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Overseas Environmental Impact Statement
Point Mugu Sea Range
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3.9 Marine Birds

3.9.1 Introduction

This section details the avian species associated with the marine environment that are known to occur within the Point Mugu Sea Range (PMSR) Study Area (Study Area) and have a potential to be impacted by the Proposed Action. This includes avian species that occur on Point Mugu; San Nicolas Island (SNI); and the support facilities on San Miguel, Santa Rosa, and Santa Cruz Islands. Current use of the existing instrumentation and support facilities on San Miguel, Santa Rosa, and Santa Cruz Islands involves periodic maintenance activities. These activities do not have significant impacts on marine birds. None of the alternatives addressed in this document include new activities at these islands. Therefore, the descriptions of the affected environment of the PMSR and impacts do not include specific mention or reference to marine birds on San Miguel, Santa Rosa, and Santa Cruz Islands.

The majority of impacts are anticipated to occur in the marine environment or the interface between the terrestrial and marine environments; hence, the focus is on marine birds. For this document, marine birds are defined as species that nest, forage, roost, and spend time in the marine environment, including shorebirds (e.g., plovers, sandpipers, oystercatchers), marsh birds (e.g., rails, some sparrow species), waterbirds (e.g., ducks, grebes, cormorants, pelicans), and seabirds (e.g., storm-petrels, auklets, murrelets, murres, puffins, albatross).

3.9.2 Region of Influence

The PMSR is within a biologically diverse region that includes the California Channel Islands and coastal waters, and Mugu Lagoon on Point Mugu, which is the largest relatively undisturbed coastal salt marsh within Southern California. The PMSR is within the Southern California Bight (SCB), an indentation of the coastline that creates a large backwater eddy or transition zone between warm equatorial waters and cold subarctic waters of the California Current (U.S. Fish and Wildlife Service, 2005). Specific to the Proposed Action, SNI is an important breeding location for several marine birds, and the nearshore and open waters within the PMSR are used by resident and migratory seabirds during a variety of life stages. Additionally, the nearshore waters around the northern Channel Islands such as San Miguel Island and its islets (Prince Island and Castle Rock) are regionally vital for marine bird foraging and nesting. The PMSR is located within the Pacific Flyway and provides stop-over areas for migratory birds (in addition to wintering habitat for many avian species). While Navy support boats and surface targets transit in and out of Port Hueneme to the PMSR, marine birds within the port are not addressed further because vessel transits would not affect marine birds within Port Hueneme.

3.9.3 Approach to Analysis

The Proposed Action would involve testing and training activities associated with several types of weapons systems, targets, aircraft, ships, missiles, ordnance (ammunition, bombs, rockets, and others), and energy systems. For the purpose of describing the affected environment and analyzing impacts on marine birds, the specific aircraft, ship, weapons system, ordnance, and other testing and training activities are less important than the resulting effects of the testing and training activities on marine birds (such as behavioral disturbance and potential for injury or mortality). Therefore, a stressor-based analysis is used to determine the potential stressors that testing and training activities may have on resident and migratory marine birds on the PMSR.

This section evaluates the "significance of impacts" on the affected environment that would result from the alternatives as compared to the baseline. The "significance of impacts" is evaluated based on the stressors to populations of marine birds that breed or roost on the PMSR or migrate through. While all the bird species that occur on the PMSR occur in a larger geographic area, the SCB, where the PMSR is located, is unique along the Pacific Coast in regard to its species composition and geographic features. Specific analysis for marine birds on Point Mugu and SNI is included because these terrestrial locations support nesting and roosting habitat for several species of marine birds. Since no construction of facilities on Point Mugu or SNI is associated with the Proposed Action, impacts on marine birds are related to testing and training activities such as an increase in noise, explosives, energy, physical disturbance/strike, and ingestion of military expended materials. Many of the testing and training activities that would be conducted on the PMSR have already had an environmental assessment conducted, which is referenced where applicable. Overall, the stressors were evaluated to determine if they would cause a significant impact on any marine birds or known avian breeding or roosting locations on Point Mugu and SNI.

3.9.4 Affected Environment

The affected environment provides the context for understanding potential impacts on marine birds that occur within the Study Area. Particular focus is on the marine birds that breed, nest, roost, and forage within the estuarine, nearshore, coastal, and marine environments on Point Mugu and SNI. Specific to the Proposed Action, locations of missile launch pads and complexes in relation to key marine bird habitats are detailed in the following sections. For the purposes of analysis, the current state of the affected environment as described below reflects ongoing Navy testing and training activities conducted within the Study Area at the current levels for establishing current baseline conditions.

3.9.4.1 General Background

Within the Study Area, several marine birds are considered sensitive species and have regulatory protection through the Migratory Bird Treaty Act (16 United States Code 703–712), federal Endangered Species Act, California Endangered Species Act, and Executive Order 13186 *(Responsibilities of Federal Agencies to Protect Migratory Birds)* and Migratory Bird Permits issued by the U.S. Fish and Wildlife Service in 2007 (50 Code of Federal Regulations Part 21). Species that are federally or state listed are provided a degree of regulatory protection which entails a permitting process with specific mitigation measures. Birds listed as federally or state threatened or endangered that occur within the Study Area are listed in Table 3.9-1. Detailed descriptions for these species, including population trends, locations of occupied habitat, and conservation measures, are provided in the Point Mugu and SNI Integrated Natural Resources Management Plans (INRMPs) (U.S. Department of the Navy, 2019a).

Two additional federally listed species have rarely been encountered within the Study Area and are not considered to regularly occur: short-tailed albatross (*Phoebastria albatrus*; federally endangered) and marbled murrelet (*Brachyramphus marmoratus*; federally threatened) (U.S. Department of the Navy, 2018a). Three historical sightings of short-tailed albatross have occurred in the last several decades off the coast of Southern California around the Channel Islands according to the *Marine Resources Assessment for the Southern California and Point Mugu Operating Area* (U.S. Department of the Navy, 2008). The species ranges widely during the nonbreeding season and is considered a vagrant in the PMSR. The marbled murrelet has been historically detected sporadically within the PMSR over the past several decades during the nonbreeding season from November through March (U.S. Department of the Navy, 2008). Short-tailed albatross and marbled murrelet forage in off-shore upwelling zones, which occur within the PMSR. Both species do not breed within or adjacent to the Study Area; do not regularly forage, winter, or migrate through the PMSR; and are considered rare visitors to the Study Area, and therefore are not discussed further.

Table 3.9-1: Federally and State Listed Marine Birds Within the Study Area

Scientific Name	Common Name	Sensitivity Status	General Habitat	Study Area Location
Haliaeetus leucocephalus	Bald eagle	State endangered	Nests and forages on several Channel Islands of Southern California	San Nicolas Island and Point Mugu
Synthliboramphus scrippsi	Scripps's murrelet (formerly Xantus's murrelet)	State threatened	Islands and nearshore waters of Southern California	Offshore around San Nicolas Island and surrounding waters
Charadrius nivosus	western snowy plover	Federally threatened	Sandy beaches, coastal dunes, tidal mud flats	Point Mugu and San Nicolas Island
Sternula antillarum browni	California least tern	Federally and state endangered	Sandy beaches, coastal dunes, open water	Point Mugu
Rallus obsoletus levipes	light-footed Ridgway's rail	Federally and state endangered	Coastal salt marsh scrub	Point Mugu
Vireo bellii pusillus	least Bell's vireo	Federally and state endangered	Riparian vegetation such as mulefat and willow scrub	Point Mugu
Passerculus sandwichensis beldingi	Belding's savannah sparrow	State endangered	Coastal salt marsh scrub	Point Mugu

Source: California Department of Fish and Wildlife (2018), U.S. Department of the Navy (U.S. Department of the Navy, 2019a).

Several additional avian species occur within the Study Area but have been removed (delisted) from the list of federally and/or state endangered and threatened species. These species are still afforded protection under the Migratory Bird Treaty Act and other regulations and include bald eagle (*Haliaeetus leucocephalus*), American peregrine falcon (*Falco peregrinus anatum*) and California brown pelican (*Pelecanus occidentalis californicus*). While bald eagles have been removed from the list of federally endangered species, they are still on the California endangered species list as an endangered species and are protected by the Bald and Golden Eagle Protection Act. Immature bald eagles have been occasionally detected on SNI over the last few years remaining around the island for a few weeks (Ruane, 2019c). Over the last six winters, one tagged bald eagle that was released from Santa Cruz Island has been regularly seen at Point Mugu. This is likely because the population of nesting bald eagles within the Channel Islands is increasing, and they currently nest on five of the eight islands. As bald eagles continue to recover in Southern California and expand their breeding locations, they are likely to be detected in more places on a regular basis. Breeding and roosting locations for California brown pelican are shown in figures in the *Marine Resources Assessment for the Southern California and Point Mugu Operating Area* (U.S. Department of the Navy, 2008). The bald eagle, American peregrine falcon, and California brown pelican are also considered California Department of Fish and Wildlife fully protected species. These birds are vulnerable to extinction because of declining population levels, limited ranges, and rarity. Several marine birds that occur within the Study Area are California Department of Fish and Wildlife species of special concern. While they are not afforded the same level of protection as a federally or state listed species, they are still considered sensitive, and Proposed Action impacts that may affect these species are discussed where applicable. Complete lists of all California Department for

Fish and Wildlife marine bird species of special concern that have been detected on Point Mugu and SNI are located in their respective INRMPs (U.S. Department of the Navy, 2019a).

