				
Short Description	Surface ship crews release and retrieve anchors in designated locations.	**Typical Duration**	Up to 1 hour	
Long Description	Ship crews choose the best available anchoring sites. The ship uses all means available to determine its position when anchor is dropped to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage.			
Typical Components	**Platforms:** Navy ships **Targets:** **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Silver Strand Training Complex	**Bays/Estuaries/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Seafloor devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement			
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Naval Defense Sea Area) and Silver Strand Training Complex (Anchorages).			

A.2.11.5 Submarine Navigation

Other Training Exercises			
Submarine Navigation			
Short Description	Submarine crews operate sonar for navigation and detection while transiting into and out of port during reduced visibility.	**Typical Duration**	Up to 2 hours
Long Description	Submarine crews train to operate sonar for navigation. The ability to navigate using sonar is critical for detection while transiting into and out of port during periods of reduced visibility. During this activity the submarine will be surfaced.		
Typical Components	**Platforms:** Submarines **Targets:** None **Systems being Trained/Tested:** High-frequency sonar, mid-frequency sonar (hull-mounted)		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** Pearl Harbor Channel and virtual channel south of Pearl Harbor Naval Base Point Loma and seaward virtual channel
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3	**High-Frequency:** HF1	
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	None		

A.2.11.6 Submarine Sonar Maintenance and Systems Checks

Other Training Exercises			
Submarine Sonar Maintenance and Systems Checks			
Short Description	Maintenance of submarine sonar and other system checks are conducted pierside or at sea.	**Typical Duration**	Up to 1 hour
Long Description	A submarine performs periodic maintenance on the AN/BQQ-10 and submarine high-frequency sonar systems while in port or at sea. Submarines conduct maintenance to their sonar systems in shallow water near their homeport, however, sonar maintenance could occur anywhere as the system's performance may warrant.		
Typical Components	**Platforms:** Submarines **Targets:** None **Systems being Trained/Tested:** Mid-frequency hull mounted sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Pierside testing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Hawaii-Southern California Transit Corridor Southern California Range Complex	**Bays/Estuaries/Pierside:** Pearl Harbor Submarine Pier San Diego Submarine Pier
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Hawaii Operations Area, and Pearl Harbor Navigation Track) and Southern California Range Complex (Southern California operating area and San Diego Navigation Track).		

A.2.11.7 Submarine Under Ice Certification

Other Training Exercises			
Submarine Under Ice Certification			
Short Description	Submarine crews operate sonar for navigation and object detection while transiting into and out of port during reduced visibility and under simulated ice conditions.	**Typical Duration**	5 days
Long Description	Submarine crews train to operate under ice. Ice conditions are simulated during training and certification events. A single exercise is comprised of 30 hours of training, spread out over 5 days in 6-hour training sessions.		
Typical Components	**Platforms:** Submarines **Targets:** None **Systems being Trained/Tested:** High–frequency hull mounted sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** Military expended materials	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Expended bathythermograph	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**High-Frequency:** HF1		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis			

A.2.11.8 Surf Zone Detachment/Equipment Test and Evaluation

Other Training Exercises			
Surf Zone Test Detachment/Equipment Test and Evaluation			
Short Description	Navy personnel test and evaluate the effectiveness of new detection and neutralization equipment designed for detecting objects in surf conditions.	**Typical Duration**	3 hours
Long Description	Navy personnel test and evaluate the effectiveness of new detection and neutralization equipment designated for surf conditions. To support clearance capability in the surf zone (out to 10 feet of water), Explosive Ordnance Disposal personnel would test and evaluate the effectiveness of new detection and neutralization equipment designated for surf conditions. Use of explosives will occur during 1 percent of training activities (0.1–29 pounds Net Explosive Weight) and will only occur in the Silver Strand Training Complex Boat Lanes. Time delay fuses may be used for these events.		
Typical Components	**Platforms:** Small boats **Targets:** Sub-surface targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Silver Strand Training Complex **Bays/Estuaries/Pierside:** San Diego Bay (Echo)
Stressors to Biological Resources	**Acoustic:** None **Physical Disturbance and Strike:** None **Energy:** None **Explosive:** None **Ingestion:** None **Entanglement:** None		
Stressors to Physical Resources	**Air Quality:** None **Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None **Socioeconomic Resources:** None **Public Health and Safety:** None		
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None, explosive effects are rare and were analyzed as part of other activities		
Procedural Mitigation Measures	**Explosive Stressors:** *(Section 5.3.3)* Explosive Ordnance Disposal **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	Potential locations for this activity include Silver Strand Training Complex (Boat Lanes 1–14, and San Diego Bay-Echo).		

A.2.11.9 Surface Ship Sonar Maintenance and Systems Checks

Other Training Exercises			
Surface Ship Sonar Maintenance and Systems Checks			
Short Description	Maintenance of surface ship sonar and other system checks are conducted pierside or at sea.	**Typical Duration**	Up to 4 hours
Long Description	This scenario consists of surface ships performing periodic maintenance to the AN/SQS-53 sonar and other ship systems while in port or at sea. This maintenance takes up to four hours. Surface ships operate active sonar systems for maintenance while in shallow water near their homeport, however, sonar maintenance could occur anywhere as the system's performance may warrant.		
Typical Components	**Platforms:** Surface combatants **Targets:** None **Systems being Trained/Tested:** High-frequency sonar, mid-frequency hull mounted		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Pierside testing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Hawaii-Southern California Transit Corridor Southern California Range Complex	**Bays/Estuaries/Pierside:** Pearl Harbor Ship Pier San Diego Naval Base Pier
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1	**High-Frequency:** HF8	
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Hawaii OPAREA, and Pearl Harbor Navigation Track), and Southern California Range Complex (Southern California OPAREA, and San Diego Navigation Track).		

A.2.11.10 Unmanned Aerial System Training and Certification

Other Training Exercises			
Unmanned Aerial System Training and Certification			
Short Description	Submarines launch unmanned aerial system while submerged.	**Typical Duration**	2 days
Long Description	During training, a negatively buoyant capsule is deployed underwater and descends to a programmed depth. The capsule then drops a weight, inflates a flotation collar, rises to the surface, and launches an unmanned aerial system. Personnel use radio frequency communications to control and communicate with the unmanned aerial system during its flight.		
Typical Components	**Platforms:** Submarines, unmanned aerial system **Targets:** None **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water device strike Aircraft and aerial target Military expended materials **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Canister, weight, flotation collar	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	None		
Assumptions Used for Analysis	Potential locations for this activity include UAS-4.		

A.2.11.11 Unmanned Underwater Vehicle Training—Certification and Development

Other Training Exercises			
Unmanned Underwater Vehicle Training - Certification and Development			
Short Description	Unmanned underwater vehicle certification involves training with unmanned platforms to ensure submarine crew proficiency. Tactical development involves training with various payloads, for multiple purposes to ensure that the systems can be employed effectively in an operational environment.	**Typical Duration**	Up to 24 hours
Long Description	Unmanned underwater vehicle certification and tactical development involves the training with unmanned platforms on which various payloads are attached and used for different purposes. Payload certification and development training assesses various systems that can be incorporated onto unmanned platforms for mine warfare, bottom mapping, and other missions. Training can range from basic remote control and autonomous navigation tests to deployment and activation of onboard systems which may include hydrodynamic instruments, launchers, and recovery capabilities. These vehicles are capable of expanding the communication and surveillance capabilities of submarines, and terrestrial commands.		
Typical Components	**Platforms:** Submarines, support craft, unmanned underwater vehicle **Targets:** None **Systems being Trained/Tested:** Acoustic modem, high-frequency sonar, synthetic aperture sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Anchor blocks	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Forward-Looking Sonar:** FLS2	**Acoustic Modems:** M3	

Other Training Exercises	
Unmanned Underwater Vehicle Training - Certification and Development	
Explosive Bins	None
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Potential locations for this activity include Hawaii Range Complex (Pacific Missile Range Facility, and Hawaii Area Tracking System), and Southern California Range Complex (Southern California Anti-Submarine Warfare Range, Shallow Water Training Range Extension Nearshore, and Tanner Bank Minefield). For air quality analysis: - 1 support craft - Average 8 hours per event

A.2.11.12 Waterborne Training

Other Training Exercises			
Waterborne Training			
Short Description	Personnel launch, operate, and recover a variety of small boats and unmanned vehicles to achieve certifications such as coxswain, crewman, and safety observer.	**Typical Duration**	Up to 12 hours
Long Description	Waterborne Training may include qualification and certification as safety observer, safety swimmer, coxswain, and crewman utilizing a variety of small crafts to include but not limited to rigid hull inflatables, aluminum chambered boat, stand-up paddleboards, kayaks, and jet skis. Boat crews train to launch and recover boats, operate crew-served unmanned vehicles, moor to buoys, anchor, and operate a variety of missions in shallow waters.		
Typical Components	**Platforms:** Small boats **Targets:** None **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Bays/Estuaries/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials - other than munitions	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Military expended materials	**Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		

Other Training Exercises	
Waterborne Training	
Assumptions Used for Analysis	For air quality analysis: - 1 Rigid Hull Inflatable Boat - Average four hours per event

A.3 TESTING ACTIVITIES

A.3.1 NAVAL AIR SYSTEMS COMMAND TESTING ACTIVITIES

Naval Air Systems Command activities will generally fall under fleet primary mission areas, such as the testing of airborne mine warfare and anti-submarine warfare weapons and systems. Naval Air Systems Command activities include, but are not limited to, the testing of new aircraft platforms (e.g., the F-35 Joint Strike Fighter aircraft), weapons, and systems (e.g., newly developed sonobuoys) that will ultimately be integrated into fleet training activities. In addition to testing new platforms, weapons, and systems, Naval Air Systems Command also conducts lot acceptance testing of sonobuoys and follow-on testing and evaluation of updated systems in support of fleet operational units. In general, the potential environmental effects from most Naval Air Systems Command testing events are similar to the associated fleet training events.

While many of these systems tested by Naval Air Systems Command will ultimately be used by the fleet, testing activities involving the same or similar systems may be conducted in different locations and manners than when conducted by the fleet. Because of these differences, the results of the analysis for testing activities may differ from the results for training activities.

A.3.1.1 Air Warfare

A.3.1.1.1 Air Combat Maneuver Test

Air Warfare			
Air Combat Maneuver Test			
Short Description	Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat.	**Typical Duration**	Up to 2 flight hours per aircraft, per event
Long Description	Air combat maneuver is the general term used to describe an air-to-air test event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No weapons are fired during air combat maneuver activities.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** Air targets **Systems being Trained/Tested:** Aircraft platform		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Other materials	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*		

Air Warfare	
Air Combat Maneuver Test	
Assumptions Used for Analysis	Chaff and flare expenditures are captured under Chaff Test and Flare Test, respectively. For air quality analysis: - two fixed-wing other aircraft (2 hours) - six fixed-wing strike aircraft (3 hours) - four manned high-performance aircraft (3 hours)

A.3.1.1.2 Air Platform—Vehicle Test

Air Warfare			
Air Platform - Vehicle Test			
Short Description	Testing performed to quantify the flying qualities, handling, airworthiness, stability, controllability, and integrity of an air platform or vehicle. No explosive weapons are released during an air platform/vehicle test.	**Typical Duration**	2–8 flight hours per event
Long Description	The air platform/vehicle test describes the testing performed to quantify the flying qualities, handling, airworthiness, stability, controllability, and integrity of an air platform/vehicle. Integration of non-weapons system including aerial refueling tests are also conducted as part of an air platform/vehicle test. Test results are compared against design and performance specifications for compliance. The test results are also used to define stability and controllability characteristics and limitations and to improve and update existing analytical and predictive models. A wide variety of fixed-wing and rotary-wing aircraft, including unmanned aerial systems would undergo air platform/vehicle testing. No weapons are released during an Air Platform/Vehicle Test. Aircraft may employ laser detection for targeting systems and trailing antenna. Events may involve two or more fighter jet aircraft and a towed target tractor by a contracted aircraft (e.g., Learjet for laser targeting tests).		
Typical Components	**Platforms:** Fixed-wing aircraft, unmanned aerial systems **Targets:** None **Systems being Trained/Tested:** Aircraft platforms		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Military expended material **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-air energy Physical interactions

<table>
<tr><th colspan="4">Air Warfare</th></tr>
<tr><th colspan="4">Air Platform - Vehicle Test</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Per chaff: one chaff plastic endcap, one compression pad; OR one plastic piston, one plastic endcap
Per flare cartridge: one silicone rubber compression pad OR one plastic piston
Non-Ingestible Material:
Per chaff: Chaff and chaff fibers
Per flare cartridge: flare (typically consumed), one plastic endcap, O-ring (rubber, nitrile)</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">For air quality analysis:
- 35 annual events, 4 hours duration each, 25 percent of time below 3,000 feet for each, all time > 12 nautical miles from shore.
- 12 of the events: 2 FA-18E/F
- 11 events: 1 E-2C</td></tr>
</table>

A.3.1.1.3 Air Platform Weapons Integration Test

Air Warfare			
Air Platform Weapons Integration Test			
Short Description	Testing performed to quantify the compatibility of weapons with the aircraft from which they would be launched or released. Non-explosive weapons or shapes are used.	**Typical Duration**	Up to 2 1/2 flight hours per aircraft per event
Long Description	The air platform weapons integration test describes the testing performed to quantify the compatibility of weapons with the aircraft from which they would be released. Tests evaluate the compatibility of the weapon and its carriage, suspension, and launch equipment with the performance and handling characteristics of the designated aircraft. Additional tests assess the ability of the weapon to separate or launch safely from the aircraft at combat velocities, including at supersonic speeds. Test results are compared against design specifications for compliance. The test results are also used to define performance characteristics and to improve and update existing analytical and predictive models.		
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft, unmanned aerial system **Targets:** None **Systems being Trained/Tested:** Munitions firing/launching systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Military expended materials **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Non-explosive practice munitions	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Air Warfare		
Air Platform Weapons Integration Test		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*	**Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive bombs and mine shapes
Assumptions Used for Analysis	For air quality analysis: - 1 aircraft per test event - 2 hours per event - P-8A (3 flights annually) - E-2C (3 flights) - MH-60 (3 flights) - F/A-18E/F (4 flights) - Each A/C spends all of its time > 12 nautical miles from shore, 25 percent below 3,000 feet	

A.3.1.1.4 Intelligence, Surveillance, and Reconnaissance Test

Air Warfare				
Intelligence, Surveillance, and Reconnaissance Test				
Short Description	Aircrews use all available sensors to collect data on threat vessels.	**Typical Duration**	2–20 flight hours per event	
Long Description	An air warfare intelligence, surveillance, and reconnaissance (ISR) test involves evaluating communications capabilities of aircraft, including unmanned aerial systems that can carry cameras, sensors, communications equipment, or other payloads. New systems are tested at sea to ensure proper communications between aircraft and ships. Intelligence, Surveillance, and Reconnaissance aircraft systems act as eyes in the sky, relaying raw imagery back to military personnel on the ground or to ships at-sea. The data is processed, analyzed, and shared with U.S. Navy or other U.S. military aircraft or vessels. New ISR technology systems provide combat identification (friend or foe) and are used for aircraft and ship-based communications.			
Typical Components	**Platforms:** Fixed-wing aircraft, fixed-wing unmanned aerial system **Targets:** Air targets, surface targets **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*			

Air Warfare	
Intelligence, Surveillance, and Reconnaissance Test	
Assumptions Used for Analysis	For air quality analysis: - 1 P-8A - 6 hours per event - 60 percent of time <3,000 feet, 100 percent of time > 12 nautical miles from shore.

A.3.1.2 Anti-Submarine Warfare

A.3.1.2.1 Anti-Submarine Warfare Torpedo Test

Anti-Submarine Warfare			
Anti-Submarine Warfare Torpedo Test			
Short Description	This event is similar to the training event torpedo exercise. Test evaluates anti-submarine warfare systems onboard rotary-wing and fixed-wing aircraft and the ability to search for, detect, classify, localize, track, and attack a submarine or similar target.	**Typical Duration**	2–6 flight hours per event
Long Description	Similar to a torpedo exercise, an anti-submarine warfare (ASW) torpedo test evaluates anti-submarine warfare systems onboard rotary-wing (e.g., MH-60R helicopter) and fixed-wing (marine patrol aircraft P-8) aircraft and the ability to search for, detect, classify, localize, track, and attack a submarine or similar target (e.g., MK-39 expendable mobile ASW training target [EMATT], or MK-30). The focus of the anti-submarine warfare torpedo test is the operation of non-explosive torpedoes (e.g., MK-46 or MK-54), but other anti-submarine warfare systems are often used during the test. MK-39 (EMATT) or MK-30 targets simulate a submarine threat and are deployed at varying depths and speeds. If available, tests may be conducted using an actual submarine as the target. This activity can be conducted in shallow or deep waters and aircraft can originate from a land base or from a surface ship. The torpedo test culminates with the release of an exercise torpedo against the target and is intended to evaluate the targeting, release, and tracking process of deploying torpedoes from aircraft. All exercise torpedoes used in testing are either running or non- running and are non-explosive. Eighty-five percent of torpedoes are recovered. A parachute assembly used for aircraft-launched torpedoes is jettisoned and sinks. Ballast (typically lead weights) may be released from the torpedoes to allow for recovery, and sink to the bottom.		
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft **Targets:** Sub-surface targets **Systems being Trained/Tested:** Torpedoes/torpedo launching systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals Chemicals Other materials	

<table>
<tr><th colspan="5">Anti-Submarine Warfare</th></tr>
<tr><th colspan="5">Anti-Submarine Warfare Torpedo Test</th></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Lightweight torpedo accessories (small decelerator/parachutes, ballast), small parachutes
Non-Ingestible Material:
Expendable bathythermograph, lightweight torpedo (non-explosive, recoverable), sonobuoys (non-explosive), expendable ASW training targets</td><td>Military Recoverable Material</td><td>Exercise Torpedoes, Recoverable ASW Training Targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">Mid-Frequency:
MF5
Torpedoes:
TORP1</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Acoustic Stressors: (Section 5.3.2)
Active sonar</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Assume one torpedo accessory package (parachute, ballast) per torpedo. Assume one target per torpedo.
For air quality analysis:
- 1 fixed-wing patrol aircraft (6 hours)
- 1 rotary-wing aircraft (2 hours)</td></tr>
</table>

A.3.1.2.2 Anti-Submarine Warfare Tracking Test—Helicopter

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Test—Helicopter			
Short Description	This event is similar to the training event anti-submarine tracking exercise–helicopter. The test evaluates the sensors and systems used to detect and track submarines and to ensure that helicopter systems used to deploy the tracking systems perform to specifications.	**Typical Duration**	2 flight hours per event
Long Description	Similar to an anti-submarine tracking exercise–helicopter, an Anti-Submarine Warfare (ASW) Tracking Test — helicopter evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications. Typically, one helicopter (e.g., MH-60) conducts anti-submarine warfare testing using the dipping sonar (e.g., AN/AQS–22), non-impulsive sonobuoys (e.g., AN/SSQ-62), passive sonobuoys (e.g., AN/SSQ-53D/E), or explosive sonobuoys (e.g., mini sound-source seeker buoys). Targets (e.g., MK-39 EMATT or MK-30) may also be employed during an anti-submarine warfare tracking test event. If available, tests may be conducted using an actual submarine as the target. This activity would be conducted in shallow or deep waters and could initiate from a land base or from a surface ship. Helicopter anti-submarine warfare tests are intended to evaluate the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications. Some anti-submarine helicopter tracking tests could be conducted as part of an anti-submarine tracking coordinated event with Fleet training activities.		
Typical Components	**Platforms:** Rotary-wing aircraft **Targets:** Sub-surface targets **Systems being Trained/Tested:** Sonobuoys and dipping sonar systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Test—Helicopter			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, sonobuoy fragments **Non-Ingestible Material:** Sonobuoys, sonobuoy wires	**Military Recoverable Material**	Recoverable sub-surface targets
Sonar and Other Transducer Bins	**Mid-Frequency:** MF4 MF5		
Explosive Bins	E3		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Explosive Stressors:** *(Section 5.3.3)* Explosive sonobuoys	
Assumptions Used for Analysis	For air quality analysis: - 1 rotary-wing aircraft - Average 2 hours per event		