3.9.4.2 Marine Birds in the Study Area

For the purposes of describing the affected environment, the Study Area is divided into three main geographic areas that contain many of the same marine birds. The Study Area is subdivided to provide an understanding of the geographic areas in which birds breed, roost, forage, and migrate through in relation to testing and training activities within the three areas. These are the marine waters component of the PMSR, Point Mugu, and SNI, as detailed in the following sections. The affected environment discussion is focused on marine birds most likely to be affected by implementation of the Proposed Action. While the primary focus of this section is on federally and state listed species, and other special-status species, regionally important marine bird breeding populations are also included.

3.9.4.2.1 Point Mugu Sea Range

Over 195 species of seabirds inhabit and use the marine waters, shore, and island habitats in the SCB (Baird, 1990). The PMSR includes the northern portion of the SCB. The SCB is a transition zone between warm equatorial waters and cold subarctic waters of the California Current and delineates the nesting ranges for several subarctic and subtropical marine birds. The region also experiences seasonal variability in oceanographic conditions, some of which have resulted in more subtropical taxa found in this region. Within the SCB, the Channel Islands support the largest breeding colonies of seabirds in Southern California with 14 confirmed species (U.S. Department of the Navy, 2019a). San Miguel Island and its surrounding islets, including Prince Island, support the largest and most diverse group of breeding seabirds in the SCB. The most abundant breeding seabird species include western gull (*Larus occidentalis*), Cassin's auklet (*Ptychoramphus aleuticus*), and Brandt's cormorant (*Phalacrocorax penicillatus*) (Carter et al., 2008). Populations of double-crested cormorants (*Phalacrocorax auritus*), ashy storm-petrel (*Oceanodroma homochroa*), pigeon guillemot (*Cepphus columba*), black storm-petrel (*Oceanodroma melania*), and Scripps's murrelet (*Synthliboramphus scrippsi*) occur throughout the Channel Islands. Tufted puffins (*Fratercula cirrhata*) historically bred within the SCB; however, the most recent comprehensive at-sea surveys from 1999 through 2002 in the SCB did not detect any tufted puffins (Mason et al., 2007). Most of the world's population of Scripps's murrelet and more than 50 percent of the world's population of ashy storm-petrel, along with the only breeding colonies of California brown pelicans in California, nest within the Channel Islands (U.S. Department of the Navy, 2019a). Specific to California brown pelicans in the SCB, the species is present year round with the greatest densities in September, and the majority of birds have been detected 6.2 miles from shore (Mason et al., 2007). After September and October, the numbers of California brown pelicans decrease in the SCB as individuals migrate south.

Historical seabird density within the PMSR was calculated using density data from May 1975 through March 1978 to calculate the number of seabirds per square mile (Minerals Management Service, 1993). Historically, the greatest seabird diversity occurred in the fall and spring during migration, with the lowest numbers in June and July (Baird, 1990). Overall seabird density was low throughout the PMSR except for the areas of upwelling and nutrient-rich areas adjacent to the California coast and coastlines around the Channel Islands. Seabird density was the highest west of SNI with more than 200 birds per square mile (U.S. Department of the Navy, 2002). These data are presented to provide historical context and highlight previous studies conducted across the PMSR. The most recent seabird density data are provided in the following paragraphs.

More recent seabird survey data for the PMSR come from a study conducted from 1999 through 2002, which surveyed seabirds off Southern California from Cambria south to the California/Mexico border (Mason et al., 2002). Aerial surveys occurred during January, May, and September with nine complete surveys flown throughout the survey area. Aerial transect surveys were conducted within five at-sea subareas, and along three coastal transects. Coastal transect data are not discussed because the majority of the PMSR is located at-sea and does not occur along the coast, apart from the portion along Point Mugu. For at-sea transects, surveys were focused on a core area around the northern Channel Islands, where transects were spaced closer together. At-sea transects outside of the core area were spaced farther apart and oriented east-to-west (instead of north-to-south for core area transects) and surveyed only once per month (while core area transects were surveyed twice per month). Survey months were chosen to document over-wintering birds in January, breeding birds in May, and post-breeding birds in September. The at-sea subareas were divided to reflect major geographical regions with differing oceanography, and proximity to islands and the mainland (Mason et al., 2007).

Surveys documented 54 species of seabirds with more than 135,000 birds counted. Surveys were conducted to compare seabird density estimates from previous studies by Briggs et al. (1987). Extrapolation of the data from Mason et al. (2007) indicates that about 1 million seabirds use the area off Southern California during January, with lower numbers in May and September. Seabirds were concentrated mainly near the northern Channel Islands and along mainland and island coasts. The most common seabird species observed during January surveys included California gull (*Larus californicus*), western grebe (*Aechmophorus occidentalis*), and Cassin's auklet. Sooty and short-tailed shearwaters (*Ardenna grisea* and *Puffinus tenuirostris*, respectively), phalaropes (*Phalaropus* species), and western gulls were most abundant in May and September (Mason et al., 2007). Seabird densities were compared with historical data collected in the same area over 20 years earlier by Briggs et al. (1987). Densities of seabirds averaged 29.3 seabirds per square mile for at-sea transects and 183.6 seabirds per square mile on coastal transects, while Briggs et al. (1987) estimated densities of 43.5 seabirds per square mile over the continental shelf. Seabird densities were 14 percent (in January), 57 percent (May), and 42 percent (September) lower than historical estimates with the most notable declines in common murre (*Uria aalge*), sooty shearwater, and Bonaparte's gull (*Chroicocephalus philadelphia*). Other species increased, including California brown pelican, Scripps's murrelet, Cassin's auklet, ashy storm-petrel, western gull, and Brandt's cormorant (Ackerman et al., 2004). The reasons for seabird population fluctuations may be both species specific and in response to environmental variability such as El Niño events. In addition to continuing impacts from Dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyl (PCB) contamination (several species still have measurable levels of eggshell thinning) and oil production, increased urbanization may be contributing to species declines (Mason et al., 2007). Additional detailed information regarding specific species distributions, figures, and species accounts is provided by Mason et al. (2007).

To compare the PMSR warning areas with the five at-sea subareas from Mason et al. (2007), three figures were created to depict the seasonal (January, May, and September) variability in terms of seabird densities per square mile (Figure 3.9-1, Figure 3.9-2, and Figure 3.9-3). The data from January, May, and September per subarea and the PMSR warning areas they coincide with are presented in Table 3.9-2. Data are presented as a range of bird densities per square mile that represent the mean number plus and minus the standard error. The highest densities of seabirds during winter (January) were documented in subarea 3 around the northern Channel Islands in warning areas W289N, the northeastern portion of W289, and W412.