A.3.1.2.3 Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft			
Short Description	The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements.	**Typical Duration**	8 hours per event
Long Description	Similar to an anti-submarine warfare (ASW) tracking exercise-maritime patrol aircraft, an anti-submarine warfare tracking test—maritime patrol aircraft evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications and meet operational requirements. P-3 or P-8 fixed-wing aircraft conduct anti-submarine warfare testing using non-impulsive sonobuoys (e.g., AN/SSQ-62 DICASS), explosive sonobuoys (e.g., MK-61 SUS), passive sonobuoys (e.g., AN/SSQ-53 DIFAR), and smoke devices (e.g., MK-58). Targets (e.g., MK-39 Expendable Mobile ASW Training Target) may also be employed during an anti-submarine warfare scenario. If available, tests may be conducted using an actual submarine as the target. This activity would be conducted in deep (typically beyond 100 feet) waters. Some anti-submarine warfare maritime patrol aircraft tracking tests could be conducted as part of a coordinated event with fleet training activities.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** Sub-surface targets **Systems being Trained/Tested:** Sonobuoys/sonobuoy launching systems, data transmission systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

Anti-Submarine Warfare			
Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, sonobuoy fragments **Non-Ingestible Material:** Sonobuoys, Expendable ASW Training Targets, sonobuoy wires	**Military Recoverable Material**	Recoverable ASW Training Targets
Sonar and Other Transducer Bins	**Mid-Frequency:** MF5 MF6 **Anti-Submarine Warfare:** ASW2 ASW5		
Explosive Bins	E1 E3		
Procedural Mitigation Measures	None		
Assumptions Used for Analysis	For air quality analysis: - 1 fixed-wing patrol aircraft - Average 8 hours per event		

A.3.1.2.4 Sonobuoy Lot Acceptance Test

Anti-Submarine Warfare			
Sonobuoy Lot Acceptance Test			
Short Description	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot or group of sonobuoys in advance of delivery to the fleet for operational use.	**Typical Duration**	6 flight hours per event
Long Description	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot or group of sonobuoys in advance of delivery to the fleet for operational use. Lot acceptance testing would occur for multiple types of sonobuoys including non-impulsive (e.g., AN/SSQ-62 DICASS) and explosive (e.g., MK-61 SUS).		
Typical Components	**Platforms:** Fixed-wing aircraft, Navy ships **Targets:** None **Systems being Trained/Tested:** Sonobuoy systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, sonobuoy fragments **Non-Ingestible Material:** Sonobuoys, sonobuoy wires	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Low-Frequency:** LF4 **Mid-Frequency:** MF5 MF6	**High-Frequency:** HF5 HF6 **Anti-Submarine Warfare:** ASW2 ASW5	
Explosive Bins	E1 E3 E4		

Anti-Submarine Warfare		
Sonobuoy Lot Acceptance Test		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	**Explosive Stressors:** *(Section 5.3.3)* Explosive sonobuoys
Assumptions Used for Analysis	Assume one parachute per sonobuoy For air quality analysis: - 1 P-8A - 6 hours per event - 75 percent of time <3,000 feet. - 100 percent <3 NM.	

A.3.1.3 Electronic Warfare

A.3.1.3.1 Chaff Test

<table>
<tr><th colspan="5">Electronic Warfare</th></tr>
<tr><th colspan="5">Chaff Test</th></tr>
<tr><td>Short Description</td><td colspan="2">This event is similar to the training event chaff exercise. Chaff tests evaluate newly developed or enhanced chaff, chaff dispensing equipment, or modified aircraft systems against chaff deployment. Tests may also train pilots and aircrews in the use of new chaff dispensing equipment. Chaff tests are often conducted with flare tests and air combat maneuver events, as well as other test events, and are not typically conducted as standalone tests.</td><td colspan="2">Typical Duration
2–4 flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="4">Chaff tests are conducted to evaluate newly developed or enhanced chaff dispensing equipment, to ensure other newly developed or modified aircraft systems are compatible with chaff deployment, and to train pilots and aircrew in the use of new chaff dispensing equipment. Fixed-wing, rotary-wing, and tilt rotor aircraft deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack (Electronic Protect deployment). Chaff tests are often conducted with flare tests or air combat maneuver events, as well as other tests, rather than as a standalone test. Weapons are not typically fired during chaff tests. Chaff is employed for a number of different tactical reasons, but the end goal is to create a target that will distract enemy radar and weapon systems away from the friendly platform. Chaff may also be employed offensively (Electronic Attack deployment), such as before a major strike to "hide" inbound striking aircraft. Different chaff types (e.g., RR-129A/AL, RR-144A/AL, and RR-170A/AL) are used by a variety of different Navy aircraft; however all chaff consists of a radar reflector material made of thin, narrow, metallic strips cut in various lengths, and is intended to elicit frequency responses which deceive enemy radars. Defensive chaff tests are the most common type of chaff test. In most cases, the chaff test is conducted to evaluate systems on the aircraft deploying the chaff, but it is also critical to view the effect of the chaff from the "enemy" perspective so that radar system operators may practice corrective procedures to overcome the chaff jamming effect. Chaff tests are often designed to gain experience and data from both perspectives. Chaff is typically deployed from an aircraft as the aircraft makes evasive maneuvers to defeat a simulated threat missile or threat aircraft. The chaff deploys in a cloud of the highly reflective filaments and deceives the guidance system of an inbound missile, allowing the aircraft to escape the threat.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Fixed-wing aircraft, rotary-wing aircraft, tilt-rotor aircraft
Targets: None
Systems being Trained/Tested: Chaff, chaff dispensing systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="4">Acoustic:
Aircraft noise

Explosive:
None

Physical Disturbance and Strike:
Aircraft and aerial target

Ingestion:
Military expended materials – other than munitions

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
</table>

<table>
<tr><th colspan="5">Electronic Warfare</th></tr>
<tr><th colspan="5">Chaff Test</th></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Habitats:
Physical disturbance and strike – military expended material
Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Per chaff cartridge: one plastic endcap, chaff fibers
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Acoustic Stressors: (Section 5.3.2)</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">For air quality analysis:
- 1 fixed-wing patrol aircraft
- 1 rotary-wing aircraft
- 3 V-22 Osprey
- Average 2 hours per event</td></tr>
</table>

A.3.1.3.2 Electronic System Evaluation

<table>
<tr><th colspan="5">Electronic Warfare</th></tr>
<tr><th colspan="5">Electronic Systems Evaluation</th></tr>
<tr><td>Short Description</td><td colspan="2">Test that evaluates the effectiveness of electronic systems to control, deny, or monitor critical portions of the electromagnetic spectrum. In general, electronic warfare testing will assess the performance of three types of electronic warfare systems: electronic attack, electronic protect, and electronic support.</td><td colspan="2">Typical Duration
2–6 flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="4">Electronic systems evaluations are performed to determine the effectiveness of designated electronic warfare systems to control, deny, or monitor critical portions of the electromagnetic spectrum. In general, electronic warfare testing will assess the performance of three types of electronic warfare systems; specifically, electronic attack, electronic protect, and electronic support.

Aircraft electronic attack systems are designed to confuse the enemy or deny the enemy the use of its electronically-targeted weapons systems. The suppression of enemy air defenses and active jamming against hostile aircraft and surface combatant radars are examples of the application of electronic attack. Aircraft electronic protect systems are designed to intercept, identify, categorize, and defeat threat weapons systems that are already targeting that or other friendly aircraft. Aircraft electronic support systems employ passive tactics to intercept, exploit, locate (target), collect, collate, and decipher information from the radio frequency spectrum for the purpose of determining the intentions of the radiating source. Test results are compared against design specifications to evaluate the performance of the actually electronic warfare system. The test results are also used to define performance characteristics and to improve and update existing analytical and predictive models.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Fixed-wing aircraft
Targets: Air Targets, electronic warfare target
Systems being Trained/Tested: Electronic warfare systems, radar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="4">Acoustic:
Aircraft noise

Explosive:
None

Physical Disturbance and Strike:
Aircraft and aerial target

Ingestion:
None

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Air Quality:
Criteria air pollutants
Habitats:
None

Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
None

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
Physical interactions</td></tr>
</table>

Electronic Warfare			
Electronic Systems Evaluation			
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*		
Assumptions Used for Analysis	All chaff and flare expenditure is captured under Chaff Test and Flare Test, respectively For air quality analysis: - 1 fixed-wing command and control aircraft - Average 6 hours per event		

A.3.1.3.3 Flare Test

<table>
<tr><th colspan="5">Electronic Warfare</th></tr>
<tr><th colspan="5">Flare Test</th></tr>
<tr><td>Short Description</td><td colspan="2">This event is similar to the training event flare exercise. Flare tests evaluate newly developed or enhanced flares, flare dispensing equipment, or modified aircraft systems against flare deployment. Tests may also train pilots and aircrew in the use of newly developed or modified flare deployment systems. Flare tests are often conducted with chaff tests and air combat maneuver events, as well as other test events, and are not typically conducted as standalone tests.</td><td colspan="2">Typical Duration
2 flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="4">Flare tests are conducted to evaluate new flares, newly developed or modified flare deployment systems, to ensure that other newly enhanced aircraft systems are compatible with flare deployment, and to train pilots and aircrew in the use of newly developed or modified flare deployment systems. Flare tests are often conducted with chaff tests and air combat maneuver events, as well as other test events, and are not typically conducted as stand-alone tests. During a flare test, flares (and in some cases chaff) are deployed, but no weapons are typically fired. Flare dispensers may also be jettisoned during a flare test intended to assess the safe release of the dispenser in the event of an emergency.

Rotary-wing and tilt rotor aircraft deploy flares as a defensive tactic (electronic protect deployment) to disrupt the infrared missile guidance systems used by heat-seeking missiles, thereby causing the missile to lock onto the flare instead of onto the aircraft and enabling the aircraft to avoid the threat. In a typical scenario, an aircraft may detect the electronic targeting signals emitted from threat radars or missiles, or aircrew may visually identify a threat missile plume when a missile is launched. At a strategically appropriate time, the pilot dispenses flares and immediately maneuvers the aircraft to distract and defeat the threat. During a typical flare test, an aircraft will dispense flares 3,000 feet above mean sea level and flares are completely consumed while in the air.

Aircraft flares use a magnesium extruded flare grain. Flare types commonly deployed during Naval Air Systems Command testing activities include but are not limited to: MJU-57, MJU-49, and MJU-38 for high speed aircraft and MJU-32 for low speed aircraft.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Rotary-wing aircraft, tilt-rotor aircraft
Targets: None
Systems being Trained/Tested: Flares, flare dispensing systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial target
Military expended materials

Ingestion:
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
</table>

<table>
<tr><th colspan="5">Electronic Warfare</th></tr>
<tr><th colspan="5">Flare Test</th></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Habitats:
Physical disturbance and strike – military expended material
Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Metals Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Per flare cartridge: one silicone rubber compression pad OR one plastic piston, one plastic endcap, O-ring (rubber, nitrile)
Non-Ingestible Material:
Per flare cartridge: flare (typically fully combusted)</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Acoustic Stressors: (Section 5.3.2)</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">Flare use from all other events are captured under this activity.
For air quality analysis:
- 1 rotary-wing aircraft
- 3 V-22 Osprey
- Average 2 hours per event</td></tr>
</table>

A.3.1.4 Mine Warfare

Mine warfare involves the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained, explosive device placed in the water at predetermined depths to destroy ships or submarines. Naval mines are deposited and left in place until triggered by the approach of or contact with an enemy ship, or until removed or otherwise destroyed. Naval mines can be laid by minelayers, other ships, submarines, and aircraft. Naval Air Systems Command mine warfare testing events include airborne mine countermeasures events, mine laying events (similar to mine exercises), and mine neutralization events. The AN/ASQ-235 airborne mine neutralization system was developed to destroy mines or otherwise rendering them non-functional. The airborne laser mine detection system test, airborne dipping sonar minehunting test, and airborne sonobuoy minehunting test evaluate the capabilities of mine warfare systems to detect, classify, and fix the location of floating, near-surfaced moored, and bottom moored mines.

A.3.1.4.1 Airborne Dipping Sonar Minehunting Test

<table>
<tr><td colspan="5">Mine Warfare</td></tr>
<tr><td colspan="5">Airborne Dipping Sonar Minehunting Test</td></tr>
<tr><td>Short Description</td><td colspan="2">A mine-hunting dipping sonar system that is deployed from a helicopter and uses high-frequency sonar for the detection and classification of bottom and moored mines.</td><td colspan="2">Typical Duration
2 flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="4">Tests of a mine-hunting dipping sonar system to evaluate the search capabilities of this helicopter-deployed, mine hunting, detection, and classification system. The sonar identifies mine-like objects.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Rotary-wing aircraft
Targets: Mine shapes
Systems being Trained/Tested: Dipping sonar systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="4">Acoustic:
Sonar and other transducers
Aircraft noise
Explosive:
None
Physical Disturbance and Strike:
Aircraft and aerial target
Ingestion:
None
Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Air Quality:
Criteria air pollutants
Habitats:
None
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
None
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">High-Frequency:
HF4</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="4">Acoustic Stressors: (Section 5.3.2)
Active sonar</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">For air quality analysis:
- 1 rotary-wing aircraft
- 50 percent within 3 miles (mi.), 30 percent 3-12 mi., 20 percent > 12 mi.
- Average 2.5 hours per event</td></tr>
</table>

A.3.1.4.2 Airborne Laser Based Mine Detection System Test

Mine Warfare			
Airborne Laser-Based Mine Detection System Test			
Short Description	An airborne mine hunting test of a laser-based mine detection system, that is operated from a helicopter (e.g., MH-60) and evaluates the system's ability to detect, classify, and fix the location of floating and near-surface, moored mines. The system uses a low energy laser to locate mines.	**Typical Duration**	2 1/2 flight hours per event
Long Description	During an airborne mine detection system test, a helicopter (e.g., MH-60) evaluates the search capabilities of the AN/AES-1 Airborne Laser Mine Detection System. The Airborne Laser Mine Detection System is a mine hunting system designed to detect, classify, and localize floating and near-surface, moored sea mines using a laser system. The Airborne Laser Mine Detection System will be integrated into the helicopter to provide a rapid wide-area reconnaissance and assessment of mine threats in littoral zones, confined straits, choke points, and amphibious objective areas for Carrier and Expeditionary Strike Groups. The Airborne Laser Mine Detection System uses pulsed laser light to image the entire near-surface volume potentially containing mines. Airborne Laser Mine Detection System is capable of day or night operations without stopping to deploy or recover equipment and without towing any equipment in the water. With untethered operations, it can attain high area search rates. This design uses the forward motion of the aircraft to generate image data negating the requirement for complex scanning mechanisms and ensuring high system reliability. Airborne Laser Mine Detection System also provides accurate target geo-location to support follow on neutralization of the detected mines.		
Typical Components	**Platforms:** Rotary-wing aircraft **Targets:** Mine shapes **Systems being Trained/Tested:** Low-energy laser systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Seafloor devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-air energy Physical interactions

Mine Warfare			
Airborne Laser-Based Mine Detection System Test			
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*		
Assumptions Used for Analysis	The activity does not require the placement of moored mines. For air quality analysis: - 1 rotary-wing aircraft - 50 percent within 3 miles (mi.), 30 percent 3-12 mi., 20 percent > 12 mi. - Average 2 hours per event		

A.3.1.4.3 Airborne Mine Neutralization Systems Test

Mine Warfare			
Airborne Mine Neutralization System (AMNS) Test			
Short Description	A test of the airborne mine neutralization system evaluates the system's ability to detect and destroy mines from an airborne mine countermeasures capable helicopter (e.g., MH-60). The airborne mine neutralization system uses up to four unmanned underwater vehicles equipped with high-frequency sonar, video cameras, and explosive and non-explosive neutralizers.	**Typical Duration**	2 1/2 flight hours per event
Long Description	Mine neutralization tests evaluate aircraft and aircraft systems intended to neutralize or otherwise destroy mines through the use of explosives or other munitions. For most neutralization tests, mine shapes or non-explosive mines are used to evaluate new or enhanced mine neutralization systems. The airborne mine neutralization system uses up to four unmanned underwater vehicles equipped with high-frequency sonar and video cameras to relocate previously detected submerged mines. The unmanned underwater vehicles are also equipped with explosives to neutralize the mines after they are located. Data from unmanned underwater vehicles are relayed to the operator in the helicopter through a fiber-optic cable enabling the operator to position the neutralizing charge onto the most vulnerable area of the mine. The explosive charge is then detonated to neutralize the mine. For most tests, recoverable non-explosive neutralizers are used. A mine shape, rather than an explosive mine, serves as the target and a range support vessel recovers the non-explosive neutralizer and the mine shape following the test. Testing scenarios include a non-explosive neutralizer against an inert mine shape, or an explosive neutralizer against an explosive mine.		
Typical Components	**Platforms:** Rotary-wing aircraft, support boat, unmanned underwater vehicle **Targets:** Mine shapes **Systems being Trained/Tested:** Mine neutralization systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosives:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials

<table>
<tr><th colspan="5">Mine Warfare</th></tr>
<tr><th colspan="5">Airborne Mine Neutralization System (AMNS) Test</th></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Mine fragments (non-preferred alternative only), neutralizer (explosive) fragments

Non-Ingestible Material:
Fiber optic cable housing canister, fiber optic cable</td><td>Military Recoverable Material</td><td>Neutralizers (non-explosive), mine shapes (non-explosive)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="4">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">E4, E11 (non-preferred alternative)</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td><td colspan="2">Explosive Stressors: (Section 5.3.3)
Explosive mine countermeasure and neutralization activities</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">No explosive mines (E11) would be used under the preferred alternative. Explosive mines are proposed and analyzed under the non-preferred alternative.
For air quality analysis:
- 1 rotary-wing aircraft
- 50 percent within 3 miles (mi.), 30 percent 3-12 mi., 20 percent > 12 mi.
- Average 2 hours per event</td></tr>
</table>

A.3.1.4.4 Airborne Sonobuoy Minehunting Test

Mine Warfare			
Airborne Sonobuoy Minehunting Test			
Short Description	A mine-hunting system made up of sonobuoys is deployed from a helicopter. A field of sonobuoys, using high-frequency sonar, is used for detection and classification of bottom and moored mines.	**Typical Duration**	2 flight hours per event
Long Description	Tests of mine-hunting sonobuoys to evaluate the search capabilities of this helicopter-deployed, mine hunting, detection, and classification system. The sonar identifies mine-like objects.		
Typical Components	**Platforms:** Rotary-wing aircraft **Targets:** Mine shapes **Systems being Trained/Tested:** Sonobuoy systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals Chemicals Other materials	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Sonobuoys, sonobuoy wires	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**High-Frequency:** HF6		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar		

Mine Warfare	
Airborne Sonobuoy Minehunting Test	
Assumptions Used for Analysis	For air quality analysis: - 1 rotary-wing aircraft - 50 percent within 3 miles (mi.), 30 percent 3-12 mi., 20 percent > 12 mi. - Average 2 hours per event

A.3.1.4.5 Mine Laying Test

Mine Warfare			
Mine Laying Test			
Short Description	Fixed-wing aircraft evaluate the performance of mine laying equipment and software systems to lay mines. A mine test may also train aircrew in laying mines using a new or enhanced mine deployment system.	**Typical Duration**	2 flight hours per event
Long Description	During a mine laying test, fixed-wing aircraft evaluate the performance of aircraft mine laying equipment or associated software systems to lay mines using non-explosive mine shapes. A mine test may also train aircrew in the technique of laying mines and in using a new or enhanced mine deployment system. Aircrew typically drop a series of about four non-explosive mine shapes (i.e., MK 76, BDU-45, or BDU-48), making multiple passes in the same flight pattern and dropping one or more shapes each time. The non-explosive mine shapes are expendable and are typically not recovered after the test.		
Typical Components	**Platforms:** Fixed-wing aircraft **Targets:** None **Systems being Trained/Tested:** Mine laying systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Military expended materials Seafloor devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Mines (Non-explosive)	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Mine Warfare		
Mine Laying Test		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*	**Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive mines and mine shapes
Assumptions Used for Analysis	When a test event occurs and aircrew receive training, the event will be analyzed as a testing event. For air quality analysis: - 1 fixed-wing patrol aircraft (P-8A) - 50 percent within 3 miles (mi.), 30 percent 3-12 mi., 20 percent > 12 mi. - Average 1 hour per event	

A.3.1.5 Surface Warfare

Surface warfare is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons, sensors, and operations directed against enemy surface vessels. Naval Air Systems Command surface warfare tests include air-to-surface missile, gunnery, and bombing tests, rocket tests, laser targeting tests, and high-energy laser weapons tests.

A sinking exercise is a specialized Fleet training event that provides an opportunity for Naval Air Systems Command aircrew along with ship and submarine crews to deliver explosive ordnance on a deactivated vessel that has been cleaned and environmentally remediated. The vessel is deliberately sunk using multiple weapons systems. A Naval Air Systems Command testing event may take place in conjunction with a sinking exercise to test aircraft or aircraft systems in the delivery of explosive ordnance on a surface target.

A.3.1.5.1 Air-to-Surface Bombing Test

<table>
<tr><td colspan="6">Surface Warfare</td></tr>
<tr><td colspan="6">Air-to-Surface Bombing Test</td></tr>
<tr><td>Short Description</td><td colspan="3">This event is similar to the training event bombing exercise air-to-surface. Fixed-wing aircraft test the delivery of bombs against surface maritime targets with the goal of evaluating the bomb, the bomb carry and delivery system, and any associated systems that may have been newly developed or enhanced.</td><td colspan="2">Typical Duration
2 flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="5">Fixed-wing aircraft test the delivery of bombs against surface maritime targets with the goal of evaluating the bomb, the bomb carry and delivery system, and any associated systems that may have been newly developed or enhanced. Both explosive and non-explosive bombs will be released during this type of test; however, the vast majority of releases will be non-explosive bombs and typically include non-explosive general purpose bombs (e.g., MK 82 and MK 83) and guided bomb units (e.g., GBU-12 and GBU-32) of various sizes. Surface targets may also be used.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Fixed-wing aircraft, unmanned aerial system
Targets: Surface targets
Systems being Trained/Tested: Bomb releasing systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Aircraft safety
Unmanned aerial, surface, and subsurface vehicle safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="5">Acoustic:
Aircraft noise
Weapons noise

Explosive:
In-water explosives

Physical Disturbance and Strike:
Aircraft and aerial target
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Habitats:
Physical disturbance and strike – military expended material
Underwater explosives

Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="5">Cultural Resources:
Explosives
Physical disturbance and strike

Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike

Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Bomb fragments, target fragments
Non-Ingestible Material:
Non-explosive bombs and mine shapes</td><td>Military Recoverable Material</td><td colspan="2">None</td></tr>
</table>

Surface Warfare		
Air-to-Surface Bombing Test		
Sonar and Other Transducer Bins	None	
Explosive Bins	E9	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive bombs and bomb shapes	**Explosive Stressors:** *(Section 5.3.3)* Explosive bombs
Assumptions Used for Analysis	For air quality analysis: - Two fixed-wing strike aircraft - Average 3 hours per event	

A.3.1.5.2 Air-to-Surface Gunnery Test

<table>
<tr><td colspan="5">Surface Warfare</td></tr>
<tr><td colspan="5">Air-to-Surface Gunnery Test</td></tr>
<tr><td>Short Description</td><td colspan="2">This event is similar to the training event gunnery exercise air-to-surface. Fixed-wing and rotary-wing aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meet required specifications or to train aircrew in the operation of a new or enhanced weapons system.</td><td colspan="2">Typical Duration
2–2 1/2 flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="4">Fixed-wing and rotary-wing aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meet required specifications or to train aircrew in the operation of a new or enhanced weapons system. Non-explosive practice munitions are typically used during this type of test; however, a small number of high explosive rounds may be used during final testing. Rounds that may be used include 7.62 millimeter (mm), 20 mm, 30 mm, 0.30-caliber, and 0.50-caliber gun ammunition.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Rotary-wing aircraft, fixed-wing aircraft, tilt-rotor aircraft
Targets: Surface targets
Systems being Trained/Tested: Gun systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety
Weapons firing safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="4">Acoustic:
Aircraft noise
Weapons noise

Explosive:
In-water explosives

Physical Disturbance and Strike:
Aircraft and aerial target
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions

Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="4">Habitats:
Physical disturbance and strike – military expended material
In-water explosives
Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="4">Cultural Resources:
Explosives
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Projectiles, projectile casings, projectile fragments, target fragments
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td>Surface targets (mobile)</td></tr>
</table>

Surface Warfare		
Air-to-Surface Gunnery Test		
Sonar and Other Transducer Bins	None	
Explosive Bins	E1	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* **Physical Disturbance and Strike:** *(Section 5.3.4)* Small-, medium-, and large-caliber non-explosive practice munitions	**Explosive Stressors:** *(Section 5.3.3)* Explosive medium-caliber and large-caliber projectiles
Assumptions Used for Analysis	For air quality analysis: - 1 rotary-wing aircraft - 1 V-22 Osprey aircraft - Average 2 hours per event	

A.3.1.5.3 Air-to-Surface Missile Test

Surface Warfare			
Air-to-Surface Missile Test			
Short Description	This event is similar to the training event missile exercise air-to-surface. Test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test.	**Typical Duration**	2–4 flight hours per event
Long Description	Similar to a missile exercise air-to-surface, an air-to-surface missile test may involve both fixed-wing and rotary-wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test. Air-to-surface missile tests can include high explosive, non-explosive, or non-firing (captive air training missile) weapons. Laser targeting systems may also be used. Both stationary and mobile targets would be utilized during testing.		
Typical Components	**Platforms:** Fixed-wing aircraft, rotary-wing aircraft, tilt-rotor aircraft **Targets:** Surface targets **Systems being Trained/Tested:** Missile firing/launching systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Weapons firing safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Missile fragments, target fragments **Non-Ingestible Material:** Non-explosive missiles	**Military Recoverable Material**	Surface targets (mobile)
Sonar and Other Transducer Bins	None		

Surface Warfare		
Air-to-Surface Missile Test		
Explosive Bins	E6 E9 E10	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* **Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive missiles and rockets	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets
Assumptions Used for Analysis	For air quality analysis: - 1 fixed-wing patrol aircraft - 2 rotary-wing aircraft - 3 V-22 Osprey aircraft - Average 2 hours per event	

A.3.1.5.4 High Energy Laser Weapons Test

Surface Warfare			
High Energy Laser Weapons Test			
Short Description	High energy laser weapons tests evaluate the specifications, integration, and performance of an aircraft mounted, approximately 25 kilowatt high energy laser. The laser is intended to be used as a weapon to disable small surface vessels.	**Typical Duration**	2 1/2 flight hours per event
Long Description	During a high energy laser weapons test, aircrew evaluate the specifications, integration, and performance of an aircraft mounted, approximately 25 kilowatt high energy laser that is intended to be used as a weapon against stationary and mobile, unmanned surface targets. The high energy laser would be employed from a helicopter (e.g., MH-60) either hovering or in forward flight, and is designed to disable the surface vessel, rendering it immobile. The high energy laser would have a range of up to six kilometers. Unmanned surface targets would be used during the high energy laser test.		
Typical Components	**Platforms:** Rotary-wing aircraft **Targets:** Surface targets **Systems being Trained/Tested:** High energy lasers		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety High-powered laser safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices Lasers **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-air energy
Military Expended Material	**Ingestible Material:** Target fragments **Non-Ingestible Material:** None	**Military Recoverable Material**	Remote-controlled surface targets
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Surface Warfare		
High Energy Laser Weapons Test		
Procedural Mitigation Measures	None	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	For air quality analysis: - 1 rotary-wing aircraft - 100 percent > 12 miles - Average 2 hours per event	

A.3.1.5.5 Laser Targeting Test

<table>
<tr><td colspan="6">Surface Warfare</td></tr>
<tr><td colspan="6">Laser Targeting Test</td></tr>
<tr><td>Short Description</td><td colspan="3">Aircrews illuminate enemy targets with lasers.</td><td>Typical Duration
4 flight hours per event</td><td></td></tr>
<tr><td>Long Description</td><td colspan="5">During a laser targeting test, aircrew use laser targeting devices integrated into aircraft or weapons systems to evaluate targeting accuracy and precision and to train aircrew in the use of newly developed or enhanced laser targeting devices designed to illuminate designated targets for engagement with laser-guided weapons. No explosive munitions are released during a laser targeting test.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Fixed-wing aircraft, rotary-wing aircraft, tilt-rotor aircraft, unmanned aerial systems
Targets: Surface targets
Systems being Trained/Tested: Laser targeting systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Aircraft safety</td><td colspan="4">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="5">Acoustic:
Aircraft noise
Explosive:
None
Physical Disturbance and Strike:
Aircraft and aerial target
Ingestion:
None
Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Habitats:
Physical disturbance and strike – military expended material
Air Quality:
Criteria air pollutants
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
Non-explosive bombs and mine shapes</td><td>Military Recoverable Material</td><td colspan="2">Surface targets (mobile)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)</td><td colspan="3">Physical Disturbance and Strike: (Section 5.3.4)
Non-explosive bombs</td></tr>
</table>

Surface Warfare	
Laser Targeting Test	
Assumptions Used for Analysis	Military expended material may be non-explosive bombs or other guided munitions. For air quality analysis: - 2 aircraft per event - 50 percent 3-12 miles - 50 percent > 12 miles - Average 4 hours per event

A.3.1.5.6 Rocket Test

Surface Warfare			
Rocket Test			
Short Description	Rocket tests are conducted to evaluate the integration, accuracy, performance, and safe separation of guided and unguided 2.75-inch rockets fired from a hovering or forward flying helicopter or tilt rotor aircraft.	**Typical Duration**	1 1/2–2 1/2 hours per event
Long Description	Rocket tests are conducted to evaluate the integration, accuracy, performance, and safe separation of laser-guided and unguided 2.75-inch rockets fired from a hovering or forward flying helicopter. Rocket tests would involve the release of primarily live motor/non-explosive warhead rockets. Some explosive warhead rockets would be tested, and during a jettison test, rockets with a non-explosive motor and non-explosive warhead would be jettisoned along with the rocket launcher. Rocket tests are also conducted to train aircrew on the use of new or enhanced weapons systems. Rocket types may include variations of the Hydra-70 rocket developed under the Advanced Precision Kill Weapons System program or similar munitions developed under Low-cost Guided Imaging Rocket program as well as MEDUSA rockets. All rockets planned for testing are 2.75-inch rockets. Some rocket tests may be conducted in conjunction with upgrades to or integration of the Forward Looking Infrared targeting system.		
Typical Components	**Platforms:** Rotary-wing aircraft, tilt-rotor aircraft **Targets:** Surface targets **Systems being Trained/Tested:** Rocket firing/launching systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Weapons firing safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Weapons noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial target Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended materials In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Rocket fragments, target fragments **Non-Ingestible Material:** Flechettes, non-explosive rockets	**Military Recoverable Material**	Remote controlled surface targets, stationary surface targets

Surface Warfare		
Rocket Test		
Sonar and Other Transducer Bins	None	
Explosive Bins	E3	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* **Physical Disturbance and Strike:** *(Section 5.3.4)* Non-explosive missiles and rockets	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets
Assumptions Used for Analysis	For air quality analysis: - 2 aircraft per event - Average 2 hours per event	

A.3.1.6 Other Testing Activities

A.3.1.6.1 Acoustic and Oceanographic Research

Other Testing Activities			
Acoustic and Oceanographic Research			
Short Description	Active transmissions within the band 10 hertz (Hz)-100 kilohertz (kHz) from sources deployed from ships and aircraft.	**Typical Duration**	8 flight hours per event
Long Description	Active acoustic transmissions within the band 10 Hz-100 kHz used for engineering tests of acoustic sources, validation of ocean acoustic models, characterization of acoustic interactions with the ocean bottom and ocean surface.		
Typical Components	**Platforms:** Fixed-wing aircraft, small boat **Targets:** Sub-surface target **Systems being Trained/Tested:** Low-energy laser, *de minimis* sonar systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		

Other Testing Activities	
Acoustic and Oceanographic Research	
Assumptions Used for Analysis	Lasers used are in-water, low-energy lasers. For air quality analysis: - 1 fixed-wing patrol aircraft - 1 small boat - Average 8 hours per event

A.3.1.6.2 Air Platform Shipboard Integration Test

Other Testing Activities				
Air Platform Shipboard Integration Test				
Short Description	Aircraft are tested to determine operability from shipboard platforms, performance of shipboard physical operations, and to verify and evaluate communications and tactical data links.	**Typical Duration**	2–12 flight hours per event	
Long Description	The air platform shipboard integration test is performed to evaluate the compatibility of an aircraft to operate from designated shipboard platforms, perform shipboard physical operations, and to verify and evaluate communications and tactical data links. This test function also includes an assessment of carrier-shipboard suitability, such as hazards of electromagnetic radiation to ordnance, hazard of electromagnetic radiation to personnel, and high energy radio frequency.			
Typical Components	**Platforms:** Fixed-wing aircraft, unmanned aerial system, tilt-rotor aircraft **Targets:** None **Systems being Trained/Tested:** Communications systems			
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise	**Physical Disturbance and Strike:** Aircraft and aerial target	**Energy:** In-air electromagnetic devices	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants	**Sediments and Water Quality:** None		
	Habitats: None			
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)*			

Other Testing Activities	
Air Platform Shipboard Integration Test	
Assumptions Used for Analysis	For air quality analysis: - 1 V-22 Osprey aircraft (2 hours) - 1 fixed-wing patrol aircraft (6 hours) - 100 percent > 12 miles

A.3.1.6.3 Kilo Dip

<table>
<tr><th colspan="6">Anti-Submarine Warfare</th></tr>
<tr><th colspan="6">Kilo dip</th></tr>
<tr><td>Short Description</td><td colspan="3">Functional check of a helicopter deployed dipping sonar system (e.g., AN/AQS-22) prior to conducting a testing or training event using the dipping sonar system.</td><td>Typical Duration</td><td>1 ½ flight hours per event</td></tr>
<tr><td>Long Description</td><td colspan="5">A kilo dip is the operational term used to describe a functional check of a helicopter deployed dipping sonar system. During a functional check, a single helicopter (e.g., MH-60) would transit to an area designated for dipping sonar testing (i.e., a dip point usually close to shore) and would deploy the sonar transducer assembly via a reel mechanism to a predetermined depth or series of depths while the helicopter hovers over the dip point. Once at the desired depth, the sonar transducer would be activated and would briefly transmit a pulsed, acoustic signal (i.e., ping) to check that all systems are functioning properly. After the check is completed, the sonar transducer assembly would be reeled in, and in some instances the helicopter would transit to a second dip point before the procedure is repeated. A kilo dip is a precursor to more comprehensive testing.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Rotary-wing aircraft
Targets: None
Systems being Trained/Tested: Dipping sonar systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Aircraft safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Aircraft noise
Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Aircraft and aerial target
Ingestion:
None</td><td>Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Air Quality:
Criteria air pollutants
Habitats:
None</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td colspan="2">Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">Mid-Frequency:
MF4</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
</table>

Anti-Submarine Warfare	
Kilo dip	
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar
Assumptions Used for Analysis	For air quality analysis: - One rotary-wing aircraft - Average 0.3 hours per event

A.3.1.6.4 Shipboard Electronic Systems Evaluation

Other Testing Activities			
Shipboard Electronic Systems Evaluation			
Short Description	Tests measure ship antenna radiation patterns and test communication systems with a variety of aircraft.	**Typical Duration**	2–20 flight hours per event
Long Description	Shipboard electronic systems evaluation tests measure ship antenna radiation patterns and evaluate communication systems linking vessels and aircraft. Aircraft capable of landing on a ship (e.g., aircraft carrier or littoral combat ship) temporarily deploy to a nearshore ship and conduct a variety of tests over a period of days to test newly installed or modified systems onboard the aircraft for compatibility with shipboard electronic systems. Follow-on test and evaluation of unmanned aerial systems would consist of dynamic interface testing, shipboard electromagnetic testing, and envelope expansion tests intended to evaluate capability of aircraft to conduct launch and recovery operations from a ship at sea as well as perform missions in a maritime environment. Altitudes would range from mean seal level to 15,000 feet (ft.) above mean sea level with the majority of flights occurring between mean sea level and 3,000 ft. Shipboard testing of new technology systems to provide precision guidance to aircraft landing on air capable ships. At-sea flight test of the aircraft would consist of shipboard compatibility (dynamic interface/envelope expansion) and, during Operational Evaluation, amphibious assault scenarios. Shipboard electronic systems evaluation tests of aircraft would also involve flight and wind envelope expansion interface testing with Amphibious Assault Ships, Amphibious Transport Dock, and Dock Landing Ship class vessels.		
Typical Components	**Platforms:** Rotary-wing aircraft, unmanned aerial systems **Targets:** None **Systems being Trained/Tested:** Communications systems		
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial target **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions

Other Testing Activities			
Shipboard Electronic Systems Evaluation			
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	None		
Assumptions Used for Analysis	For air quality analysis: - 1 rotary-wing aircraft - 100 percent > 12 miles - Average 6 hours per event		

A.3.1.6.5 Undersea Range System Test

Other Testing Activities			
Undersea Range System Test			
Short Description	Following installation of a Navy underwater warfare training and testing range, tests of the nodes (components of the range) will be conducted to include node surveys and testing of node transmission functionality.	**Typical Duration**	Node survey—varies, Node transmissions 8 hours/day for 1 day
Long Description	The bottom mounted nodes are surveyed post installation utilizing a range pinger and the bi-directional nodes are tested post installation to establish system parameters and baseline hearing range as each projector is activated at full power while listening on adjacent hydrophones. The nodes may also be activated during periodic Operational and Maintenance checks and also following a significant weather event where the node locations and range functionality would be verified.		
Typical Components	**Platforms:** Surface Vessel for Survey **Targets:** None **Systems being Trained/Tested:** Range Pinger (*de minimus*), low frequency and high frequency Bi-directional Nodes		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex (Barking Sands Tactical Underwater Range) **Inland Waters/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers; Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices; Seafloor devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF9	**Broadband:** BB4	
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar		

Other Testing Activities	
Undersea Range System Test	
Assumptions Used for Analysis	None

A.3.2 NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES

A.3.2.1 Anti-Submarine Warfare

A.3.2.1.1 Anti-Submarine Warfare Mission Package Testing

Anti-Submarine Warfare			
Anti-Submarine Warfare Mission Package Testing			
Short Description	Ships and their supporting platforms (rotary-wing aircraft and unmanned aerial systems) detect, localize, and prosecute submarines.	**Typical Duration**	1–2 weeks, with 4–8 hours of active sonar use with intervals of non-activity in between.
Long Description	Littoral combat ships conduct detect-to-engage operations against modern diesel-electric and nuclear submarines using airborne and surface assets (both manned and unmanned). Active and passive acoustic systems are used to detect and track submarine targets, culminating in the deployment of lightweight torpedoes to engage the threat.		
Typical Components	**Platforms:** Rotary-wing aircraft, surface combatant **Targets:** Sub-surface targets **Systems being Trained/Tested:** Acoustic countermeasures, anti-submarine sonar, helicopter-deployed sonar, mid-frequency sonar, sonobuoys, torpedo sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals Chemicals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions

<table>
<tr><th colspan="5">Anti-Submarine Warfare</th></tr>
<tr><th colspan="5">Anti-Submarine Warfare Mission Package Testing</th></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
Acoustic countermeasures, sonobuoys (non-explosive), sonobuoy wires expendable anti-submarine warfare (ASW) training targets, bathythermographs and wires, lightweight torpedo accessories</td><td>Military Recoverable Material</td><td>Lightweight torpedoes (non-explosive), recoverable ASW Training Targets</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Mid-Frequency:
MF1 MF4
MF5 MF12</td><td>Anti-Submarine Warfare:
ASW1 ASW2
ASW3 ASW5</td><td colspan="2">Torpedoes:
TORP1</td></tr>
<tr><td>Explosive Bins</td><td colspan="4">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Active sonar</td><td colspan="2">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Towed in-water devices</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="4">For air quality analysis:
- 1 rotary-wing aircraft (SH-60)
- 100 percent <3,000 feet, 76 percent >12 miles (mi.), 24 percent 3-12 mi., 0 percent <3 mi.
- Average 3.6 hours per event</td></tr>
</table>

A.3.2.1.2 At-Sea Sonar Testing

Anti-Submarine Warfare			
At-Sea Sonar Testing			
Short Description	At-sea testing to ensure systems are fully functional in an open ocean environment.	**Typical Duration**	From 4 hours to 11 days
Long Description	At-sea sonar testing is required to calibrate or document the functionality of sonar and torpedo systems while the ship or submarine is in an open ocean environment. At-sea sonar testing is conducted to verify the ship meets design acoustic specifications, define the underwater characteristics of the ship, determine effects of systems and equipment on ship's acoustic characteristics, and provide technical background necessary to initiate development of design improvements to reduce noise. Tests also consist of electronic support measurement, photonics, and sonar sensor accuracy testing. In some instances, a submarine's passive detection capability is tested when a second submarine utilizes its active sonar or is equipped with a noise augmentation system in order to replicate acoustic or electromagnetic signatures of other vessel types or classes.		
Typical Components	**Platforms:** Amphibious warfare ship, fixed-wing patrol aircraft, rotary-wing aircraft, submarines, support craft, surface combatant **Targets:** Sub-surface targets, surface targets **Systems being Trained/Tested:** Acoustic countermeasures, acoustic modem, electromagnetic devices, high-frequency sonar, low-frequency sonar, mid-frequency sonar, sonobuoys, underwater communications		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Towed in-water device safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-water electromagnetic devices In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals Chemicals Other materials	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions

Anti-Submarine Warfare							
At-Sea Sonar Testing							
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Acoustic countermeasures, bathythermographs and wires, lightweight torpedo accessories, sonobuoys (non-explosive), sonobuoy wires			**Military Recoverable Material**	Electromagnetic devices, lightweight torpedo (non-explosive), recovered mobile sub-surface target		
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF2 MF5 MF10	MF1K MF3 MF9 MF11	**Low-Frequency:** LF4 **High-Frequency:** HF1	LF5	**Anti-Submarine Warfare:** ASW3 **Acoustic Modems:** M3	ASW4	
Explosive Bins	None						
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar				**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices		
Assumptions Used for Analysis	All torpedoes are exercise torpedoes and do not use sonar or other acoustic sources. Active sonar is intermittent throughout the duration of this event. For air quality analysis: - 1 rotary-wing aircraft (SH-60) - 1 fixed-wing patrol aircraft (P-8A) - All activity conducted >12 miles from shore - Average 10 hours per event						

A.3.2.1.3 Countermeasure Testing

Anti-Submarine Warfare			
Countermeasure Testing			
Short Description	Countermeasure testing involves the testing of systems that will detect, localize, and track incoming weapons, including marine vessel targets. Testing includes surface ship torpedo defense systems and marine vessel stopping payloads.	**Typical Duration**	From 4 hours to 6 days, depending on the countermeasure being tested
Long Description	Countermeasure testing involves the testing of systems that will detect, localize, and track incoming weapons, including marine vessel targets. At-sea testing of the Surface Ship Torpedo Defense systems includes towed acoustic systems, torpedo warning systems, and countermeasure anti-torpedo subsystems. Some countermeasure scenarios would employ non-explosive torpedoes against targets released by secondary platforms (helicopter or submarine). While surface vessels are in transit, countermeasure systems may be used to identify false alert rates. Testing of the Maritime Vessel Stopping payloads will deliver the appropriate measure(s) to affect a target vessel's propulsion and associated control surfaces to significantly slow and potentially stop the advance of the vessel.		
Typical Components	**Platforms:** Aircraft carrier, navy ships and boats, support craft, surface combatant **Targets:** Sub-surface targets, surface targets **Systems being Trained/Tested:** Acoustic countermeasures, high-frequency sonar, torpedo sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Towed in-water device safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex Hawaii-Southern California Transit Corridor **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes Biodegradable Polymer
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended material	**Sediments and Water Quality:** Metals Chemicals Other Materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions

Anti-Submarine Warfare			
Countermeasure Testing			
Military Expended Material	**Ingestible Material:** Biodegradable polymer, small decelerators/parachutes **Non-Ingestible Material:** Acoustic countermeasures, motorized autonomous targets, heavyweight torpedo accessories, guidance wire, lightweight torpedo accessories, motorized autonomous target, sonobuoys (non-explosive), sonobuoy wires	**Military Recoverable Material**	Heavyweight torpedo (non-explosive), lightweight torpedo (non-explosive), recovered mobile sub-surface target
Sonar and Other Transducer Bins	**High-Frequency:** HF5	**Anti-Submarine Warfare:** ASW3 ASW4	**Torpedoes:** TORP1 TORP2
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	Not all events will include the use of acoustics. For air quality analysis: -2 support craft for 12 hours each, for 32 of the 35 annual activities, no support craft in Transit Corridor		

A.3.2.1.4 Pierside Sonar Testing

Anti-Submarine Warfare			
Pierside Sonar Testing			
Short Description	Pierside testing to ensure systems are fully functional in a controlled pierside environment prior to at-sea test activities.	**Typical Duration**	Up to 3 weeks total per ship, with each source run independently and not continuously during this time
Long Description	Ships and submarines would activate mid- and high-frequency tactical sonars, underwater communications systems, and navigational devices to ensure they are fully functional prior to at-sea test events. Testing may also include the firing of inert torpedo shapes. Event duration varies; with average durations of three weeks with active sonar used intermittently over two days during the total event duration. This also includes pierside sonar testing during surface combatant sea trials.		
Typical Components	**Platforms:** Moored platform, submarines, surface combatant **Targets:** None **Systems being Trained/Tested:** Acoustic modem, high-frequency sonar, mid-frequency sonar, underwater communication		
Standard Operating Procedures *(Section 2.3.3)*	Pierside testing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: None	**Inland Waters/Pierside:** Pierside at Pearl Harbor, Hawaii; San Diego, California
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** None **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF3 MF9	**High-Frequency:** HF1 HF3 HF8	**Acoustic Modems:** M3
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar		
Assumptions Used for Analysis	Event duration is three weeks with active sonar used intermittently.		

A.3.2.1.5 Submarine Sonar Testing/Maintenance

Anti-Submarine Warfare			
Submarine Sonar Testing/Maintenance			
Short Description	Pierside and at-sea testing of submarine systems occurs periodically following major maintenance periods and for routine maintenance.	**Typical Duration**	Up to 3 weeks, with intermittent use of active sonar
Long Description	Following major and routine maintenance periods, pierside and at-sea testing and maintenance is required. Multiple systems with active and passive acoustic sources such as navigation systems, fathometers, underwater communications systems, underwater distress beacons, range finders, and other similar systems, will be tested.		
Typical Components	**Platforms:** Submarines **Targets:** None **Systems being Trained/Tested:** Acoustic modem, high-frequency sonar, mid-frequency sonar		
Standard Operating Procedures *(Section 2.3.3)*	Pierside testing safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex	**Inland Waters/Pierside:** Pierside at Pearl Harbor, Hawaii; San Diego, California
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** None **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3	**High-Frequency:** HF1 HF3	**Acoustic Modems:** M3
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Sonar would not be used continuously throughout duration of test. For biological resource analysis, vessel noise and vessel strike are only analyzed for the periods while the submarines are surfaced, typically brief in nature. Mitigation measures related to vessel movement are only considered during the period of surfacing as well. For human resource stressor analysis, physical disturbance and strike and physical interactions are only analyzed for the periods while the submarine are surfaced, typically brief in nature.		

A.3.2.1.6 Surface Ship Sonar Testing/Maintenance

Anti-Submarine Warfare				
Surface Ship Sonar Testing/Maintenance				
Short Description	Pierside and at-sea testing of ship systems occurs periodically following major maintenance periods and for routine maintenance.	**Typical Duration**	Up to 3 weeks, with intermittent use of active sonar	
Long Description	Following major and routine maintenance periods, pierside and at-sea testing and maintenance is required. Multiple systems with active and passive acoustic sources such as tactical sonar, navigation systems, fathometers, underwater communications systems, underwater distress beacons, range finders, and other similar systems will be tested.			
Typical Components	**Platforms:** Surface combatant **Targets:** None **Systems being Trained/Tested:** Acoustic countermeasures, mid-frequency sonar, underwater communications			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Pierside testing safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex, Southern California Range Complex	**Inland Waters/Pierside:** Pierside at Pearl Harbor, Hawaii; San Diego, California	
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF9 MF1K MF10	**Anti-Submarine Warfare:** ASW3		
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		

Anti-Submarine Warfare	
Surface Ship Sonar Testing/Maintenance	
Assumptions Used for Analysis	Sonar will not be continuously active for the duration of the test

A.3.2.1.7 Torpedo (Explosive) Testing

Anti-Submarine Warfare			
Torpedo (Explosive) Testing			
Short Description	Air, surface, or submarine crews employ explosive and non-explosive torpedoes against artificial targets.	**Typical Duration**	1–2 days during daylight hours
Long Description	Non-explosive and explosive torpedoes (carrying a warhead) will be launched at a suspended target by a submarine and fixed- or rotary-wing aircraft or surface combatants. Event duration is one to two days during daylight hours.		
Typical Components	**Platforms:** Aircraft carrier, fixed-wing aircraft, moored platform, rotary-wing aircraft, submarines, support craft, surface combatant **Targets:** Sub-surface targets, surface targets **Systems being Trained/Tested:** Acoustic countermeasures, helicopter deployed sonar, high-frequency sonar, mid-frequency sonar, sonobuoys, torpedo sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Chemicals Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy Physical interactions

<table>
<tr><th colspan="4">Anti-Submarine Warfare</th></tr>
<tr><th colspan="4">Torpedo (Explosive) Testing</th></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes, target fragments, heavyweight and lightweight torpedo (explosive) fragments
Non-Ingestible Material:
Sonobuoys, sonobuoy wires, buoy (non-explosive), guidance wires, bathythermographs and wires, heavyweight and lightweight torpedo accessories, expendable surface target, expendable ASW training target, stationary artificial target, canister</td><td>Military Recoverable Material</td><td>Heavyweight torpedoes (non-explosive), lightweight torpedoes (non-explosive), recovered mobile sub-surface target, recovered stationary sub-surface target, recovered stationary surface target</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">Mid-Frequency:
MF1 MF5
MF3 MF6
MF4
High-Frequency:
HF1 HF6
HF5
Anti-Submarine Warfare:
ASW3
Torpedoes:
TORP1 TORP2</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">E8 E11</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Active sonar

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement

Explosive Stressors: (Section 5.3.3)
Torpedo (Explosive) Testing</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Only one heavyweight torpedo test could occur in 1 day; two heavyweight torpedo tests could occur on consecutive days. Two lightweight torpedo tests could occur in a single day.
All non-explosive torpedoes are recovered.
For air quality analysis:
- 1 rotary-wing (SH-60) aircraft (8 hours)
- 1 fixed-wing patrol (P-8A) aircraft (8 hours)
- 100 percent < 3,000 feet, >12 miles
- 6 support craft (12 hours)</td></tr>
</table>

A.3.2.1.8 Torpedo (Non-Explosive) Testing

Anti-Submarine Warfare			
Torpedo (Non- Explosive) Testing			
Short Description	Air, surface, or submarine crews employ non-explosive torpedoes against submarines, surface vessels, or artificial targets.	**Typical Duration**	Up to 2 weeks
Long Description	Aerial, surface, and subsurface assets fire exercise torpedoes against surface or subsurface targets or at no target and programmed with a particular run geometry. Torpedo testing evaluates the performance and the effectiveness of hardware and software upgrades of heavyweight or lightweight torpedoes. It also includes testing of experimental torpedoes. Not all torpedo tests involve acoustics. Exercise torpedoes are recovered, typically from surface ships and helicopters that are specifically crewed and outfitted for torpedo recovery. Event duration is dependent on number of torpedoes fired.		
Typical Components	**Platforms:** Fixed-wing patrol aircraft, moored platform, rotary-wing aircraft, submarines, support craft, surface combatant **Targets:** Sub-surface Targets, Surface Targets **Systems being Trained/Tested:** Acoustic countermeasures, acoustic modem, helicopter-deployed sonar, high-frequency sonar, mid-frequency sonar, sonobuoys, torpedo sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** Physical disturbance and strike – military expended materials	**Sediments and Water Quality:** Metals Chemicals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes, **Non-Ingestible Material:** Acoustic countermeasures, buoy (non-explosive), bathythermograph and wires, heavyweight and lightweight torpedo accessories, guidance wires, sonobuoys (non-explosive), sonobuoy wires, canister, motorized autonomous target, stationary artificial target	**Military Recoverable Material**	Lightweight (non-explosive) torpedoes, heavyweight (non-explosive) torpedoes, recoverable acoustic countermeasures, recovered mobile sub-surface target, recovered stationary sub-surface target

Anti-Submarine Warfare								
Torpedo (Non- Explosive) Testing								
Sonar and Other Transducer Bins	**Mid-Frequency:**			**High-Frequency:**		**Torpedoes:**		
	MF1	MF5		HF1	HF6	TORP1	TORP2	
	MF3	MF6				TORP3		
	MF4			**Anti-Submarine Warfare:**		**Acoustic Modems:**		
				ASW3	ASW4	M3		
Explosive Bins	None							
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar					**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	All torpedoes are recovered. Events can last up to two weeks and use up to 40 torpedoes. Typically, no more than eight torpedoes are fired per day during daylight hours. For air quality analysis: - One rotary-wing (SH-60) aircraft (8 hours) - One fixed-wing patrol (P-8A) aircraft (8 hours) - 100 percent < 3,000 feet, >12 miles - Six support craft (8 hours)							

A.3.2.2 Electronic Warfare

A.3.2.2.1 Radar and Other System Testing

<table>
<tr><th colspan="4">Electronic Warfare</th></tr>
<tr><th colspan="4">Radar and Other System Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Test may include use of military or commercial radar, communication systems (or simulators), or high energy lasers. Testing may occur aboard a ship against drones, small boats, rockets, missiles, or other targets.</td><td>Typical Duration
12 hours per day over a 7-day period</td></tr>
<tr><td>Long Description</td><td colspan="3">At-sea and docked testing may include use of military or commercial radar, communication systems (or simulators), or high energy lasers. No subsurface transmission will occur during this testing. Testing of various air and surface targets may include unmanned aerial systems, missiles, or small craft (floating cardboard triwalls, towed, anchored, or self-propelled vessels). High energy laser testing may include tracking, scoring, and neutralization runs with single or multiple targets.</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Combat logistics ship, rotary-wing aircraft, small boat, submarines, surface combatant, tilt-rotor
Targets: Air targets, surface targets
Systems being Trained/Tested: Radar, high energy lasers</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Aircraft safety
High-powered laser safety
Towed in-water device safety
Unmanned aerial, surface, and subsurface vehicle safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
Pearl Harbor, Hawaii
San Diego, California</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices
In-water electromagnetic devices
Lasers

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Habitats:
Physical disturbance and strike – military expended material</td><td>Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Metals Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-air energy
Physical interactions</td></tr>
</table>

<table>
<tr><th colspan="4">Electronic Warfare</th></tr>
<tr><th colspan="4">Radar and Other System Testing</th></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Per chaff: one chaff plastic endcap, one compression pad; OR one plastic piston, one plastic endcap; missile fragments, target fragments
Non-Ingestible Material:
Non-explosive missiles, kinetic energy projectiles, sabot – kinetic energy round, expendable aerial drones, expendable surface targets, canister</td><td>Military Recoverable Material
Recoverable towed surface targets, recoverable stationary surface target, recoverable aerial drones, large or extra-large parachutes (recovered with drones)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Non-explosive missiles and rockets
Explosive Stressors: (Section 5.3.3)
Explosive missiles and rockets</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">All explosive missiles detonate in air during this test event.
HE lasers will not be tested pierside.
Any sources used during this activity would be de minimis and not quantitatively analyzed and therefore are not included under munitions.
For air quality analysis:
- 3 contract jet aircraft
- 1 rotary-wing aircraft (SH-60)
- 1 fixed-wing strike aircraft (F/A-18E)
- 100 percent >12 miles
- Average 12 hours per event</td></tr>
</table>

A.3.2.3 Mine Warfare

A.3.2.3.1 Mine Countermeasure and Neutralization Testing

Mine Warfare			
Mine Countermeasure and Neutralization Testing			
Short Description	Air, surface, and subsurface vessels neutralize threat mines and mine-like objects.	**Typical Duration**	1–10 days, with intermittent use of countermeasure/neutralization systems during this period
Long Description	Mine countermeasure-neutralization and mine system testing is required to ensure systems can effectively neutralize threat (live or inert) mines that will otherwise restrict passage through an area and to ensure U.S. Navy mines remain effective against enemy ships. These systems may be deployed with a variety of ships, aircraft, submarines, or unmanned autonomous vehicles and operate in water depths up to 6,000 feet. Mines are neutralized by cutting mooring cables of buoyant mines, producing acoustic energy that fires acoustic-influence mines, employing radar or laser fields, producing electrical energy to replicate the magnetic signatures of surface ships in order to detonate threat mines, detonation of mines using remotely-operated vehicles, and using explosive charges to destroy threat mines.		
Typical Components	**Platforms:** Combat logistics ship, moored platform, rotary-wing aircraft, support craft, surface combatant, unmanned underwater vehicle **Targets:** Sub-surface targets **Systems being Trained/Tested:** Electromagnetic devices, high-frequency sonar, radar, low energy lasers		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety Towed in-water device safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-water electromagnetic devices In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	 Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions

<table>
<tr><th colspan="4">Mine Warfare</th></tr>
<tr><th colspan="4">Mine Countermeasure and Neutralization Testing</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Airborne Mine Neutralization System neutralizer fragments
Non-Ingestible Material:
Fiber optic cable, mine shapes (non-explosive), airborne targets</td><td>Military Recoverable Material</td><td>Mine shapes (non-explosive)</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">High-Frequency:
HF4</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">E4</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Active sonar

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Towed in-water devices

Explosive Stressors: (Section 5.3.3)
Explosive mine countermeasure and neutralization activities</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">For air quality analysis:
- 2 rotary-wing aircraft (SH-60)
- 2 support craft
- 50 percent within 3 miles (mi.), 30 percent 3-12 mi., 20 percent outside 12 mi.
- Average 8 hours per event</td></tr>
</table>