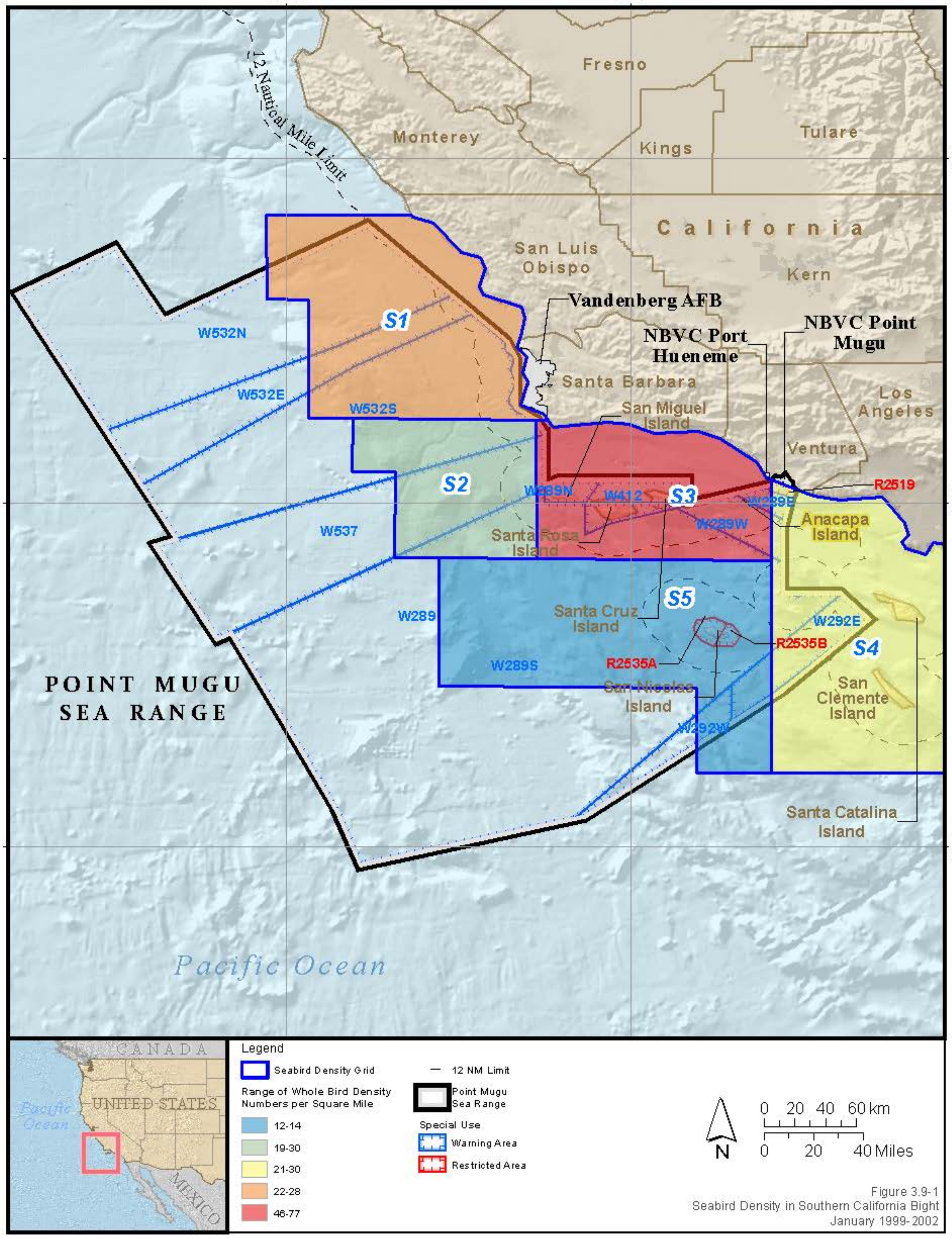

Figure 3.9-1: Seabird Density in Southern California Bight January 1999–2002

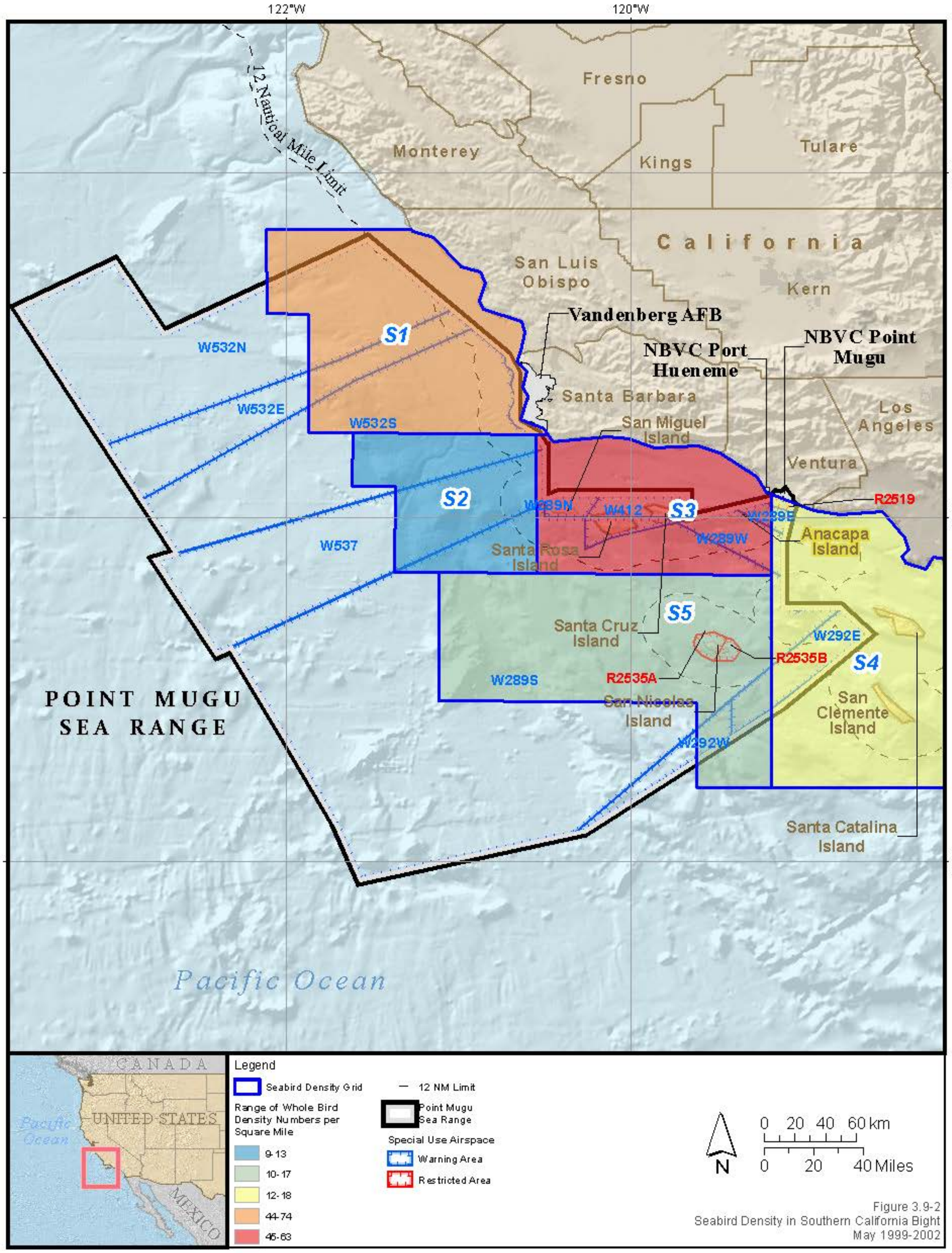

Figure 3.9-2: Seabird Density in Southern California Bight May 1999–2002

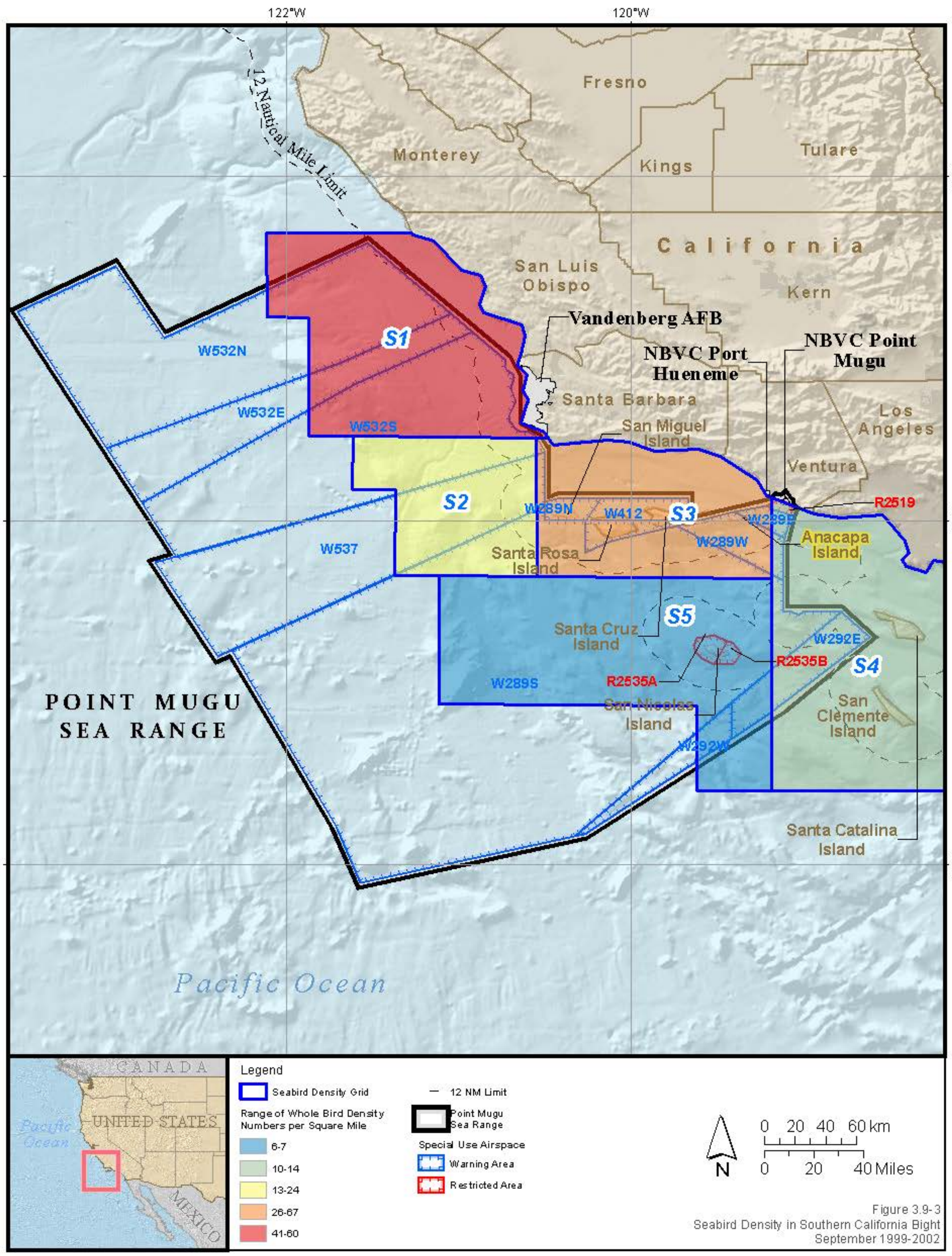

Figure 3.9-3: Seabird Density in Southern California Bight September 1999–2002

Table 3.9-2: Bird Densities per Square Mile for Surveyed Areas within the PMSR

Subarea	Month	Range of Seabird Densities per Square Mile[1]	Overlaps with Warning Area[2]
1	January	22–28	W532N, E, S
	May	44–74	
	September	41–60	
2	January	19–30	W289, W532S, W537
	May	9–13	
	September	13–24	
3	January	46–77	W289N, W289E, W289W, W289, W412, W532S, W537
	May	45–63	
	September	26–67	
4	January	21–30	W289E, W289W, W289S, W292E
	May	12–18	
	September	10–14	
5	January	12–14	W289, W289S, W292W, W292E
	May	10–17	
	September	6–7	

[1]Mean at-sea density data were derived from Mason et al., (2007). Mean number of birds per month plus/minus the standard error was used to provide the range of birds per square mile. Numbers were rounded to the nearest whole number.
[2]These data represent only a portion of the actual warning area within the PMSR. Not all warning areas were surveyed equally, and most data extend to only the middle portion of the warning area.

There were lower numbers of birds, but in similar densities in subareas 1, 2, and 4. During the breeding season (May), the highest densities of birds were detected in subarea 1 with the second-highest numbers in subarea 3. During the post-breeding season (September), the same trend as the breeding season was observed. Overall low densities of birds were detected within subarea 5 where SNI is located. It is important to note that the at-sea surveys conducted by Mason et al. (2007) only include a portion of the PMSR and do not provide full coverage of all warning areas. Most of the transects conducted by Mason et al. (2007) do not extend beyond the middle portion for each of the warning areas. It is not possible to extrapolate the data from the more coastal portion of the survey area to encompass the entire PMSR. Therefore, avian density estimates are likely lower farther west (farther from the coast and Channel Islands) in the PMSR, but an accurate density estimate is not available.

The majority of testing and training activities occur in W289 and will continue to occur within increased tempo in that warning area, especially north and west of SNI. Since the Proposed Action also includes increased use of W532N, W532E, and W532S, which coincide with subarea 1, additional information is provided specific to those warning areas. W532N, W532E, and W532S had some of the highest densities of seabirds during May and September based on data from 1999 to 2002 (Mason et al., 2007), but since it does not include any of the Channel Islands (no nearby nesting or roosting habitat within the PMSR) birds are likely migrating and feeding/foraging in this area. Since the southern boundary of subarea 1 (within W532) is located along the edge of a transition zone between colder, up-welled waters of Central California and warmer waters of Southern California, seabirds may be taking advantage of this transition zone for foraging. Sooty and short-tailed shearwaters, phalaropes, and Cassin's auklets were most abundant in subarea 1 in May, and sooty and short-tailed shearwaters, phalaropes, common and arctic terns (*Sterna hirundo* and *Sterna paradisaea*, respectively), and pink-footed shearwaters (*Puffinus creatopus*) were the most abundant species in September.

Surprisingly, subarea 5, where SNI is located, had some of the lowest seabird densities compared to the other subareas. While seabird densities were concentrated in the near-shore waters around SNI, there was low seabird density across the rest of the subarea. The specific seabird distribution and abundance maps in Mason et al. (2007) for various seabird groups documented low numbers of tube-nosed species (Procellariiformes) such as shearwaters, fulmars, and storm-petrels. There were high densities of cormorant species (especially Brandt's cormorants), and species of gulls (especially western gulls) (Mason et al., 2007), which is consistent with species known to breed on SNI.

3.9.4.2.2 Point Mugu

Mugu Lagoon, an approximately 2,200-acre coastal salt marsh, provides important foraging, nesting, roosting, and migration habitat for a variety of marine bird species. Mugu Lagoon and adjacent coastal beaches provide diverse habitat that supports several sensitive birds, including western snowy plover (*Charadrius nivosus nivosus*), California least tern (*Sternula antillarum browni*), light-footed Ridgway's rail (*Rallus obsoletus levipes*), and Belding's savannah sparrow (*Passerculus sandwichensis beldingi*). Mugu Lagoon provides habitat for over 66,000 shorebirds during spring migration and more than 10,000 birds in the fall and winter, rendering it an important migratory stopover for birds along the Pacific Flyway. Shorebird species at Point Mugu are composed primarily of western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), willet (*Tringa semipalmata*), marbled godwit (*Limosa fedoa*), and dowitchers (*Limnodromus* sp.). The tidal-influenced coastal salt marsh at Point Mugu, along with the exposed mudflats within Mugu Lagoon, provides the rich matrix of habitats necessary to support vast assemblages of birds. In particular, species like light-footed Ridgway's rail and Belding's savannah sparrow occur year-round within the coastal salt marsh habitat on Point Mugu. California brown pelicans also roost at the mouth of Mugu Lagoon with the highest abundance from June through September (U.S. Department of the Navy, 2008).

Of the four federally listed bird species on Point Mugu, three are considered marine birds for this document (western snowy plover, California least tern, and light-footed Ridgway's rail). The fourth federally listed bird, least Bell's vireo (*Vireo bellii pusillus*), is a migratory songbird that breeds in riparian habitat. Least Bell's vireos have been detected in recent years (initially detected in 2001) on Point Mugu in scattered willow patches, including the former golf course, Alumni Park, willows near the runway (which have since been removed), and near the Las Posas Gate (U.S. Department of the Navy, 2018c). Breeding least Bell's vireos were first confirmed near the Las Posas Gate in 2016, with potential breeding in 2017 at the former golf course. A minimum of three males were documented singing on territories in 2018, with at least two of them suspected of nesting (U.S. Department of the Navy, 2019c). Since suitable least Bell's vireo habitat is not present near any launch locations and no testing and training activities are anticipated to occur within occupied habitat, impacts on least Bell's vireo are not expected to occur as part of the project. Therefore, the species will not be discussed further; if necessary, additional information can be found in the most recent *Naval Base Ventura County Point Mugu Listed Species Monitoring Report* (U.S. Department of the Navy, 2019c).

Information on the three federally listed marine birds that breed on Point Mugu is provided in the most recent *Naval Base Ventura County Point Mugu Listed Species Monitoring Report 2018* (U.S. Department of the Navy, 2019c), with species life history descriptions included in the Point Mugu INRMP (U.S. Department of the Navy, 2019a) and summarized below.

3.9.4.2.2.1 Western Snowy Plover

The western snowy plover was listed as federally threatened in 1993 with critical habitat designated in 1995 (58 *Federal Register* 2236, 60 *Federal Register* 11767). Habitat on Point Mugu was exempted from designation due to appropriate protection to their habitat from implementation of the Point Mugu INRMP (U.S. Department of the Navy, 2018c). Western snowy plovers occur on Point Mugu year-round, primarily on the sandy beaches along the Pacific Ocean. The species nests primarily at Holiday Beach, Holiday Salt Panne, Ormond East Beach, Ormond East Salt Panne, Mad Road, Eastern Arm, and around the airfield, with annual fluctuation (Figure 3.9-4). Western snowy plovers also occasionally nest on Pads Alpha and Bravo, L Street, the runway overrun, and other locations in the airfield. While not all locations on Figure 3.9-4 are necessarily ideal nesting habitat for western snowy plovers, they represent the majority of locations where the species consistently nests on Point Mugu. Most recent monitoring in 2017 and 2018 documented 99 breeding plovers, the highest number of adults recorded since monitoring began in 1991 (U.S. Department of the Navy, 2019c). When comparing the previous five years of data with 2018, the dates of first nest, first chicks, and date of peak active nests have become progressively earlier. For western snowy plovers, the 2017 breeding season was the most successful in a decade and 2018 had very similar results. Both years showed high numbers of nest attempts, nests hatched, pairs calculated by concurrently active nests, and most adults counted during breeding season surveys (U.S. Department of the Navy, 2019c). In 2018, the number of concurrently active breeding pairs was the highest ever, at 43 pairs. Winter season surveys for western snowy plovers occur annually, and numbers have fluctuated widely (U.S. Department of the Navy, 2018c). Since western snowy plovers are not tied to nesting beaches during the winter, they may spend more time foraging or roosting in Mugu Lagoon or on other local beaches. Additionally, some plovers may leave the area during winter, while other plovers may emigrate in during winter.