A.3.2.3.2 Mine Countermeasure Mission Package Testing

Mine Warfare			
Mine Countermeasure Mission Package Testing			
Short Description	Vessels and associated aircraft conduct mine countermeasure operations.	**Typical Duration**	1–2 weeks with intervals of mine countermeasure mission package use during this time
Long Description	Littoral Combat Ships conduct mine detection using unmanned submersible and aerial vehicles, magnetic and acoustic sensor systems deployed by vessel or support helicopters, and laser systems. Mines are then neutralized using magnetic, acoustic, and supercavitating systems.		
Typical Components	**Platforms:** Rotary-wing aircraft, surface combatant, unmanned aerial system, unmanned underwater vehicle **Targets:** Sub-surface targets **Systems being Trained/Tested:** High-frequency sonar, towed sonar systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Unmanned aerial, surface, and subsurface vehicle safety Towed in-water device safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** Military expended materials – munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	
Stressors to Human Resources	**Cultural Resources:** Explosives	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Airborne Mine Neutralization System neutralizer fragments **Non-Ingestible Material:** Fiber optic cable, mine shapes (non-explosive)	**Military Recoverable Material**	Mine shapes (non-explosive)
Sonar and Other Transducer Bins	**High-Frequency:** HF4	**Synthetic Aperture Sonars:** SAS2	

Mine Warfare	
Mine Countermeasure Mission Package Testing	
Explosive Bins	E4
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices **Explosive Stressors:** *(Section 5.3.3)* Explosive mine countermeasure and neutralization activities
Assumptions Used for Analysis	For air quality analysis: - 1 rotary-wing aircraft (SH-60) - 50 percent within 3 miles (mi.), 30 percent 3-12 mi., 20 percent outside 12 mi. - Average 5 hours per event

A.3.2.3.3 Mine Detection and Classification Testing

Mine Warfare			
Mine Detection and Classification Testing			
Short Description	Air, surface, and subsurface vessels and systems detect, classify, and avoid mines and mine-like objects. Vessels also assess their potential susceptibility to mines and mine-like objects.	**Typical Duration**	Up to 24 days, with up to 12 hours of acoustic activity each day
Long Description	Mine detection and classification systems require testing to evaluate the capability of generating underwater magnetic and acoustic signature fields as well as sonar systems that can detect, and classify a wide range of threat mines at tactically different water depths. Surface craft may deploy an underwater sensor system that uses ship signature to develop a susceptibility profile against mine-like objects. In order to develop better and safer methods of minesweeping, the Navy is currently testing new systems to detect locate, identify, and avoid mines including a laser airborne mine detection system that uses laser illumination coupled with sensitive electro-optic receivers to find mines in the upper part of the water column. This type of equipment has traditionally been designed for operation from a manned helicopter; however, the Navy is developing the capability to operate from unmanned aerial systems.		
Typical Components	**Platforms:** Moored platform, rotary-wing aircraft, sea basing ship, small boat, submarines, support craft, surface combatant **Targets:** Sub-surface targets **Systems being Trained/Tested:** High-frequency sonar, mid-frequency sonar, sonobuoys, low energy laser		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Seafloor devices **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices In-water electromagnetic devices **Entanglement:** Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – seafloor devices	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Sonobuoys (non-explosive), sonobuoy wires, mine shapes (non-explosive), stationary artificial targets	**Military Recoverable Material**	Mine shapes (non-explosive)

Mine Warfare	
Mine Detection and Classification Testing	
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF5 **High-Frequency:** HF1 HF8
Explosive Bins	None
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	Some mine shapes could be deployed for a specific event, and then retrieved afterwards. However, some mine shapes are left in place so that multiple events could use the same shapes without needing to redeploy. The in-air low energy laser stressor was used in analysis of potential impacts on human resources. For air quality analysis: - 2 rotary-wing aircraft (SH-60) (8 hours each) - 4 support craft (12 hours each) - 50 percent within 3 miles (mi.), 30 percent 3–12 mi., 20 percent outside 12 mi.

A.3.2.4 Surface Warfare

A.3.2.4.1 Gun Testing—Large-Caliber

<table>
<tr><th colspan="6">Surface Warfare</th></tr>
<tr><th colspan="6">Gun Testing—Large-Caliber</th></tr>
<tr><td>Short Description</td><td colspan="3">Surface crews test large-caliber guns to defend against surface targets.</td><td>Typical Duration</td><td>1–2 weeks</td></tr>
<tr><td>Long Description</td><td colspan="5">Surface combatants conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. Gun testing may also include the surface warfare mission package for the Littoral Combat Ship, which provides a layered strike-defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 57 millimeter gun weapon system.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Surface combatant
Targets: Surface targets
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Weapons firing safety
Towed in-water device safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Vessel noise
Weapons noise
Explosive:
In-air explosives
In-water explosives</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials
Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Habitats:
Physical disturbance and strike – military expended material
Underwater explosives</td><td colspan="2">Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Explosives
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td>Public Health and Safety:
In-water energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Large-caliber projectile (explosive) fragments, target fragments
Non-Ingestible Material:
Expendable surface target, large-caliber (non-explosive) projectiles, large caliber casings</td><td>Military Recoverable Material</td><td colspan="2">Remote controlled surface target, towed surface target</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">E3</td></tr>
</table>

Surface Warfare		
Gun Testing—Large-Caliber		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Weapons firing noise **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions	**Explosive Stressors:** *(Section 5.3.3)* Explosive medium-caliber and large-caliber projectiles
Assumptions Used for Analysis	None	

A.3.2.4.2 Gun Testing—Medium-Caliber

Surface Warfare			
Gun Testing—Medium-Caliber			
Short Description	Surface crews test medium-caliber guns to defend against surface targets.	**Typical Duration**	1–2 weeks, with intervals of surface warfare mission package use during this time
Long Description	Surface combatants conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. Gun testing may also include the surface warfare mission package on the Littoral Combat Ship, which provides a layered strike-defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 30 mm gun weapon system.		
Typical Components	**Platforms:** Surface combatant **Targets:** Surface targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety Towed in-water device safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** In-air explosives In-water explosives	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Explosives Metals	
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Medium-caliber projectile (explosive) fragments, medium-caliber (non-explosive) projectiles, medium-caliber projectile casings, target fragments **Non-Ingestible Material:** Expendable surface target	**Military Recoverable Material**	Remote controlled surface target, towed surface target
Sonar and Other Transducer Bins	None		
Explosive Bins	E1		

Surface Warfare		
Gun Testing—Medium-Caliber		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions	**Explosive Stressors:** *(Section 5.3.3)* Explosive medium-caliber and large-caliber projectiles
Assumptions Used for Analysis	Explosive events fire 450 rounds. Non-explosive events fire 960 rounds.	

A.3.2.4.3 Gun Testing—Small-Caliber

Surface Warfare			
Gun Testing—Small-Caliber			
Short Description	Surface crews test small-caliber guns to defend against surface targets.	**Typical Duration**	1 day to 2 weeks
Long Description	Small-caliber guns are fired from surface vessels. This testing also includes anti-terrorism/force protection. During this event, surface craft surface targets will make threat profile approaches to the ship. Ship will demonstrate small-caliber gun testing with non-explosive rounds against the threat target. Small-caliber gun testing includes other class ship sea trials and surface warfare mission package testing.		
Typical Components	**Platforms:** Sea basing ship, surface combatant **Targets:** Surface targets **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety Towed in-water device safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** Small-caliber projectile casings, small-caliber projectiles (non-explosive) **Non-Ingestible Material:** Expendable surface target	**Military Recoverable Material**	Remote controlled surface target, towed surface target
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions		
Assumptions Used for Analysis	400–2,000 rounds per event Ships may not be conducting tests consistently for the entire duration.		

A.3.2.4.4 Kinetic Energy Weapon Testing

Surface Warfare			
Kinetic Energy Weapon Testing			
Short Description	A kinetic energy weapon uses stored energy released in a burst to accelerate a projectile.	**Typical Duration**	1 day
Long Description	A kinetic energy weapon uses stored energy released in a burst to accelerate a projectile to more than seven times the speed of sound to a range of up to 200 miles.		
Typical Components	**Platforms:** Surface combatant **Targets:** Air targets, surface targets **Systems being Trained/Tested:** Kinetic energy weapon		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety	**Typical Locations**	**Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex **Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise Weapons noise **Explosive:** In-air explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** Large caliber (explosive) projectile fragments, target fragments **Non-Ingestible Material:** Expendable aerial drones, expendable stationary surface targets, kinetic energy rounds, sabot – kinetic energy rounds, large caliber projectile casings	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		

Surface Warfare	
Kinetic Energy Weapon Testing	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Small-, medium-, and large-caliber non-explosive practice munitions
Assumptions Used for Analysis	Assume one target per event Explosive rounds are designed to detonate above the surface target.

A.3.2.4.5 Missile and Rocket Testing

<table>
<tr><th colspan="6">Surface Warfare</th></tr>
<tr><th colspan="6">Missile and Rocket Testing</th></tr>
<tr><td>Short Description</td><td colspan="3">Missile and rocket testing includes various missiles or rockets fired from submarines and surface combatants. Testing of the launching system and ship defense is performed.</td><td>Typical Duration</td><td>1 day to 2 weeks</td></tr>
<tr><td>Long Description</td><td colspan="5">Missile and rocket testing includes various missiles or rockets (standard missiles, Water Piercing Missile Launch) fired from submarines and surface combatants. Testing may occur during surface combatant sea trials and surface warfare mission package testing.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Submarines, surface combatant
Targets: Air targets, land targets, surface targets
Systems being Trained/Tested: Missile and rocket firing systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Weapons firing safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="5">Acoustic:
Vessel noise
Weapons noise
Explosive:
In-air explosives
In-water explosives
Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices
Military expended materials
Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions
Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="5">Habitats:
Physical disturbance and strike – military expended material
Underwater explosives
Air Quality:
Criteria air pollutants
Sediments and Water Quality:
Explosives Chemicals
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="5">Cultural Resources:
Explosives
Physical disturbance and strike
Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike
Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Missile (explosive) fragments, rocket (explosive) fragments, target fragments, small-caliber (non-explosive) projectiles, small caliber (non-explosive) casings
Non-Ingestible Material:
Expendable aerial drones, missiles (non-explosive), rockets (non-explosive)</td><td>Military Recoverable Material</td><td colspan="2">Recoverable air and surface targets, large or extra-large parachutes (recovered with drones)</td></tr>
</table>

Surface Warfare		
Missile and Rocket Testing		
Sonar and Other Transducer Bins	None	
Explosive Bins	E6	
Procedural Mitigation Measures	**Explosive Stressors:** *(Section 5.3.3)* Explosive missiles and rockets	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Non-explosive missiles and rockets
Assumptions Used for Analysis	Targets used during non-explosive tests will be recovered. Explosive missiles will detonate either in the air or at the water's surface. Ships will not be conducting test constantly for the entire duration. This activity includes both air warfare and surface warfare events, but is captured under the Surface Warfare Protective Measures Assessment Protocol for simplicity.	

A.3.2.5 Unmanned Systems

A.3.2.5.1 Unmanned Surface Vehicle System Testing

<table>
<tr><th colspan="6">Unmanned Systems</th></tr>
<tr><th colspan="6">Unmanned Surface Vehicle System Testing</th></tr>
<tr><td>Short Description</td><td colspan="3">Testing involves the production and/or upgrade of unmanned surface vehicles. This may include testing of mine detection capabilities, evaluating the basic functions of individual platforms, or complex events with multiple vehicles.</td><td>Typical Duration</td><td>Up to 10 days. Some propulsion systems (gilders) could operate continuously for multiple months.</td></tr>
<tr><td>Long Description</td><td colspan="5">Unmanned surface vehicle testing includes assessment of single-vehicle and multi-vehicle technical performance and functionality during mission operations. Most unmanned vehicle mission operations include launch, transit, mission profile execution, and recovery operations. Unmanned surface vehicles are generally remote-controlled, semi-autonomous, modular, multi-mission platforms. Unmanned surface vehicles include rigid hull inflatable boats, cooperative autonomous research platform (autonomous kayaks), and remote-controlled jet skis. Unmanned surface vehicles may be launched from surface vessels, piers, or land. Once launched, the vehicles may be towed or self-propelled to the test area. Unmanned surface vehicles may deploy, tow, operate, or recover payload systems such as tow bodies containing multi-function sensors. Systems on or towed by the unmanned surface vehicle may be acoustically active or produce radio-frequency transmissions or provide laser illumination for electro-optical detection.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Unmanned surface vehicles, support boat
Targets: None
Systems being Trained/Tested: High-frequency sonar</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Unmanned aerial, surface, and subsurface vehicle safety
Towed in-water device safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Ingestion:
None</td><td colspan="2">Energy:
In-air electromagnetic devices
Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
None</td><td colspan="3">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Accessibility
Physical disturbance and strike</td><td colspan="2">Public Health and Safety:
In-air energy
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
None
Non-Ingestible Material:
None</td><td>Military Recoverable Material</td><td colspan="2">None</td></tr>
</table>

Unmanned Systems		
Unmanned Surface Vehicle System Testing		
Sonar and Other Transducer Bins	**High-Frequency:** HF4	**Synthetic Aperture Sonars:** SAS2
Explosive Bins	None	
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	None	

A.3.2.5.2 Unmanned Underwater Vehicle Testing

Unmanned Systems			
Unmanned Underwater Vehicle Testing			
Short Description	Testing involves the production and/or upgrade of unmanned underwater vehicles. This may include testing of mine detection capabilities, evaluating the basic functions of individual platforms, or complex events with multiple vehicles.	**Typical Duration**	Up to 35 days. Some propulsion systems (gliders) could operate continuously for multiple months.
Long Description	Unmanned underwater vehicle testing ranges from single-vehicle tests to evaluate hydrodynamic parameters, to full mission, multiple vehicle functionality assessments. Most unmanned underwater vehicle operations include a launch, transit, mission profile execution, and recovery operations. Unmanned underwater vehicles include modular, multi-mission platforms and their payloads, and anti-submarine warfare targets. Unmanned underwater vehicles may be launched from aircraft, surface craft, submarines, piers, or land. Once launched, the vehicles are either towed or self-propelled to the test area. Unmanned underwater vehicles may also deploy, tow, operate, or recover remote sensors and payload systems. Systems on or towed by the unmanned vehicle may be acoustically active, produce radio-frequency transmissions or provide laser illumination for electro-optical detection. Vehicle development involves the production and upgrade of new unmanned platforms on which to attach various payloads used for different purposes. Platforms can include unmanned underwater vehicles, unmanned surface vehicles, and unmanned aerial systems. Payload testing assesses various systems that can be incorporated onto unmanned platforms for mine warfare, bottom mapping, and other missions.		
Typical Components	**Platforms:** Patrol boats, small boat, submarines, support craft, surface combatant, unmanned underwater vehicle **Targets:** Mine warfare targets, sub-surface targets, surface targets **Systems being Trained/Tested:** High-frequency sonar, underwater communications		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Unmanned aerial, surface, and subsurface vehicle safety Towed in-water device safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Seafloor devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike seafloor devices In-water explosives	**Air Quality:** None **Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** None

Unmanned Systems			
Unmanned Underwater Vehicle Testing			
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Anchors, mines shapes (non-explosive), expendable motorized autonomous target, expendable stationary artificial target, miscellaneous surface targets, stationary surface targets	**Military Recoverable Material**	Anchors, recoverable stationary artificial target, mine shape (non-explosive)
Sonar and Other Transducer Bins	**Mid-Frequency:** MF9	**High-Frequency:** HF4	
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	
Assumptions Used for Analysis	Some mine shapes could be deployed for a specific event, and then retrieved afterwards. However, some mine shapes are left in place so that multiple events could use the same shapes without needing to redeploy. Multiple vehicles may operate simultaneously in one or multiple areas.		

A.3.2.6 Vessel Evaluation

A.3.2.6.1 Air Defense Testing

Vessel Evaluation			
Air Defense Testing			
Short Description	Tests the ship's capability to detect, identify, track, and successfully engage live and simulated targets. Gun systems are tested using explosive and non-explosive rounds.	**Typical Duration**	7 days
Long Description	Air Defense events are conducted in clear and varied electronic attack environments, using a mix of missile firings to verify the ship's capability to detect, identify, track, and successfully engage live and simulated targets. The tests include testing the radar's track load in the presence of debris, long range engagement processing, low-elevation detection and tracking, track load in the presence of electronic attack and chaff, and missile performance. Tests currently include firing of the 5 inch .62-caliber gun, and will potentially include a 155 millimeter gun.		
Typical Components	**Platforms:** Amphibious warfare ship, rotary-wing aircraft, support craft, surface combatant **Targets:** Air targets **Systems being Trained/Tested:** Radar systems, gun systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety Weapons firing safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex Hawaii Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** In-air explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-air energy Physical interactions

<table>
<tr><th colspan="4">Vessel Evaluation</th></tr>
<tr><th colspan="4">Air Defense Testing</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Per chaff: one chaff plastic endcap, one compression pad; OR one plastic piston, one plastic endcap; chaff fibers, missile (explosive) fragments, large-caliber (explosive) projectile fragments, target fragments, medium-caliber (non-explosive) projectiles, medium caliber (non-explosive) projectile casings
Non-Ingestible Material:
Canister, large-caliber (non-explosive) projectiles, missiles (non-explosive), large-caliber projectile casings, expendable aerial drones</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="3">Acoustic Stressors: (Section 5.3.2)
Weapons firing noise

Explosive Stressors: (Section 5.3.3)
Explosive medium-caliber and large-caliber projectiles

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Small-, medium-, and large-caliber non-explosive practice munitions
Non-explosive missiles and rockets</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Ships will not be conducting test constantly for the entire duration.</td></tr>
</table>

A.3.2.6.2 In-Port Maintenance Testing

Vessel Evaluation				
In-Port Maintenance Testing				
Short Description	Each combat system is tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea Combat System Ship Qualification Trial events.	**Typical Duration**	3 weeks	
Long Description	Each combat system is tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea Combat System Ship Qualification Trial events. The ship's test plans and procedures, Maintenance Repair/Requirements Cards, and computerized planned maintenance system are used in establishing testing standards for each system and pieces of equipment. Ship's crew, under supervision of subject matter experts, complete all actions and receive remedial training where required. Trouble Observation Reports are written on noted discrepancies.			
Typical Components	**Platforms:** Amphibious warfare ship, surface combatant **Targets:** None **Systems being Trained/Tested:** Radar, low energy lasers			
Standard Operating Procedures *(Section 2.3.3)*	Pierside testing safety	**Typical Locations**		
		Range Complexes/Testing Ranges: None	**Inland Waters/Pierside:** Pearl Harbor, Hawaii San Diego, California	
Stressors to Biological Resources	**Acoustic:** None **Explosive:** None	**Physical Disturbance and Strike:** None **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy In-air energy	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	None			
Assumptions Used for Analysis	None			

A.3.2.6.3 Propulsion Testing

Vessel Evaluation			
Propulsion Testing			
Short Description	Ship is run at high speeds in various formations (straight-line and reciprocal paths).	**Typical Duration**	1 day
Long Description	Propulsion testing is one part of the total sea trial activity. During this event, the ship is tested for maneuverability, including full power and endurance runs.		
Typical Components	**Platforms:** Amphibious warfare ship, fleet support ship, sea basing ship, surface combatant **Targets:** None **Systems being Trained/Tested:** None		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	Ships will not be conducting test constantly for the entire duration. Ships may not be traveling in a straight line. Ships will operate across the full spectrum of capable speeds. During surface combatant sea trials full-power runs are conducted for a total of 4 hours, and endurance runs are conducted for a total of 2 hours.		