3.9.4.2.2.2 California Least Tern

The California least tern was listed as federally endangered in June 1970, and no critical habitat has been designated (35 *Federal Register* 16047). The species nests on sandy beaches on Point Mugu during the breeding season (mid-April through mid-August) but does not winter in the area. In 2018, California least terns nested on Ormond East, Holiday Beach, Holiday Salt Panne, and Eastern Arm (Figure 3.9-4) (U.S. Department of the Navy, 2019c). The two main breeding colonies are located at Ormond East and Holiday Beach. During the 2018 breeding season there were 291 nest attempts with 41 percent that hatched. While the 2017 nesting season had some of the lowest fledgling counts since 2013, the 2018 season showed a substantial increase in fledgling counts (61 to 72) compared to previous years. The estimated number of breeding pairs was not determined in 2017 or 2018, but has ranged from a low of 288–361 in 2013 to a high of 608–844 in 2012 (U.S. Department of the Navy, 2018c).

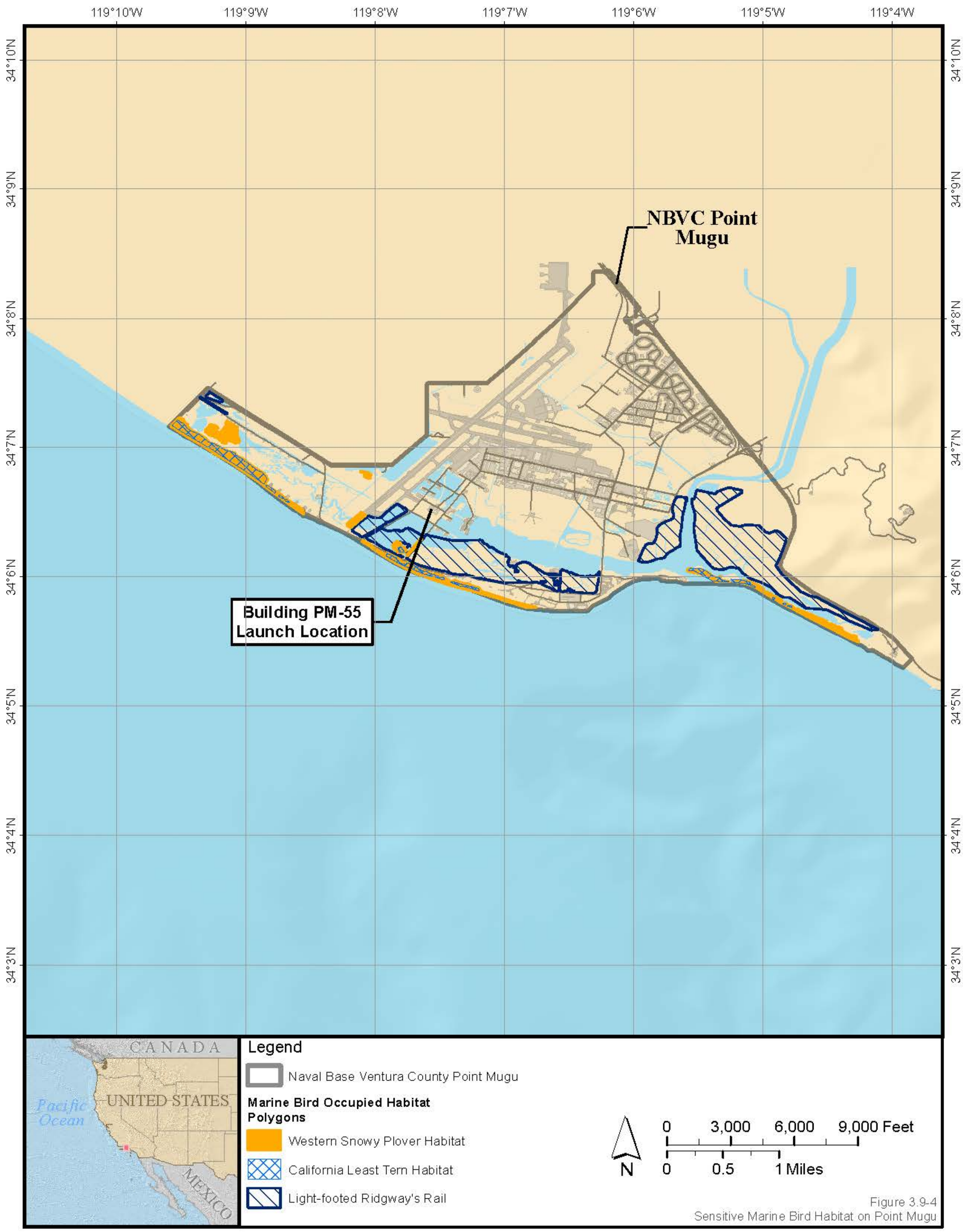

Figure 3.9-4: Sensitive Marine Bird Habitat on Point Mugu

3.9.4.2.2.3 Light-Footed Ridgway's Rail

Light-footed Ridgway's rail was listed as federally endangered in October 1970, and no critical habitat has been designated (35 *Federal Register* 16047). The species occurs year-round in coastal salt marsh habitat within and adjacent to Mugu Lagoon. The most recent surveys in 2018 documented seven breeding pairs of light-footed Ridgway's rail plus seven unpaired males within Mugu Lagoon and adjacent coastal salt marsh (U.S. Department of the Navy, 2018c). This is the lowest count in the past six years. Breeding pair numbers have fluctuated between 5 pairs in 2008 and 23 pairs since 2013. The species has declined substantially across its range with close to a fifty percent drop in pairs between 2017 and 2018 alone (U.S. Department of the Navy, 2019c). Light-footed Ridgway's rail habitat is shown in Figure 3.9-4.

3.9.4.2.2.4 Belding's Savannah Sparrow

This state endangered sparrow occurs year-round in coastal salt marsh habitats in Southern California. Recent range-wide surveys for the species conducted in 2015 found the Point Mugu subpopulation to be the single-largest, subpopulation comprising 30 percent of the state total at 1,130 territories (Zembal & Hoffman, 2010). Belding's savannah sparrow habitat on Point Mugu is similar to light-footed Ridgway's rail habitat (Figure 3.9-4) but is more extensive because it includes more upland vegetation types.

3.9.4.2.3 San Nicolas Island

Over 300 species of birds have been documented in and around SNI, including 58 that have some special status assigned by government or non-government agencies. These species include both marine and non-marine bird species that are listed in the SNI INRMP (U.S. Department of the Navy, 2015b). SNI lies approximately 65 miles southwest of Point Mugu and provides roosting habitat, and both potential and confirmed nesting habitat for several seabirds, including California brown pelican, western gull, Brandt's cormorant, pelagic cormorant (*Phalacrocorax pelagicus*), black oystercatcher (*Haematopus bachmani*), western snowy plover, and ashy storm-petrel, among other species (U.S. Department of the Navy, 2002). Locations of sensitive marine bird roosting locations and nesting areas are depicted in Figure 3.9-5 and detailed by species below.

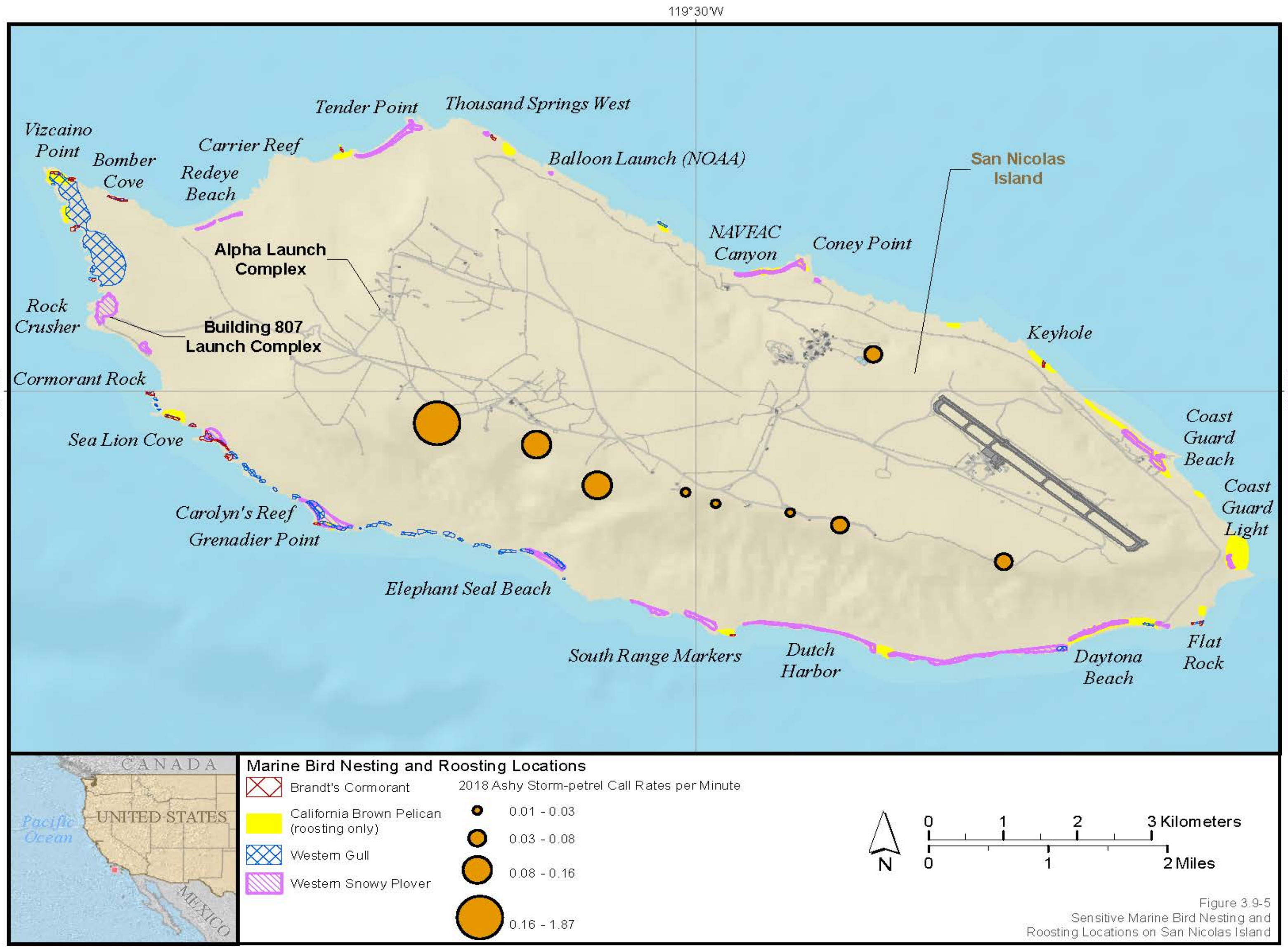

Figure 3.9-5: Sensitive Marine Bird Nesting and Roosting Locations on San Nicolas Island

3.9.4.2.3.1 California Brown Pelican

The California brown pelican was delisted as a federal and state listed endangered species due to population recovery. The species nests on several of the Channel Islands, including Santa Barbara Island, Anacapa Island, Prince Island near San Miguel Island, and San Clemente Island (U.S. Department of the Navy, 2015b). California brown pelicans roost in scattered locations around SNI (Figure 3.9-5); in 2017, two to three California brown pelicans were suspected of nesting, but not confirmed (Ruane, 2019a). There are at least 17 documented roosting locations for California brown pelicans around SNI (Figure 3.9-5) (U.S. Department of the Navy, 2008). Historical surveys at roost sites for California brown pelicans from 1972 through 2006 were analyzed and it was determined that most pelicans roosted diurnally on the north shore, in proximity to main foraging areas (Capitolo et al., 2012). They forage in the surrounding near-shore waters and numbers fluctuate depending upon the time of year. SNI is used year-round for both diurnal and nocturnal roosting with most birds concentrated at the western tip known as Vizcaino Point. Among non-El Niño years, monthly diurnal counts range from less than 100 birds during the breeding season (January through June) to 1,000 birds during the fall (Capitolo et al., 2012). Numbers have historically increased during El Niño conditions with a peak estimate of 13,500 night-roosting pelicans in 1972. The single, major night roost shifted from Cormorant Rock Area (used from 1972 through 1992) to Vizcaino Point by 2006, following reduced human disturbance in 1992–1996 from closure of roads, removal of buildings, and limiting research activities (Capitolo et al., 2012).

3.9.4.2.3.2 Cormorants and Gulls

Both Brandt’s cormorant and western gull regularly nest on SNI at Vizcaino Point and other coastal sites on SNI (Figure 3.9-5). The Brandt’s cormorant colony on SNI represents one of the largest breeding colonies in California. When comparing 12 years of nesting data, numbers of Brandt’s cormorant have fluctuated from a low of 1,856 nests in 2009 to a high of 7,358 nests in 2014 (Capitolo & Tyler, 2017). The most recent count in June 2018 detected 4,647 Brandt’s cormorant nests and 6,157 birds (Capitolo & Tyler, 2019). Surveys of Brandt’s cormorants have documented a dramatic increase in nesting numbers due to the closure of a road to Vizcaino Point in the mid-1990s. In contrast, one of the main nesting areas at Cormorant Rock Area in the mid-1990s documented a complete abandonment of the colony in 2014; however, nesting resumed at Cormorant Rock in 2017 and 2018 with low numbers of Brant’s cormorants (Capitolo & Tyler, 2019). The cause of abandonment of the Cormorant Rock Area is not fully understood, but disturbance from mammalian and avian predators is possible in addition to disturbance from humans (Capitolo & Tyler, 2017). In addition to Brandt’s cormorants, pelagic cormorants have begun nesting on SNI, with 26 nests in 2015, 39 nests in 2018, and one double-crested cormorant nest was documented in 2012 (Capitolo & Tyler, 2017, 2019; U.S. Department of the Navy, 2015b). Western gull surveys were conducted concurrently with Brandt’s cormorant surveys most recently in 2018. The estimate of nests in 2018 (1,127 nests) was lower than in previous years, and still much lower than peak estimates of more than 2,500 nests based on ground surveys during 1991 through 1996 (Capitolo & Tyler, 2017). Overall, the island-wide numbers of western gull nests have not substantially changed between 2007 and 2018. The most recent population SNI population estimate of western gulls in 2016 was 2,516 individuals. Nesting areas preferred by western gulls appear to be shifting away from Vizcaino Point to locations along the south shore, particularly the Dutch Harbor Area (Figure 3.9-5). An additional gull species, Heermann’s gull (*Larus heermanni*), was documented nesting for the first time in the region in 2017 and 2018 among a colony of western gulls (Ruane, 2019b). Furthermore, Caspian terns (*Hydroprogne caspia*) were observed at a nest site at Vizcaino Point in 2017 with the first documented Caspian tern nest in 2015 at Coast Guard Beach (Capitolo & Tyler, 2019).

3.9.4.2.3.3 Western Snowy Plover

Western snowy plovers are year-round residents on SNI (in addition to Point Mugu). Approximately 75–100 individuals occur on scattered beaches with the highest concentrations on Tender Beach, Coast Guard Beach, west of Dutch Harbor to Daytona Beach, and Sand Spit (Figure 3.9-5). Nesting success is generally low due to a variety of factors such as depredation by SNI fox (*Urocyon littoralis dickeyi*) and gulls, high winds and high tides, and crushing by marine mammals. The breeding season population has ranged from 28 to 133 plovers since 1993; the 28 individuals in 2017 is one of the lowest numbers on record. While 15 plover nests were located in 2017, with all nests on Tender Beach (the only beach where nesting surveys regularly occur each year), only one nest was confirmed to have hatched. The most recent breeding season surveys in 2018 documented 25 individual western snowy plovers (U.S. Department of the Navy, 2019b). Half of the plovers were on Tender Beach, but plovers were also detected on Red Eye Beach-East, Coast Guard Beach-West, and on Bachelor Beach. A pre-fledge plover chick was detected on Tender Beach and a fledgling was observed at both Bachelor Beach and Rock Crusher South, suggesting some successfully breeding occurred in 2018 (U.S. Department of the Navy, 2019b). The winter population of western snowy plovers has ranged from seven to 243 plovers but has continued to decline since 2012. Surveys in February 2017 documented 24 individuals, the second-lowest number on record (U.S. Department of the Navy, 2018b). The most recent winter surveys in January 2018 documented 52 individual western snowy plovers with the main concentration on Tender Beach, which frequently has the largest concentration of plovers (U.S. Department of the Navy, 2019b). While western snowy plovers historically nested around the Building 807 Launch Complex, the species has not been documented nesting there recently.

3.9.4.2.3.4 Ashy Storm-Petrel and Scripps's Murrelet

Ashy storm-petrel and Scripps's murrelet are seabirds that have been recorded around SNI, but until recently their breeding status was undetermined on the island. Detailed descriptions of their life history, including their status, habitat associations, distribution, information specific to the PMSR, and their behavior and life history, are provided in the *Marine Resources Assessment for the Southern California and Point Mugu Operating Area* (U.S. Department of the Navy, 2008) and summarized briefly herein.