A.3.2.6.4 Submarine Sea Trials—Propulsion Testing

Vessel Evaluation				
Submarine Sea Trials—Propulsion Testing				
Short Description	Submarine is run at high speeds in various formations, and at various depths.		**Typical Duration**	Up to 5 days
Long Description	Propulsion testing is one part of the total submarine sea trial activity. During this activity, submarines undergo a controlled deep dive to test depth, emergency surfacing, full-power operations, high speed turns, and extreme depth changes.			
Typical Components	**Platforms:** Submarines **Targets:** None **Systems being Trained/Tested:** None			
Standard Operating Procedures *(Section 2.3.3)*		**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** None	**Physical Disturbance and Strike:** None	**Energy:** None	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** None	**Sediments and Water Quality:** None		
	Habitats: None			
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions	
Military Expended Material	**Ingestible Material:** None	**Military Recoverable Material**	None	
	Non-Ingestible Material: None			
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement			
Assumptions Used for Analysis	Subs will not be conducting test constantly for the entire duration. Subs may not be traveling in a straight line. Subs will operate across the full spectrum of capable speeds.			

A.3.2.6.5 Submarine Sea Trials—Weapons System Testing

Vessel Evaluation				
Submarine Sea Trials—Weapons System Testing				
Short Description	Submarine weapons and sonar systems are tested at-sea to meet the integrated combat system certification requirements.		**Typical Duration**	Up to 7 days
Long Description	Submarine weapons and sonar systems are tested at-sea to meet the integrated combat system certification requirements. This test involves subjecting the integrated combat system through rigorous testing which consists of passive and active sonar activities, launching "water slugs" and exercise torpedoes.			
Typical Components	**Platforms:** Moored platform, submarines, support craft **Targets:** Sub-surface targets **Systems being Trained/Tested:** Acoustic modem, high-frequency sonar, mid-frequency sonar, underwater communications, torpedo sonar			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables	
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Heavyweight torpedo accessories, guidance wire, motorized autonomous targets	**Military Recoverable Material**	Heavyweight (non-explosive) torpedoes	
Sonar and Other Transducer Bins	**Mid-Frequency:** MF3 MF10 MF9	**High-Frequency:** HF1 **Acoustic Modems:** M3	**Torpedoes:** TORP2	
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	Submarines will not be conducting test constantly for the entire duration.			

A.3.2.6.6 Surface Warfare Testing

Vessel Evaluation			
Surface Warfare Testing			
Short Description	Tests the capabilities of shipboard sensors to detect, track, and engage surface targets. Testing may include ships defending against surface targets using explosive and non-explosive rounds, gun system structural test firing and demonstration of the response to Call for Fire against land based targets (Simulated by sea based locations).	**Typical Duration**	7 days
Long Description	Surface warfare events are gun weapons system tests conducted in a clear environment to demonstrate the capability of shipboard and remote (helicopter) sensors to detect and track surface or land based (simulated by sea based locations) targets and engage targets with simulated and live gun and missile firings. The event may qualify the ship's surface warfare gun capability to receive track data from the sensors, filter it, calculate ballistics, recommend aimpoint corrections (spots), generate gun orders, select ammunition properly for targets at differing ranges, and deliver surface direct fire on the surface or land based targets. Testing can also include structural test firing.		
Typical Components	**Platforms:** Amphibious warfare ship, support craft, surface combatant **Targets:** Air targets, electronic warfare targets, surface targets **Systems being Trained/Tested:** Gun systems, electronic warfare systems		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Weapons firing safety Towed in-water device safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Southern California Range Complex Hawaii Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise Weapons noise **Explosive:** In-air explosives In-water explosives	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – munitions Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended materials In-water explosives	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals Explosives	 Other materials
Stressors to Human Resources	**Cultural Resources:** Explosives Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** Physical interactions In-air energy In-water energy

<table>
<tr><th colspan="4">Vessel Evaluation</th></tr>
<tr><th colspan="4">Surface Warfare Testing</th></tr>
<tr><td>Military Expended Material</td><td>Ingestible Material:
Per chaff: one chaff plastic endcap, one compression pad; OR one plastic piston, one plastic endcap; chaff fibers;
Large-caliber projectile (explosive) fragments, medium-caliber projectile (explosive) fragments, missile (explosive) fragments, medium caliber (non-explosive) projectiles, medium-caliber projectile casings, small-caliber projectile (explosive) fragments, small-caliber (non-explosive) projectiles, small caliber projectile casings, target fragments
Non-Ingestible Material:
Large-caliber (non-explosive) projectiles, large-caliber projectile casings, missiles (non-explosive), air targets</td><td>Military Recoverable Material</td><td>Aerial drones, large or extra-large parachutes (recovered with drones), remote controlled surface target, stationary surface target, towed air target, towed surface target, fixed and mobile threat emitters</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="3">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="3">E1 E5 E8</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="2">Acoustic Stressors: (Section 5.3.2)
Weapons firing noise

Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement
Small-, medium-, and large-caliber non-explosive practice munitions
Non-explosive missiles and rockets</td><td colspan="2">Explosive Stressors: (Section 5.3.3)
Explosive medium-caliber and large-caliber projectiles
Explosive missiles and rockets</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="3">Ships will not be conducting tests constantly for the entire duration</td></tr>
</table>

A.3.2.6.7 Undersea Warfare Testing

Vessel Evaluation			
Undersea Warfare Testing			
Short Description	Ships demonstrate capability of countermeasure systems and underwater surveillance, weapons engagement and communications systems. This tests ships ability to detect, track, and engage undersea targets.	**Typical Duration**	Up to 10 days
Long Description	Undersea warfare events may be comprised of tracking and firing events or tests of hull-mounted sonar system capabilities to detect and avoid torpedo type targets. Tracking and firing events ensure the operability of the undersea warfare suite and its interface with the rotary-wing helicopter. Tests include demonstrating the ability of the ship to search, detect and track a target and conduct attacks with exercise torpedoes. Detection and avoidance events may use surface craft and underwater platforms to test the capability of mid- and high-frequency acoustic sources. Subsurface moving targets, rocket and air-dropped weapons, sonobuoys, towed arrays and sub-surface torpedo-like devices may be used. Approximately one week of in-port training may precede the event.		
Typical Components	**Platforms:** Rotary-wing aircraft, submarines, support craft, surface combatant **Targets:** Sub-surface targets, surface targets **Systems being Trained/Tested:** Acoustic countermeasures, helicopter-deployed dipping sonar, high-frequency sonar, mid-frequency sonar, sonobuoys, torpedo sonar		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Aircraft safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex Hawaii Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials **Ingestion:** Military expended materials – other than munitions	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables Decelerators/parachutes
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** Metals Other materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Accessibility Airborne acoustics Physical disturbance and strike	**Public Health and Safety:** In-water energy In-air energy Physical interactions

Vessel Evaluation			
Undersea Warfare Testing			
Military Expended Material	**Ingestible Material:** Small decelerators/parachutes **Non-Ingestible Material:** Acoustic countermeasures, buoy (non-explosive), heavyweight and lightweight torpedo accessories, guidance wire, rockets (non-explosive), sonobuoys (non-explosive), sonobuoy wires, expendable motorized autonomous target, miscellaneous surface targets	**Military Recoverable Material**	Heavyweight (non-explosive) torpedo, lightweight (non-explosive) torpedo, miscellaneous surface target, recoverable motorized autonomous target
Sonar and Other Transducer Bins	**Mid-Frequency:** MF1 MF5 MF4 MF6	**High-Frequency:** HF4 HF8 **Anti-Submarine Warfare:** ASW4	**Torpedoes:** TORP1 TORP2
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	Five targets per event All sonobuoys have a parachute unless otherwise noted. Ships will not be conducting test constantly during the entire duration.		

A.3.2.6.8 Vessel Signature Evaluation

<table>
<tr><th colspan="5">Vessel Evaluation</th></tr>
<tr><th colspan="5">Vessel Signature Evaluation</th></tr>
<tr><td>Short Description</td><td colspan="2">Surface ship, submarine and auxiliary system signature assessments. This may include electronic, radar, acoustic, infrared and magnetic signatures.</td><td colspan="2">Typical Duration
Typically 1–5 days, up to 20 days depending on the test being conducted</td></tr>
<tr><td>Long Description</td><td colspan="4">Radar cross signature testing of surface ships and submarines is accomplished on new ships and periodically throughout a ship’s life cycle to measure how detectable the ship is to radar. For example, Assessment Identification of Mine Susceptibility assessments are passive electromagnetic and acoustic measurements performed on mine countermeasure ships and on the Littoral Combat Ship mine countermeasure modules (i.e. auxiliary systems) to determine their mine susceptibility using seafloor deployed magnetometers and hydrophones, and a ship-board GPS tracking system. Signature testing of all surface ships and submarines verifies that each vessel’s signature is within specifications, and may include the use of helicopter-deployed instrumentation, ship-mounted safety and navigation systems, fathometers, tracking devices, radar systems, and underwater communications equipment. Also included in this activity is the Shipboard Electronic Systems Evaluation Facility which conducts measurements of antenna radiation patterns, Federal Aviation Administration identification of Friend or Foe systems, and Tactical Air Navigation Systems.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Aircraft carrier, amphibious warfare ship, combat logistics ship, fixed-wing aircraft, fleet support ship, mine warfare, patrol boats, rotary-wing aircraft, sea basing ship, small boat, special mission ship, specialized high speed vehicle, submarines, support craft, surface combatant
Targets: None
Systems being Trained/Tested: Acoustic countermeasures, radar, electromagnetic devices</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
Pearl Harbor, Hawaii</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices

Ingestion:
None</td><td colspan="2">Energy:
In-water electromagnetic devices
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
None</td><td colspan="2">Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
Physical disturbance and strike</td><td>Socioeconomic Resources:
Accessibility
Physical disturbance and strike</td><td colspan="2">Public Health and Safety:
In-water energy
In-air energy
Physical interactions</td></tr>
</table>

Vessel Evaluation			
Vessel Signature Evaluation			
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Acoustic countermeasures	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	**Anti-Submarine Warfare:** ASW3		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	None		

A.3.2.7 Other Testing

A.3.2.7.1 Chemical and Biological Simulant Testing

<table>
<tr><th colspan="5">Other Testing Activities</th></tr>
<tr><th colspan="5">Chemical and Biological Simulant Testing</th></tr>
<tr><td>Short Description</td><td colspan="2">Chemical-biological agent simulants are deployed against surface ships.</td><td>Typical Duration</td><td>3 days</td></tr>
<tr><td>Long Description</td><td colspan="4">The capabilities of surface ship defense systems to detect and protect in the event of chemical and biological attacks are tested. Testing involves the deployment of harmless compounds (i.e., simulants) as substitutes for chemical and biological warfare agents. Because chemical and biological warfare agents remain a security threat, the Department of Defense uses relatively harmless compounds (simulants) as substitutes for chemical and biological warfare agents to test equipment intended to detect their presence. Chemical and biological agent detectors monitor for the presence of chemical and biological warfare agents and protect military personnel and civilians from the threat of exposure to these agents. The simulants trigger a response by sensors in the detection equipment without irritating or injuring personnel involved in testing detectors.
Navy Chemical Agent Simulant 82 (commonly referred to as NCAS-82), glacial acetic acid, triethyl phosphate, sulfur hexafluoride, 1,1,1,2 tetrafluoroethane (a refrigerant commonly known as R134), and 1,1-difluoroethane (a refrigerant commonly known as R-152a) are also referred to as gaseous simulants and can be released in smaller quantities in conjunction with glacial acetic acid or triethyl phosphate releases. The types of biological simulants that may be used include spore-forming bacteria, non-spore-forming bacteria, ovalbumin, bacteriophage MS2, and Aspergillus niger. The simulants are generally dispersed by hand at the detector or by aircraft as a fine mist or aerosol.</td></tr>
<tr><td>Typical Components</td><td colspan="4">Platforms: Fixed-wing aircraft, rotary-wing aircraft, surface combatant
Targets: None
Systems being Trained/Tested: None</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Aircraft safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Aircraft noise
Vessel noise

Explosive:
None</td><td>Physical Disturbance and Strike:
Aircraft and aerial targets
Vessels and in-water devices

Ingestion:
None</td><td colspan="2">Energy:
In-air electromagnetic devices

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
Criteria air pollutants
Habitats:
None</td><td colspan="2">Sediments and Water Quality:
Chemicals Other materials</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
Accessibility
Airborne acoustics
Physical disturbance and strike</td><td colspan="2">Public Health and Safety:
Physical interactions</td></tr>
</table>

Other Testing Activities			
Chemical and Biological Simulant Testing			
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None
Sonar and Other Transducer Bins	None		
Explosive Bins	None		
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement		
Assumptions Used for Analysis	Examples of Chemical Simulants: glacial acetic acid, triethyl phosphate Examples of Biological Simulants: spore-forming bacteria, non-spore-forming bacteria, the protein ovalbumin, MS2 bacteriophages, and the fungus *Aspergillus niger*		

A.3.2.7.2 Insertion/Extraction

Other Testing Activities				
Insertion/Extraction				
Short Description	Testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances.	**Typical Duration**	Up to 30 days	
Long Description	Testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances. Testing could include the use of forces deployed from submerged submarines while at sea.			
Typical Components	**Platforms:** Submarines **Targets:** None **Systems being Trained/Tested:** Submersibles, mid-frequency sonar, acoustic modems			
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** None **Ingestion:** None	**Energy:** None **Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** In-water energy Physical interactions	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	**Mid-Frequency:** MF9	**Acoustic Modems:** M3		
Explosive Bins	None			
Procedural Mitigation Measures	None			
Assumptions Used for Analysis	Test will not occur constantly throughout duration. For biological resource analysis, vessel noise and vessel strike are only analyzed for the periods while the submarines are surfaced, typically brief in nature. Mitigation measures related to vessel movement are only considered during the period of surfacing as well. For human resource stressor analysis, physical disturbance and strike and physical interactions are only analyzed for the periods while the submarine are surfaced, typically brief in nature.			

A.3.2.7.3 Non-Acoustic Component Testing

Other Testing Activities				
Non-Acoustic Component Testing				
Short Description	Testing of towed or floating buoys for communications through radio-frequencies or two-way optical communications between an aircraft and underwater system(s).	**Typical Duration**	3 days (4 hours per day for 3 days)	
Long Description	Testing associated with radio frequency communications could occur from towed antennas from surface vessels, from single-transmit buoys released from submarines, or tethered buoys from submarines for two-way communication. Optical communications tests may include communication between helicopter or fixed-wing aircraft and manned or unmanned underwater systems, and may also include ground truth sensors mounted on surface craft.			
Typical Components	**Platforms:** Navy ships and boats, amphibious warfare ship, combat logistics ship, fixed-wing aircraft, moored platform, rotary-wing aircraft, sea basing ship, small boat, submarines, support craft, unmanned underwater vehicle **Targets:** None **Systems being Trained/Tested:** Communication systems, lasers			
Standard Operating Procedures *(Section 2.3.3)*	Aircraft safety Vessel safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations**		
		Range Complexes/Testing Ranges: Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None	
Stressors to Biological Resources	**Acoustic:** Aircraft noise Vessel noise	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices	**Energy:** In-air electromagnetic devices	
	Explosive: None	**Ingestion:** None	**Entanglement:** None	
Stressors to Physical Resources	**Air Quality:** None	**Sediments and Water Quality:** None		
	Habitats: None			
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility	**Public Health and Safety:** None	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	None	
Sonar and Other Transducer Bins	None			
Explosive Bins	None			
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement			

Other Testing Activities	
Non-Acoustic Component Testing	
Assumptions Used for Analysis	None

A.3.2.7.4 Signature Analysis Operations

Other Testing Activities			
Signature Analysis Operations			
Short Description	Surface ship and submarine testing of electromagnetic, acoustic, optical, and radar signature measurements.	**Typical Duration**	Periodically over multiple days
Long Description	Signature analysis activities include electromagnetic, acoustic, optical, and radar signature measurements, recording, and post-run analyses of data of Navy surface and subsurface vessels. These activities include electromagnetic signature measurement, calibration, and detection of submarines, acoustic and magnetic signature detection of unmanned underwater vehicles and surface ships, radar, and optical detection of surface ships. Testing includes intelligence, surveillance, reconnaissance missions.		
Typical Components	**Platforms:** Moored platform, submarines, support craft **Targets:** None **Systems being Trained/Tested:** Electromagnetic, acoustic, optical, and radar systems, acoustic modems, high-frequency sonar, underwater communications		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Military Expended Materials **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Air Quality:** Criteria air pollutants **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** Accessibility Physical disturbance and strike	**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Expendable anchors, bathythermographs and wires	**Military Recoverable Material**	Recoverable anchors
Sonar and Other Transducer Bins	**Mid-Frequency:** MF9	**High-Frequency:** HF1	**Acoustic Modems:** M3
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	None		

A.3.3 OFFICE OF NAVAL RESEARCH TESTING ACTIVITIES

A.3.3.1 Acoustic and Oceanographic Science and Technology

A.3.3.1.1 Acoustic and Oceanographic Research

Acoustic and Oceanographic Science and Technology			
Acoustic and Oceanographic Research			
Short Description	Research using active transmissions from sources deployed from ships, aircraft, and unmanned underwater vehicles. Research sources can be used as proxies for current and future Navy systems.	**Typical Duration**	Up to 14 days
Long Description	Active acoustic transmissions used for engineering tests of acoustic sources, validation of ocean acoustic models, tests of signal processing algorithms, and characterization of acoustic interactions with the ocean bottom, fish and ocean surface. Standard oceanographic research sensing (acoustic doppler current profiler, fathometer-like systems) also to be employed.		
Typical Components	**Platforms:** Special mission ship, unmanned underwater vehicle **Targets:** Sub-surface targets **Systems being Trained/Tested:** Airguns, sonar, sonobuoys, underwater communications, low-power lasers		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Southern California Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Vessel noise Aircraft noise Sonar and other transducers Air guns **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Military expended materials Seafloor devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** Wires and cables
Stressors to Physical Resources	**Habitats:** Physical disturbance and strike – military expended material Physical disturbance and strike – seafloor devices	**Air Quality:** Criteria air pollutants **Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Physical disturbance and strike	**Public Health and Safety:** In-air energy Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Expendable inert mine shapes, sonobuoys (non-explosive), stationary artificial targets	**Military Recoverable Material**	Anchors, recoverable inert mine shapes, small parachutes (recovered), target fragments (recovered)

Acoustic and Oceanographic Science and Technology			
Acoustic and Oceanographic Research			
Sonar and Other Transducer Bins	**Low-Frequency:** LF3 LF5 LF4	**Mid-Frequency:** MF8 MF9 **Anti-Submarine Warfare:** ASW2	**Air gun:** AG **Broadband:** BB4
Explosive Bins	E3		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar Air guns	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	None		

A.3.3.1.2 Large Displacement Unmanned Underwater Vehicle Testing

<table>
<tr><th colspan="6">Acoustic and Oceanographic Science and Technology</th></tr>
<tr><th colspan="6">Large Displacement Unmanned Undersea Vehicle Testing</th></tr>
<tr><td>Short Description</td><td colspan="3">Autonomy testing and environmental data collection with Large Displacement Unmanned Undersea Vehicles (Innovative Navy Prototype).</td><td>Typical Duration</td><td>Up to 60 days per deployment</td></tr>
<tr><td>Long Description</td><td colspan="5">Large Displacement Unmanned Undersea Vehicle Innovative Navy Prototype (LDUUV INP) testing includes launch, autonomous transit (up to 60 days), environmental data collection (e.g., bathymetry, water column properties, ocean surface properties) and retrieval. LDUUV INP testing throughout the study area will include de minimis acoustic sources (modems, imaging sonars and fathometers) for safe navigation and data collection.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Unmanned Underwater Vehicle
Targets: Sub-surface Targets
Systems being Trained/Tested: Undersea vehicle, environmental data collection systems</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Unmanned aerial, surface, and subsurface vehicle safety</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Hawaii-Southern California Transit Corridor
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Vessel noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices

Ingestion:
None</td><td>Energy:
None

Entanglement:
None</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="3">Habitats:
Physical disturbance and strike – military expended material</td><td colspan="2">Air Quality:
None
Sediments and Water Quality:
None</td></tr>
<tr><td>Stressors to Human Resources</td><td colspan="2">Cultural Resources:
Physical disturbance and strike</td><td colspan="2">Socioeconomic Resources:
Physical disturbance and strike</td><td>Public Health and Safety:
Physical interactions</td></tr>
<tr><td>Military Expended Material</td><td colspan="3">Ingestible Material:
None
Non-Ingestible Material:
Stationary artificial target</td><td>Military Recoverable Material</td><td>None</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td colspan="5">None</td></tr>
<tr><td>Explosive Bins</td><td colspan="5">None</td></tr>
<tr><td>Procedural Mitigation Measures</td><td colspan="5">Physical Disturbance and Strike: (Section 5.3.4)
Vessel movement</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="5">Any sources used during this activity would be de minimis and not quantitatively analyzed and therefore are not included under systems.</td></tr>
</table>

A.3.3.1.3 Long Range Acoustic Communications

Acoustic and Oceanographic Science and Technology			
Long Range Acoustic Communications			
Short Description	Bottom mounted acoustic source off of the Hawaiian Island of Kauai will transmit a variety of acoustic communications sequences.	**Typical Duration**	Year-round; active transmissions 200 days a year
Long Description	Bottom mounted acoustic source off of the Hawaiian Island of Kauai will transmit a variety of acoustic communications sequences that will be recorded by a variety of fixed and mobile platforms at ranges from the 100s to the 1,000s of kilometers.		
Typical Components	**Platforms:** Moored platform, small boat **Targets:** None **Systems being Trained/Tested:** Low-frequency communication system		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety	**Typical Locations**	
		Range Complexes/Testing Ranges: Hawaii Range Complex	**Inland Waters/Pierside:** None
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Seafloor devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** None	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** In-water energy
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	Exercise Torpedoes, Recoverable Anti-Submarine Warfare Training Targets
Sonar and Other Transducer Bins	**Low-Frequency:** LF4		
Explosive Bins	None		
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement	
Assumptions Used for Analysis	None		

A.3.4 Space and Naval Warfare Systems Command Testing Activities

The Space and Naval Warfare Systems Command is the information warfare systems command for the U.S. Navy. The mission of the Space and Naval Warfare Systems Command is to acquire, develop, deliver, and sustain decision superiority for the warfighter. Space and Naval Warfare Systems Command Systems Center Pacific is the research and development part of the Space and Naval Warfare Systems Command focused on developing and transitioning technologies in the area of command, control, communications, computers, intelligence, surveillance, and reconnaissance for the Navy. The Space and Naval Warfare Systems Command Systems Center Pacific regularly conducts research, development, test, and evaluation projects to support emerging technologies for intelligence, surveillance, and reconnaissance; anti-terrorism and force protection; mine countermeasures; anti-submarine warfare; oceanographic research; remote sensing; and communications. These activities include, but are not limited to, the regular testing of surface and subsurface vehicles; intelligence, surveillance, and reconnaissance/information operations sensor systems; underwater surveillance technologies; and underwater communications.

A.3.4.1 Anti-Terrorism/Force Protection

Space and Naval Warfare Systems Command			
Anti-Terrorism/Force Protection			
Short Description	Testing sensor systems that can detect threats to naval piers, ships, and shore infrastructure.	**Typical Duration**	1 day
Long Description	Anti-Terrorism/Force Protection testing may include the following activities: • Testing sensor systems to detect mine shapes on ship hulls and pier structures. • Testing of sensors for swimmer interdiction and other threats. • Testing of sensor systems that can detect explosive and radioactive signatures of concern.		
Typical Components	**Platforms:** Moored platform, small boats, remotely operated vehicle, in-water structure, unmanned bottom crawler, unmanned underwater vehicle **Targets:** Sub-surface targets **Systems being Trained/Tested:** Various sensor systems including mine and swimmer detection systems		
Standard Operating Procedures *(Section 2.3.3)*	Swimmer defense activity safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Southern California Range Complex Silver Strand Training Complex	**Inland Waters/Pierside:** San Diego Bay
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers **Explosive:** None	**Physical Disturbance and Strike:** Vessels and in-water devices Seafloor devices **Ingestion:** None	**Energy:** None **Entanglement:** None
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** Chemicals	
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** None
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** None	**Military Recoverable Material**	Target mine shapes
Sonar and Other Transducer Bins	**Swimmer Defense:** SD1		
Explosive Bins	None		
Procedural Mitigation Measures	Vessel movement		
Assumptions Used for Analysis	None		

A.3.4.2 Communications

<table>
<tr><th colspan="6">Space and Naval Warfare Systems Command</th></tr>
<tr><th colspan="6">Communications</th></tr>
<tr><td>Short Description</td><td colspan="3">Testing of underwater communications and networks to extend the principles of FORCEnet below the ocean surface.</td><td>Typical Duration</td><td>Typically 5 days for 6–8 hours per day</td></tr>
<tr><td>Long Description</td><td colspan="5">Underwater communications testing may include following activities:
Testing of two-way networked communications while maintaining mission profile and continuing operations while communicating at operating depths and speeds. The goal of this testing is to enable two-way communications while operating in missions that require submarines to remain submerged to minimize counter-detection and maximize tactical positioning.
Testing underwater network systems that may include fiber optics cables, laser communications, and acoustic modem networks.
Testing air to water communications, such as radio frequency, laser, etc.</td></tr>
<tr><td>Typical Components</td><td colspan="5">Platforms: Moored platform, support craft, unmanned underwater vehicle, research vessel
Targets: None
Systems being Trained/Tested: Communications systems using sonar and sonobuoys, fiber optic cables, in-air radio communications, and lasers</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td colspan="2">Vessel safety
Unmanned Vehicle</td><td colspan="3">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Inland Waters/Pierside:
None</td></tr>
<tr><td>Stressors to Biological Resources</td><td colspan="2">Acoustic:
Sonar and other transducers
Vessel noise

Explosive:
None</td><td colspan="2">Physical Disturbance and Strike:
Vessels and in-water devices
Military expended materials

Ingestion:
Military expended materials – munitions
Military expended materials – other than munitions</td><td>Energy:
None

Entanglement:
Wires and cables
Decelerators/parachutes</td></tr>
<tr><td>Stressors to Physical Resources</td><td colspan="2">Air Quality:
None
Habitats:
None</td><td colspan="3">Sediments and Water Quality:
Metals</td></tr>
<tr><td>Stressors to Human Resources</td><td>Cultural Resources:
None</td><td>Socioeconomic Resources:
None</td><td colspan="3">Public Health and Safety:
None</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Ingestible Material:
Small decelerators/parachutes
Non-Ingestible Material:
Sonobuoys, clump anchors</td><td>Military Recoverable Material</td><td colspan="2">Fiber optic cables</td></tr>
<tr><td>Sonar and Other Transducer Bins</td><td>Low-Frequency:
LF4</td><td>High-Frequency:
HF6</td><td colspan="3">Anti-Submarine Warfare:
ASW2 ASW5</td></tr>
</table>

Space and Naval Warfare Systems Command	
Communications	
Explosive Bins	None
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar **Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement
Assumptions Used for Analysis	During certain Communications Testing events, long lengths of fiber optic cable would be deployed in the water column in the Southern California Range Complex. Long lengths (up to approximately 60 mi.) of slightly negatively buoyant fiber optic cables would be temporarily deployed in the water column between moored points at depths of approximately 600 to 850 ft. for durations of approximately one week (although some deployments could extend to one month). Each fixed mooring points associated with the deployment of fiber optic cables would consist of a mooring cable suspended from a float or a surface ship, and is anchored to the seafloor. Fiber optic cable breaking strength would be approximately 100 lb. or less. Fiber optic cable is designed to resist coiling when unspooled. Researchers would monitor for disruption of fiber optic transmissions. The goal is to recover all fiber optic cable; however, if cable breaks during recovery (due to its relatively low tensile strength), any non-recoverable pieces are expected to sink. Underwater fiber optic nodes (or endpoints) may also be connected via cable to temporary surface communications buoys.

A.3.4.3 Energy and Intelligence, Surveillance, and Reconnaissance/Information Operations Sensor Systems

<table>
<tr><th colspan="4">Space and Naval Warfare Systems Command</th></tr>
<tr><th colspan="4">Energy and Intelligence, Surveillance, and Reconnaissance/Information Operations Sensor Systems</th></tr>
<tr><td>Short Description</td><td colspan="2">Develop, integrate, and demonstrate Intelligence, Surveillance, and Reconnaissance systems and in-situ energy systems to support deployed systems.</td><td>Typical Duration
Typically 5 days for 6–8 hours per day</td></tr>
<tr><td>Long Description</td><td colspan="3">Intelligence, Surveillance, and Reconnaissance/Information Operations systems testing and in-situ energy testing may include the following activities:
Testing deployable autonomous undersea technologies that improve the Navy's capability to conduct effective anti-submarine warfare operations in littoral waters. Such tests would measure undersea surveillance performance using networked electromagnetic and passive acoustic sensors. During these tests several arrays would be deployed on the seafloor, buried in sandy seafloors or suspended in the water column with a mooring structure. The arrays would be comprised of passive hydrophones or electromagnetic sensors. Acoustic modems/communications transducers would be used to send messages of varying millisecond tones. Systems may also employ towed devices, remotely operated vehicles, or unmanned underwater vehicles. Acoustic releases would be would be used for the recovery of the hardware.
Testing of sensors on the undersea systems testbed trunk cable. Test nodes would be added/removed to the trunk cable as dictated by testing requirements.
Testing deployment, recovery and performance of maritime charging stations and communication nodes.
Testing energy harvesting technologies.
Bioacoustics research</td></tr>
<tr><td>Typical Components</td><td colspan="3">Platforms: Moored platform, support craft, unmanned surface vehicle, unmanned underwater vehicle, remotely operated vehicle
Targets: None
Systems being Trained/Tested: Airguns, sonar, underwater communications, low energy laser, in-air radio communications</td></tr>
<tr><td>Standard Operating Procedures (Section 2.3.3)</td><td>Vessel safety
Unmanned aerial, surface, and subsurface vehicle safety</td><td colspan="2">Typical Locations
Range Complexes/Testing Ranges:
Hawaii Range Complex
Southern California Range Complex
Silver Strand Training Complex
Hawaii-Southern California Training and Testing Transit Corridor
Inland Waters/Pierside:
San Diego Bay</td></tr>
<tr><td>Stressors to Biological Resources</td><td>Acoustic:
Sonar and other transducers
Vessel noise
Air guns
Explosive:
None</td><td>Physical Disturbance and Strike:
Vessels and in-water devices
Seafloor devices
Ingestion:
None</td><td>Energy:
In-water electromagnetic devices
Entanglement:
Wires and cables</td></tr>
</table>

Space and Naval Warfare Systems Command				
Energy and Intelligence, Surveillance, and Reconnaissance/Information Operations Sensor Systems				
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None	**Sediments and Water Quality:** Other Materials		
Stressors to Human Resources	**Cultural Resources:** None	**Socioeconomic Resources:** None	**Public Health and Safety:** None	
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Clump anchors	**Military Recoverable Material**	Anchor blocks/sand bags	
Sonar and Other Transducer Bins	**Low-Frequency:** LF4 LF5 LF6 **Mid-Frequency:** MF10	**High-Frequency:** HF2 HF7	**Airgun:** AG	
Explosive Bins	None			
Procedural Mitigation Measures	**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed in-water devices	**Acoustic Stressors:** *(Section 5.3.2)* Air guns Active sonar		
Assumptions Used for Analysis	For energy harvesting testing, seafloor device bottom disturbance results from a mat-type object on the bottom, with at least a portion buried up to 6 inches in the sediment. The mat would remain up to several months, then be recovered. The mat allows for unmanned underwater vehicles charging at depth. Mats would be about 8 feet x 16 feet. Unmanned underwater vehicle charging stations and communications nodes/docks would be temporarily moored to the sea floor. All devices and mooring equipment would be recovered. Some recharging stations would be placed on a thermal vent, others would use a different technology, not requiring a thermal vent. Some Intelligence, Surveillance, and Reconnaissance activities would include temporary placement of cable arrays on the sea floor. All equipment is recovered at end of testing.			

A.3.4.4 Vehicle Testing

Space and Naval Warfare Systems Command			
Vehicle Testing			
Short Description	Testing of surface and subsurface vehicles and sensor systems, which may involve Unmanned Underwater Vehicles, gliders, and Unmanned Surface Vehicles.	**Typical Duration**	Typically 5 days for 6–8 hours per day
Long Description	The vehicle testing and sensor systems may include the following: • General testing of the navigational and tracking systems for Unmanned Underwater Vehicles and Unmanned Surface Vehicles. • Testing of mine-hunting sensors and magnetic mine countermeasure systems in shallow water environments and in and around rocky outcroppings. This type of testing supports inert mine-hunting systems and provides training to Navy personnel on approaches to deploy, detect, and defend against mine systems using unmanned undersea vehicles. • Testing of underwater surveillance systems and anti-submarine warfare systems to detect and track surface and subsurface targets in support of classification, assessment, and response scenarios. • Testing of passive arrays for conducting submarine detection and tracking experiments and demonstrations. The arrays are composed of hydrophones to receive acoustic energy radiated by targets of interest. • Testing of Autonomous Oceanographic Research and Meteorology and Oceanography sensors to sample and characterize the ocean water column properties at spatial and temporal resolutions of the bathymetry, imagery data, conductivity, temperature and depth data, and optical data. • Testing the launching of communication payloads and non-explosive objects from temporarily-placed seafloor devices and unmanned systems in the water column.		
Typical Components	**Platforms:** Moored Platform; unmanned aerial system; remote operated vehicle; support craft; autonomous small, medium, and large surface and subsurface vehicles **Targets:** None **Systems being Trained/Tested:** Underwater navigation, mine-hunting, surveillance, and sampling systems involving the following: forward looking sonar, sonar, synthetic aperture sonar, underwater communications		
Standard Operating Procedures *(Section 2.3.3)*	Vessel safety Unmanned aerial, surface, and subsurface vehicle safety	**Typical Locations** **Range Complexes/Testing Ranges:** Hawaii Range Complex Hawaii-Southern California Transit Corridor Southern California Range Complex Silver Strand Training Complex	**Inland Waters/Pierside:** San Diego Bay
Stressors to Biological Resources	**Acoustic:** Sonar and other transducers Aircraft noise Vessel noise **Explosive:** None	**Physical Disturbance and Strike:** Aircraft and aerial targets Vessels and in-water devices Seafloor devices **Ingestion:** None	**Energy:** In-air electromagnetic devices **Entanglement:** None

Space and Naval Warfare Systems Command				
Vehicle Testing				
Stressors to Physical Resources	**Air Quality:** None **Habitats:** None		**Sediments and Water Quality:** Other Materials	
Stressors to Human Resources	**Cultural Resources:** Physical disturbance and strike	**Socioeconomic Resources:** Airborne acoustics		**Public Health and Safety:** Physical interactions
Military Expended Material	**Ingestible Material:** None **Non-Ingestible Material:** Clump anchors		**Military Recoverable Material**	Mine shapes, anchors, inert launched payloads
Sonar and Other Transducer Bins	**Mid-Frequency:** MF9 MF13 **High-Frequency:** HF6 **Low-Frequency:** LF3	**Forward-Looking Sonar:** FLS2 FLS3 **Acoustic Modems:** M3		**Synthetic Aperture Sonars:** SAS1 SAS3 SAS2 **Broadband:** BB4
Explosive Bins	None			
Procedural Mitigation Measures	**Acoustic Stressors:** *(Section 5.3.2)* Active sonar		**Physical Disturbance and Strike:** *(Section 5.3.4)* Vessel movement Towed In-Water Device	
Assumptions Used for Analysis	Unmanned aerial systems all involve small aircraft used for communications relays. Unmanned Underwater Vehicles range in size from small hand-launched systems to the Large Displacement Unmanned Undersea Vehicle. Unmanned Surface Vehicles would include small craft to vessels up to 200 ft. in length. Speeds vary based on mission requirements. Unmanned vessels could be autonomous and would be equipped with sensors for vessel avoidance to comply with International Regulations for Preventing Collisions at Sea.			

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Appendix B: Activity Stressor Matrices

Final
Environmental Impact Statement/Overseas Environmental Impact Statement
Hawaii-Southern California Training and Testing

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APPENDIX B ACTIVITY STRESSOR MATRICES

This appendix contains three matrices. The first two matrices in this appendix list the training and testing activities that occur in the Hawaii-Southern California Training and Testing Study Area and their associated stressors. The third matrix lists the resources analyzed in this Environmental Impact Statement/Overseas Environmental Impact Statement and the stressors they are potentially affected by.