Ashy storm-petrels are pelagic seabirds that come ashore to breed and raise young. Within the SCB, they are known to nest on Prince, San Miguel, Santa Cruz, Anacapa, Santa Barbara, and San Clemente Islands (Carter et al., 1992; Carter et al., 2016; Wolf, 2007). Half of the global population (estimated at 5,000 breeding pairs) is concentrated around the Channel Islands within the PMSR. Ashy-storm petrels have a protracted breeding season that extends from March through December with adult birds visiting island breeding sites in February prior to breeding (Wolf, 2007). The species breeds on rocky islands in a crevice or burrow and disperses offshore after the breeding season (Carter et al., 2016). At-sea surveys have documented hotspots where ashy storm-petrels congregate during the main period of molt, which includes one hotspot in the PMSR in the Santa Cruz Basin (Carter et al., 2016). Recent acoustical field surveys on SNI have documented ashy-storm petrels on the north, south, and east sides of the island (below the mesa), as detailed in the following paragraph.

Scripps's murrelets occur in low numbers in Southern California, with the closest birds nesting on Santa Barbara Island. Scripps's murrelets are concentrated in the SCB during the breeding season (March through June) with the highest densities in the vicinity of Santa Barbara Island, where 51 percent of the California population nests (Burkett et al., 2003). They also nest on San Miguel, Santa Cruz, and Anacapa Islands and forage within 62–93 miles of nesting colonies (Whitworth et al., 2000). Surveys for Scripps's murrelets were conducted in the 1980s on SNI with no birds detected.

In 2016, automated acoustic recorders were placed in strategic locations on SNI to detect and quantify the vocalizations of ashy storm-petrels and Scripps's murrelets. Low levels of ashy storm-petrel activity were detected at three sites, and one Scripps's murrelet call was detected (Roberts et al., 2018). To further examine potential nesting activity on SNI, acoustic sensors were placed during the 2017 breeding season in several locations around the island in possible ashy storm-petrel breeding habitat (May through September). Surveys documented ashy storm-petrel calls from six of the seven acoustic sensors placed along the south-facing cliffs of SNI (see Figure 3.9-5). Data included calls typically uttered by birds inside breeding burrows, indicating the potential presence of a colony on SNI. No calls of Scripps's murrelets were detected from one detector placed on the pier (however, analyses were not conducted at other detector locations), and therefore their breeding status on the island is still unknown. The east and south-sides of SNI, where potential nesting locations of ashy-storm petrels are located, occur in areas with limited or no ground-based testing and training activities. Acoustic monitoring continued in 2018 with additional recorders deployed. For the first time the calls of ashy storm-petrels were recorded on the north side of SNI, just below the sewage treatment ponds (see Figure 3.9-5). Of the 11 acoustic recorder locations, nine of them recorded calls of ashy-storm petrels in 2018 and are shown on Figure 3.9-5 (Gondek & McKown, 2019). Similar to 2017, the highest numbers of calls were recorded at the westernmost location on the southern side of the island (see Figure 3.9-5). Therefore, ashy storm-petrels have been detected on the north, south, and east sides of SNI.

3.9.4.2.3.5 Other Avian Species

While not classified as a marine bird, the American peregrine falcon, a species delisted from the federal Endangered Species Act, but still protected under the Migratory Bird Treaty Act, has been documented nesting on SNI in recent years. Two pairs successfully nested on SNI in 2014, followed by three pairs in 2015 (U.S. Department of the Navy, 2015b). Peregrine falcons feed on seabird species (in addition to terrestrial bird species) and hence may be affected by impacts on seabird species.

Additional sensitive avian species that have been documented to occur on SNI and the surrounding offshore waters are discussed in the SNI INRMP (U.S. Department of the Navy, 2015b).

3.9.5 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) and Section 3.0.5 (Overall Approach to Analysis) could impact marine birds, as defined in this section, in the Study Area. Table 3.9-3 presents the proposed testing and training activities and stressors that could potentially affect marine birds. The stressors analyzed for marine birds include acoustic (aircraft, vessel, and weapons noise), explosives, energy, physical disturbance and strike; ingestion from military expended materials; entanglement from decelerators/parachutes; and indirect effects (impacts on marine bird habitat and prey). While all previously listed stressors may have direct impacts on marine birds from Navy testing and training activities on the PMSR, indirect effects are also considered since there may be impacts on the habitats and prey sources that marine birds rely on.

In general, the Proposed Action includes increased testing and training activities conducted at sea within the PMSR. In addition, activities analyzed as part of the Proposed Action include missile launch activities on SNI (from the Alpha Launch Complex and Building 807 Launch Complex) and at Naval Base Ventura County Point Mugu (from Building PM-55 and other launch sites [Alpha, Bravo, Charlie, and Nike-Zeus pads]).

Table 3.9-3: Summary of Stressors Analyzed for Marine Birds from Testing and Training Activities Within the PMSR

Activity	Stressor	Potential Impact Types	ESA Determination
Air-to-Air	Acoustic – aircraft noise	Aircraft and weapons noise have a potential to cause injury to marine bird hearing. However, most activities occur at high altitudes where marine birds do not normally occur.	May adversely affect ESA-listed species
	Acoustic – weapons noise		
	Physical Disturbance/Strike	There is a potential for marine birds to be physically disturbed or struck during low-level activities. Most low-level flight activities do not occur directly above high densities of marine birds and aircraft operators typically fly at altitudes greater than 500 feet above ground level.	May adversely affect ESA-listed species
	Ingestion	Ingestion of military expended materials could result in sublethal or lethal impacts on marine birds. However, the likelihood of ingestion is low based on the dispersed nature of the materials.	May adversely affect ESA-listed species
	Entanglement	There is a potential for marine birds to become entangled and suffer injury or mortality from decelerators/parachutes from aerial targets. However, most targets would be recovered, and decelerators/parachutes are not expected to remain at the water's surface for very long before sinking.	Discountable or insignificant and not likely to adversely affect ESA-listed species
Air-to-Surface	Acoustic – aircraft noise	Aircraft, vessels, and weapons noise have a potential to cause injury to marine bird hearing. However, most activities occur at sea away from high densities of marine birds. Due to generally low densities of marine birds in areas of testing and training activities, and since many targets are mobile (where birds are likely to fly, swim, or dive away from approaching targets), marine birds have a low potential to experience injury from aircraft, vessel, and weapons noise.	May adversely affect ESA-listed species
	Acoustic – vessel noise		Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – weapons noise		May adversely affect ESA-listed species
	Explosives (in-water) – at surface	There is a potential for injury or mortality and behavioral disturbance to marine birds from explosions if birds are present nearby.	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Physical Disturbance/Strike	There is a potential for marine birds to be physically disturbed or struck by vessels, aircraft, targets, and ordnance; however, most activities occur offshore in areas of lower marine bird densities.	May adversely affect ESA-listed species
	Ingestion	Ingestion of military expended materials could result in sublethal or lethal impacts on marine birds. However, the likelihood of ingestion is low based on the dispersed nature of the materials.	May adversely affect ESA-listed species

Table 3.9-3: Summary of Stressors Analyzed for Marine Birds from Testing and Training Activities Within the PMSR (continued)

Activity	Stressor	Potential Impact Types	ESA Determination
Surface-to-Air	Acoustic – aircraft noise	Aircraft, vessels, and weapons noise have a potential to cause injury to marine bird hearing. However, most activities occur at sea away from high densities of marine birds. Due to the low avian densities where most testing and training activities would occur, marine birds are not expected to experience acoustic injury from aircraft, vessel, and weapons noise.	May adversely affect ESA-listed species
	Acoustic – vessel noise		Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – weapons noise		May adversely affect ESA-listed species
	Explosives (in-air)	The potential for injury or mortality and behavioral disturbance to marine birds from in-air explosions is low, as most explosions would likely occur at higher elevations than marine birds typically fly.	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Energy (in-air)	The potential for marine bird injury or mortality from in-air energy is low as the potential for a bird to pass through the energized area (and remain within the beam long enough for injury or mortality) is low.	May adversely affect ESA-listed species
	Physical Disturbance/Strike	There is a potential for marine birds to be physically disturbed or struck by vessels, aircraft, targets, and ordnance; however, most activities occur far from shore in areas of lower marine bird densities.	May adversely affect ESA-listed species
	Ingestion	Ingestion of military expended materials could result in sublethal or lethal impacts on marine birds. However, the likelihood of ingestion is low based on the dispersed nature of the materials.	May adversely affect ESA-listed species
	Entanglement	There is a potential for marine birds to become entangled and suffer injury or mortality from decelerators/parachutes from aerial targets. However, most targets would be recovered, and any decelerators/parachutes are not expected to remain at the water's surface for very long before sinking.	Discountable or insignificant and not likely to adversely affect ESA-listed species