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Table B-1: Stressors by Training Activity

Hawaii-Southern California Training Activity	Biological Resources																				Physical Resources					Human Resources [3]							
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
MAJOR TRAINING EXERCISES – LARGE INTEGRATED ANTI-SUBMARINE WARFARE																																	
Composite Training Unit Exercise	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Rim of the Pacific Exercise	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MAJOR TRAINING EXERCISES – MEDIUM INTEGRATED ANTI-SUBMARINE WARFARE																																	
Fleet Exercise/Sustainment Exercise	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Undersea Warfare Exercise	✓		✓	✓	✓				✓	✓		✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
INTEGRATED/COORDINATED TRAINING																																	
Small Integrated Anti-Submarine Training	✓		✓	✓			✓		✓			✓	✓	✓			✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		✓
Medium Coordinated Anti-Submarine Warfare Training	✓		✓	✓					✓			✓	✓	✓			✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		✓
Small Coordinated Anti-Submarine Warfare Training	✓		✓	✓					✓			✓	✓	✓			✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		✓
AIR WARFARE																																	
Air Combat Maneuver				✓					✓				✓									✓		✓			✓		✓	✓	✓			
Air Defense Exercise			✓	✓					✓			✓	✓									✓							✓	✓	✓			
Gunnery Exercise (Air-to-Air)				✓	✓				✓				✓	✓						✓		✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise (Surface-to-Air)			✓	✓	✓		✓		✓			✓	✓	✓						✓		✓	✓	✓			✓	✓	✓	✓			✓
Missile Exercise (Air-to-Air)			✓	✓	✓		✓		✓			✓	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓
Missile Exercise – Man-portable Air Defense System				✓	✓		✓						✓	✓						✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓
Missile Exercise (Surface-to-Air)			✓	✓	✓		✓		✓			✓	✓	✓						✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓

Table B-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																				Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
AMPHIBIOUS WARFARE																																		
Amphibious Assault			✓	✓					✓			✓	✓								✓						✓	✓	✓	✓			✓
Amphibious Assault – Battalion Landing			✓						✓			✓									✓						✓	✓		✓			✓
Amphibious Marine Expeditionary Unit Exercise	✓		✓	✓					✓	✓		✓	✓	✓			✓	✓			✓	✓		✓	✓	✓			✓				
Amphibious Marine Expeditionary Unit Integration Exercise			✓	✓					✓			✓	✓								✓						✓	✓	✓	✓		✓	✓
Amphibious Raid			✓	✓					✓			✓	✓								✓						✓	✓		✓			✓
Expeditionary Fires Exercise/Supporting Arms Coordination Exercise			✓	✓	✓				✓			✓	✓								✓							✓	✓				✓
Humanitarian Assistance Operations			✓	✓					✓			✓	✓								✓						✓	✓		✓			✓
Marine Expeditionary Unit Composite Training Unit Exercise	✓		✓	✓	✓				✓	✓		✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Naval Surface Fire Support Exercise – At Sea			✓		✓			✓	✓			✓		✓						✓		✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Naval Surface Fire Support Exercise – Land-Based Target			✓		✓				✓			✓		✓								✓							✓	✓				✓
ANTI-SUBMARINE WARFARE																																		
Anti-Submarine Warfare Torpedo Exercise – Helicopter	✓		✓	✓					✓			✓	✓	✓				✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Torpedo Exercise – Maritime Patrol Aircraft	✓		✓	✓					✓			✓	✓	✓				✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Torpedo Exercise – Ship	✓		✓	✓					✓			✓		✓							✓	✓					✓	✓	✓	✓	✓		✓

Table B-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																			Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
ANTI-SUBMARINE WARFARE (CONTINUED)																																	
Anti-Submarine Warfare Torpedo Exercise – Submarine	✓		✓	✓								✓	✓	✓			✓					✓		✓				✓			✓	✓		✓
Anti-Submarine Warfare Tracking Exercise – Helicopter	✓		✓	✓					✓			✓	✓	✓				✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Tracking Exercise – Maritime Patrol Aircraft	✓		✓	✓					✓			✓	✓	✓				✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Tracking Aircraft	✓		✓						✓			✓		✓			✓					✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Tracking Exercise – Ship	✓		✓						✓			✓		✓			✓					✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Tracking Exercise – Submarine	✓		✓									✓		✓										✓				✓			✓	✓		✓
Service Weapons Test	✓		✓	✓				✓	✓			✓	✓	✓			✓			✓		✓	✓	✓	✓	✓		✓			✓	✓		✓
ELECTRONIC WARFARE																																	
Counter Targeting Chaff Exercise – Aircraft				✓					✓				✓							✓	✓	✓				✓			✓	✓				✓
Counter Targeting Chaff Exercise – Ship			✓						✓			✓								✓	✓	✓				✓			✓					✓
Counter Targeting Flare Exercise				✓					✓				✓							✓	✓	✓		✓	✓	✓			✓	✓				✓
Electronic Warfare Operations			✓	✓					✓			✓	✓									✓							✓	✓	✓		✓	✓
EXPEDITIONARY WARFARE																																	
Dive and Salvage Operations			✓									✓			✓							✓						✓	✓		✓			✓
Personnel Insertion/Extraction – Surface and Subsurface			✓									✓										✓							✓					
Personnel Insertion/Extraction – Swimmer/Diver			✓									✓										✓							✓					
Small Boat Attack			✓		✓							✓								✓		✓		✓					✓					

Table B-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																				Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
MINE WARFARE																																		
Airborne Mine Countermeasure – Mine Detection	✓			✓					✓			✓	✓		✓							✓						✓	✓	✓	✓	✓	✓	✓
Civilian Port Defense – Homeland Security Anti-Terrorism/Force Protection Exercise	✓		✓	✓				✓	✓	✓		✓	✓		✓							✓	✓				✓	✓	✓	✓	✓	✓	✓	✓
Limpet Mine Neutralization System			✓					✓				✓										✓	✓		✓									
Marine Mammal System								✓							✓					✓	✓	✓	✓	✓				✓	✓	✓	✓	✓		✓
Mine Countermeasure Exercise – Ship Sonar	✓		✓						✓	✓		✓			✓							✓						✓	✓		✓	✓	✓	✓
Mine Countermeasure Exercise – Surface	✓		✓						✓			✓			✓							✓							✓			✓		✓
Mine Countermeasures Mine Neutralization Remotely Operated Vehicle Operations	✓		✓	✓				✓				✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mine Countermeasure – Towed Mine Neutralization			✓	✓					✓	✓		✓	✓		✓							✓						✓	✓	✓	✓	✓		✓
Mine Laying				✓					✓				✓	✓	✓							✓		✓				✓	✓	✓	✓		✓	✓
Mine Neutralization Explosive Ordnance Disposal			✓					✓				✓		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Submarine-Launched Mobile Mines			✓	✓					✓			✓	✓		✓		✓											✓		✓				
Submarine Mine Exercise	✓											✓																						
Surface Ship Object Detection	✓		✓						✓			✓			✓							✓						✓	✓		✓	✓	✓	✓
Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading			✓					✓				✓		✓	✓					✓	✓	✓	✓				✓	✓	✓	✓	✓	✓		✓

Table B-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																			Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
MINE WARFARE (Continued)																																	
Underwater Demolition Qualification/Certification			✓					✓				✓								✓	✓	✓	✓		✓			✓					
SURFACE WARFARE																																	
Bombing Exercise Air-to-Surface			✓	✓	✓			✓	✓			✓	✓	✓				✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Gunnery Exercise Air-to-Surface – Medium-Caliber			✓	✓	✓				✓			✓	✓	✓				✓		✓	✓	✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise Air-to-Surface – Small-Caliber			✓	✓	✓				✓			✓	✓	✓				✓		✓	✓	✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise Surface-to-Surface Boat – Medium-Caliber			✓		✓			✓				✓		✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gunnery Exercise Surface-to-Surface Boat – Small-Caliber			✓		✓							✓		✓						✓	✓	✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise Surface-to-Surface Ship – Large Caliber			✓		✓			✓	✓			✓		✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gunnery Exercise Surface-to-Surface Ship – Medium Caliber			✓		✓			✓	✓			✓		✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gunnery Exercise Surface-to-Surface Ship – Small-Caliber			✓		✓				✓			✓		✓						✓	✓	✓		✓		✓			✓	✓	✓			✓
Independent Deployer Certification Exercise/Tailored Surface Warfare Training	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Integrated Live Fire			✓	✓	✓		✓	✓	✓			✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Laser Targeting – Aircraft			✓	✓					✓			✓	✓									✓							✓	✓	✓		✓	✓
Maritime Security Operations			✓	✓	✓				✓			✓	✓	✓						✓	✓	✓		✓		✓			✓	✓	✓			✓
Missile Exercise Air-to-Surface			✓	✓	✓			✓	✓			✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Missile Exercise Air-to-Surface Rocket				✓	✓			✓	✓				✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table B-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																			Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
SURFACE WARFARE (Continued)																																	
Missile Exercise Surface-to-Surface			✓		✓			✓	✓			✓		✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Sinking Exercise			✓	✓	✓			✓	✓			✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OTHER TRAINING EXERCISES																																	
Elevated Causeway System		✓	✓													✓						✓							✓	✓		✓		
Kilo Dip	✓			✓					✓				✓									✓							✓	✓	✓	✓		✓
Offshore Petroleum Discharge System															✓							✓							✓					
Precision Anchoring			✓						✓			✓			✓							✓						✓	✓		✓			✓
Submarine Navigation Exercise	✓											✓																					
Submarine Sonar Maintenance and Systems Checks	✓											✓																				✓	
Submarine Under Ice Certification	✓											✓																				✓	
Surf Zone Test Detachment/ Equipment Test and Evaluation																																	
Surface Ship Sonar Maintenance and Systems Checks	✓		✓						✓			✓										✓										✓	
Unmanned Aerial System Training and Certification				✓								✓	✓	✓								✓											
Unmanned Underwater Vehicle Training -Certification and Development	✓		✓									✓		✓																			
Waterborne Training			✓									✓		✓							✓	✓		✓				✓	✓	✓	✓			✓

Table B-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																			Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
Training Activity																																	

[1] Testing Activities Only
[2] Other Materials include marine markers and flares, chaff, towed and stationary targets, and miscellaneous components of other expended objects
[3] Area of interest is U.S. Territorial Waters (seaward of the mean high water line to 12 nautical miles and any inshore waters)
[4] Vibration and shock waves from underwater explosions.
[5] Physical disturbance and strike stressors resulting from in-water devices, military expended materials, seafloor devices, pile driving, and vibration from sonic booms in U.S. territorial waters (seaward of the mean high water line to 12 nautical miles).
[6] Availability of access on the ocean and in the air
[7] Loud Noises from weapons firing, in-air explosions, and sonic booms
[8] Active sonar, underwater explosions, air guns, vessel movements, mine warfare training devices, and unmanned underwater systems
[9] Sources or electromagnetic energy and lasers
[10] Interaction of Navy or Marine Corps aircraft, vessels, and equipment with general public
Note: A check indicates events that take place for Alternative 1 and Alternative 2.

Table B-2: Stressors by Testing Activity

Hawaii-Southern California Testing Activity	Biological Resources																				Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
NAVAL AIR SYSTEMS COMMAND																																		
AIR WARFARE																																		
Air Combat Maneuver				✓					✓				✓							✓	✓				✓			✓	✓	✓			✓
Air Platform-Vehicle Test				✓					✓				✓	✓						✓	✓		✓		✓		✓	✓	✓	✓		✓	✓
Air Platform Weapons Integration Test				✓					✓				✓	✓							✓		✓				✓	✓	✓	✓			✓
Intelligence, Surveillance, and Reconnaissance Test				✓					✓				✓								✓							✓	✓	✓			✓
ANTI-SUBMARINE WARFARE																																		
Anti-Submarine Warfare Torpedo Test	✓			✓					✓			✓	✓	✓			✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Tracking Test – Helicopter	✓			✓				✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft	✓			✓				✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Sonobuoy Lot Acceptance Test	✓		✓	✓				✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓				✓	✓	✓	✓	✓	✓		✓
ELECTRONIC WARFARE																																		
Chaff Test				✓					✓				✓								✓	✓				✓			✓	✓				✓
Electronic Systems Evaluation				✓					✓				✓									✓							✓	✓	✓			✓
Flare Test				✓					✓				✓	✓							✓	✓		✓		✓		✓	✓	✓	✓			✓
MINE WARFARE																																		
Airborne Dipping Sonar Minehunting Test	✓			✓					✓				✓									✓							✓	✓	✓	✓		✓
Airborne Laser-Based Mine Detection System Test				✓					✓				✓		✓							✓							✓	✓	✓		✓	✓
Airborne Mine Neutralization System Test (AMNS)			✓	✓				✓	✓			✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table B-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																				Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
MINE WARFARE (CONTINUED)																																		
Airborne Sonobuoy Minehunting Test	✓			✓					✓				✓	✓			✓	✓			✓	✓		✓	✓	✓			✓	✓	✓	✓		✓
Mine Laying Test				✓					✓				✓	✓	✓							✓		✓		✓		✓	✓	✓	✓			✓
SURFACE WARFARE																																		
Air-to-Surface Bombing Test				✓	✓			✓	✓				✓	✓						✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Air-to-Surface Gunnery Test				✓	✓			✓	✓				✓	✓						✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Air-to-Surface Missile Test				✓	✓			✓	✓				✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
High-Energy Laser Weapons Test			✓	✓					✓		✓	✓	✓								✓	✓	✓						✓	✓	✓		✓	
Laser Targeting Test				✓					✓				✓									✓							✓	✓	✓		✓	✓
Rocket Test				✓	✓			✓	✓				✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OTHER TESTING ACTIVITIES																																		
Acoustic and Oceanographic Research			✓	✓					✓			✓	✓									✓							✓	✓	✓			✓
Air Platform Shipboard Integration Test				✓					✓				✓									✓							✓	✓	✓			✓
Kilo Dip	✓			✓					✓				✓									✓							✓	✓	✓	✓		✓
Shipboard Electronic Systems Evaluation				✓					✓				✓									✓							✓	✓	✓			✓
Undersea Range System Test	✓		✓									✓			✓																			

Table B-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																				Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
NAVAL SEA SYSTEMS COMMAND																																		
ANTI-SUBMARINE WARFARE																																		
Anti-Submarine Warfare Mission Package Testing	✓		✓	✓					✓			✓	✓	✓			✓	✓			✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
At-sea Sonar Testing	✓		✓	✓					✓	✓		✓	✓	✓			✓	✓			✓	✓		✓	✓	✓			✓		✓	✓	✓	✓
Countermeasure Testing	✓		✓						✓			✓		✓			✓	✓	✓		✓	✓		✓	✓	✓		✓	✓		✓	✓	✓	✓
Pierside Sonar Testing	✓																														✓			
Submarine Sonar Testing/Maintenance	✓																														✓	✓		✓
Surface Ship Sonar Testing/Maintenance	✓		✓						✓			✓										✓						✓	✓		✓	✓	✓	✓
Torpedo (Explosive) Testing	✓		✓	✓				✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Torpedo (Non-explosive) Testing	✓		✓	✓					✓			✓	✓	✓			✓	✓			✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
ELECTRONIC WARFARE																																		
Radar and other System Testing			✓	✓					✓	✓	✓	✓	✓	✓						✓	✓	✓		✓		✓		✓	✓	✓	✓		✓	✓
MINE WARFARE																																		
Mine Countermeasure and Neutralization Testing	✓		✓	✓				✓	✓	✓		✓	✓	✓	✓		✓			✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	✓
Mine Countermeasure Mission Package Testing	✓		✓	✓				✓	✓			✓	✓	✓	✓		✓			✓		✓	✓	✓			✓		✓	✓	✓	✓	✓	✓
Mine Detection and Classification Testing	✓		✓	✓					✓	✓		✓	✓		✓			✓			✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
SURFACE WARFARE																																		
Gun Testing – Large Caliber			✓		✓		✓	✓	✓			✓		✓						✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Gun Testing – Medium Caliber			✓		✓		✓	✓	✓			✓		✓						✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓

Table B-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																				Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
SURFACE WARFARE (CONTINUED)																																		
Gun Testing – Small Caliber			✓		✓				✓			✓		✓						✓		✓		✓			✓	✓	✓	✓			✓
Kinetic Energy Weapon Testing			✓		✓		✓		✓			✓	✓	✓						✓	✓	✓		✓			✓	✓	✓	✓		✓	✓
Missile and Rocket Testing			✓		✓		✓	✓	✓			✓	✓	✓						✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
UNMANNED SYSTEMS																																		
Unmanned Surface Vehicle System Testing	✓		✓						✓			✓										✓						✓	✓		✓		✓	✓
Unmanned Underwater Vehicle Testing	✓		✓						✓			✓			✓													✓	✓					
VESSEL EVALUATION																																		
Air Defense Testing			✓	✓	✓		✓		✓			✓	✓	✓						✓	✓	✓		✓		✓		✓	✓	✓	✓		✓	✓
In-port Maintenance Testing									✓																							✓	✓	
Propulsion Testing			✓						✓			✓										✓						✓	✓		✓		✓	✓
Submarine Sea Trials – Propulsion Testing																													✓		✓			✓
Submarine Sea Trials – Weapons System Testing	✓		✓						✓			✓					✓					✓						✓	✓		✓	✓	✓	✓
Surface Warfare Testing			✓	✓	✓		✓	✓	✓			✓	✓	✓						✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Undersea Warfare Testing	✓		✓	✓					✓			✓	✓	✓			✓	✓			✓	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
Vessel Signature Evaluation			✓	✓					✓	✓		✓	✓									✓						✓	✓		✓	✓	✓	✓
OTHER TESTING ACTIVITIES																																		
Chemical and Biological Simulant Testing			✓	✓					✓			✓	✓									✓			✓	✓			✓	✓	✓			✓
Insertion/Extraction	✓																					✓							✓			✓		✓

Table B-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																				Physical Resources					Human Resources [3]								
	Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
	Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
OTHER TESTING ACTIVITIES (Continued)																																		
Non-Acoustic Component Testing			✓	✓					✓			✓	✓																✓					
Signature Analysis Operations	✓		✓						✓			✓		✓			✓					✓							✓		✓			✓
OFFICE OF NAVAL RESEARCH																																		
ACOUSTIC AND OCEANOGRAPHIC SCIENCE AND TECHNOLOGY																																		
Acoustic and Oceanographic Research	✓		✓	✓		✓			✓		✓	✓	✓	✓	✓		✓					✓						✓			✓		✓	✓
Large Displacement Unmanned Underwater Vehicle Testing			✓									✓																✓			✓			✓
Long-Range Acoustic Communications	✓											✓			✓																		✓		
SPACE AND NAVAL WARFARE SYSTEMS COMMAND																																		
Anti-Terrorism/Force Protection	✓											✓			✓										✓									
Communications	✓		✓						✓			✓		✓			✓	✓		✓	✓			✓										
Energy and Intelligence, Surveillance, and Reconnaissance/Information Operations Sensor Systems	✓		✓			✓				✓		✓			✓		✓									✓									
Vehicle Testing	✓		✓	✓					✓			✓	✓		✓											✓		✓		✓		✓		✓

[1] Testing Activities Only
[2] Other Materials include marine markers and flares, chaff, towed and stationary targets, and miscellaneous components of other expended objects
[3] Area of interest is U.S. Territorial Waters (seaward of the mean high water line to 12 nautical miles and any inshore waters)
[4] Vibration and shock waves from underwater explosions.
[5] Physical disturbance and strike stressors resulting from in-water devices, military expended materials, seafloor devices, pile driving, and vibration from sonic booms in U.S. territorial waters (seaward of the mean high water line to 12 nautical miles).
[6] Availability of access on the ocean and in the air
[7] Loud Noises from weapons firing, in-air explosions, and sonic booms
[8] Active sonar, underwater explosions, air guns, vessel movements, mine warfare training devices, and unmanned underwater systems
[9] Sources or electromagnetic energy and lasers
[10] Interaction of Navy or Marine Corps aircraft, vessels, and equipment with general public
Note: A check indicates events that take place for Alternative 1 and Alternative 2.

Table B-3: Stressors by Resource

	Stressors vs. Resources	Biological Resources																				Physical Resources					Human Resources [3]								
		Acoustic Stressors						Explosive Stressors		Energy Stressors			Physical Disturbance and Strike Stressors					Entanglement Stressors			Ingestion Stressors		Air Quality Stressors	Sediments and Water Quality Stressors				Cultural Resource Stressors		Socioeconomic Resource Stressors			Public Health & Safety Stressors		
		Sonar & Other Transducers	Pile Driving	Vessel Noise	Aircraft Noise	Weapons Noise	Air Guns	In-Air Explosions	In-Water Explosions	In-Air Electromagnetic Devices	In-Water Electromagnetic Devices	High-Energy Lasers	Vessels & In-water Device Strike	Aircraft & Aerial Target Strike	Military Expended Material	Seafloor Devices	Pile Driving	Wires & Cables	Decelerators/Parachutes	Biodegradable Polymer [1]	Military Expended Materials – Munitions	Military Expended Materials – Other than Munitions	Criteria Air Pollutants	Explosives	Metals	Chemicals	Other Materials [2]	Explosives [4]	Physical Disturbance & Strike [5]	Accessibility [6]	Airborne Acoustics [7]	Physical Disturbance & Strike [5]	Underwater Energy [8]	In-Air Energy [9]	Physical Interactions [10]
Physical	Air Quality							✓														✓	✓												
	Sediments and Water Quality								✓															✓	✓	✓	✓								
Biological	Vegetation								✓				✓		✓	✓	✓							✓	✓	✓	✓								
	Invertebrates	✓	✓				✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Habitats								✓				✓		✓	✓	✓																		
	Fishes	✓	✓	✓		✓	✓		✓		✓	✓	✓		✓	✓		✓		✓	✓			✓	✓	✓	✓								
	Marine Mammals	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓		✓	✓	✓	✓			✓	✓	✓	✓								
	Reptiles	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓		✓	✓	✓	✓			✓	✓	✓	✓								
	Birds	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓					✓	✓	✓	✓												
Human	Cultural Resources				✓				✓						✓	✓												✓	✓							
	Socioeconomic Resources	✓		✓	✓	✓	✓		✓				✓	✓	✓			✓						✓	✓	✓	✓			✓	✓	✓			
	Public Health and Safety	✓				✓	✓		✓			✓	✓	✓	✓	✓																✓	✓	✓

[1] e.g., hull-mounted mid-frequency active sonar
[2] Cultural resources stressor
[3] Socioeconomic Resources stressor
[4] Public health and safety stressor
[5] Acoustics stressor (includes only underwater explosives and airborne sonic booms)
Note: A check indicates events that take place for Alternative 1 and Alternative 2.

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