Table 3.9-3: Summary of Stressors Analyzed for Marine Birds from Testing and Training Activities Within the PMSR (continued)

Activity	Stressor	Potential Impact Types	ESA Determination
Surface-to-Surface	Acoustic – aircraft noise	Aircraft, vessels, and weapons noise have a potential to cause injury to marine bird hearing. However, most activities occur at sea away from high densities of marine birds (which tend to occur closer to shore). The areas where surface-to-surface testing and training activities are likely to occur have low avian densities and therefore marine birds are not expected to experience auditory injury from aircraft, vessel, and weapons noise.	May adversely affect ESA-listed species
	Acoustic – vessel noise		Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – weapons noise		May adversely affect ESA-listed species
	Explosives (in-water) – at surface	There is a potential for injury or mortality and behavioral disturbance to marine birds from in-water explosions depending upon the location of the explosion in relation to marine bird densities.	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Energy – high-energy lasers	There is a potential for marine birds to suffer injury or mortality; however, potential for a marine bird to pass through the beam of a laser (and remain within the beam long enough for injury or mortality) during firing is low.	May adversely affect ESA-listed species
	Physical Disturbance/Strike	There is a potential for marine birds to be physically disturbed or struck by a variety of vessels, targets, and ordnance; however, most activities occur offshore in areas of lower marine bird densities.	May adversely affect ESA-listed species
	Ingestion	Ingestion of military expended materials could result in sublethal or lethal impacts on marine birds. However, the likelihood of ingestion is low based on the dispersed nature of the materials.	May adversely affect ESA-listed species
Strategic Operations	Acoustic – weapons noise	Weapons noise has a potential to cause injury to marine bird hearing. However, marine birds occur in low densities where most testing and training activities occurs and therefore have a low potential to occur in the immediate area during weapons firing. Marine birds are not expected to experience injury from weapons noise.	May adversely affect ESA-listed species
	Physical Disturbance/Strike	There is a potential for marine birds to be physically disturbed or struck during strategic operations; however, most activities occur offshore in areas of lower marine bird densities.	May adversely affect ESA-listed species

Table 3.9-3: Summary of Stressors Analyzed for Marine Birds from Testing and Training Activities Within the PMSR (continued)

Activity	Stressor	Potential Impact Types	ESA Determination
Electronic Warfare	Acoustic – aircraft noise	Aircraft and vessel noise have a potential to cause disturbance to marine birds. Aircraft have a potential to cause permanent physical damage to marine bird hearing if birds are in close range (25–43 feet) while aircraft are in use. However, most activities occur at sea away from high densities of marine birds. Additionally, birds are likely to avoid the area prior to noise levels reaching injury thresholds due to behavioral avoidance and are not expected to experience injury.	May adversely affect ESA-listed species
	Acoustic – vessel noise		Discountable or insignificant and not likely to adversely affect ESA-listed species
	Energy (in-air)	The potential for marine bird injury or mortality from in-air energy is low as the potential for a bird to pass through the energized area (and remain within the beam long enough for injury or mortality) is low.	May adversely affect ESA-listed species
	Physical Disturbance/Strike	There is a potential for marine birds to be physically disturbed or struck during electronic warfare testing and training activities. To reduce the potential for avian injury and mortality, the line of sight from the shooter to target position is cleared of birds and other wildlife (and an observer is present to halt/cease firing if wildlife is observed re-entering the line of sight) prior to any firing.	May adversely affect ESA-listed species
	Ingestion	Ingestion of military expended materials could result in sublethal or lethal impacts on marine birds. However, the likelihood of ingestion is low based on the dispersed nature of the materials.	May adversely affect ESA-listed species

Table 3.9-3: Summary of Stressors Analyzed for Marine Birds from Testing and Training Activities Within the PMSR (continued)

Activity	Stressor	Potential Impact Types	ESA Determination
Directed Energy Weapons	Acoustic – aircraft noise	Aircraft and vessel noise have a potential to cause injury to marine bird hearing; however, most activities occur at sea away from high densities of marine birds. While noise levels generated by aircraft are within the range of noise levels that can cause permanent physical damage to the avian ear, birds are likely to avoid the area prior to noise levels reaching injury thresholds due to behavioral avoidance and are not expected to experience injury.	May adversely affect ESA-listed species
	Acoustic – vessel noise		Discountable or insignificant and not likely to adversely affect ESA-listed species
	Energy – high-energy lasers and microwave	There is a potential for marine birds to suffer injury or mortality during firing of directed energy weapons. However, the line of sight is cleared of wildlife prior to firing, and the potential for a marine bird to pass through the beam of a laser (and remain within the beam long enough for injury or mortality) during firing is low.	May adversely affect ESA-listed species
	Physical Disturbance/Strike	There is a potential for physical disturbance/strike during directed energy weapons testing and training activities. However, most marine birds are expected to move out of harm's way (from approaching vessels, aircraft, and while targets are being deployed), and the line of sight for the weapons system is determined clear of birds prior to directed energy firing.	May adversely affect ESA-listed species
	Ingestion	Ingestion of military expended materials could result in sublethal or lethal impacts on marine birds. However, the likelihood of ingestion is low based on the dispersed nature of the materials.	May adversely affect ESA-listed species
	Entanglement	There is a potential for marine birds to become entangled and suffer injury or mortality from decelerators/parachutes from aerial targets. However, most targets would be recovered, and any decelerators/parachutes are not expected to remain at the water's surface for very long before sinking.	Discountable or insignificant and not likely to adversely affect ESA-listed species

3.9.5.1 No Action Alternative

Under the No Action Alternative, proposed testing and training activities would not occur within the PMSR. Other military activities not associated with this Proposed Action would continue to occur. Stressors, as listed above, would not be introduced into the marine environment. Therefore, existing environmental conditions would either remain unchanged or would improve slightly after cessation of ongoing testing and training activities.

Discontinuing the testing and training activities would result in fewer stressors within the marine environment where testing and training activities have historically been conducted. Therefore, discontinuing testing and training activities under the No Action Alternative would lessen the potential for impacts on marine birds, but would not measurably improve the overall distribution or abundance of marine birds.

3.9.5.2 Alternative 1 (Preferred Alternative)

A comparison of operational tempo proposed for each alternative, and proposed types and level of activities, are provided in Section 2.2.3 (Alternatives Carried Forward).

There would be an increase in the number of annual flight operations from a variety of aircraft and an increase in vessel usage. In most cases, an increase would occur in the number of annual events and total ordnance expended. In particular, the number of missiles launched would increase. Most missiles are launched from Navy vessels at sea in areas of lower avian density compared to areas on land or close to shore. The amount of gun ammunition and bombs expended, aerial target launches, surface target use, hypersonic vehicle test events, and rocket launches would also increase. In contrast, the number of chaff and flare events would decrease. The numbers of directed energy (DE) days would not increase compared to current baseline levels. DE events would be conducted through use of the DE systems integration laboratory (DESIL) on Point Mugu, through the DE facility on SNI, or from vessels and aircraft. All DE activities occurring on the PMSR would be the same types of activities and tempo previously analyzed under the *Environmental Assessment Point Mugu Sea Range Countermeasures Testing and Training* (U.S. Department of the Navy, 2014) and subsequent Biological Opinion (BO) (U.S. Fish and Wildlife Service, 2014), the *Laser Testing & Training Naval Air Warfare Center Weapons Division Sea Range Point Mugu, CA Environmental Assessment/Overseas Environmental Assessment* (U.S. Department of the Navy, 2010b), or the *Environmental Assessment Directed Energy Test Facilities at San Nicolas Island* (U.S. Department of the Navy, 2015a) and subsequent BO (U.S. Fish & Wildlife Service, 2012, 2014).

Testing and training activities under Alternative 1 would generally involve an increase in the stressors detailed in the following sections but are not anticipated to result in measurable impacts on any marine bird populations. Some testing and training activities that occur on the PMSR were covered in previous environmental assessments (EAs) or environmental impact statements (EISs) (see Section 1.7.4, Related Environmental Documents), and there are programmatic BOs in place for impacts on federally listed species on Point Mugu (U.S. Fish and Wildlife Service, 2016a) and SNI (U.S. Fish and Wildlife Service, 2001), in addition to the BOs for the *Environmental Assessment Point Mugu Sea Range Countermeasures Testing and Training* and *Environmental Assessment Directed Energy Test Facilities at San Nicolas Island* listed above (U.S. Fish & Wildlife Service, 2012, 2014). Measures in these two BOs would continue to apply to activities conducted on the installations. Additionally, the Point Mugu and SNI INRMPs include measures to further reduce impacts on marine birds. Based on the analysis below, the increase in testing and training activities and new platforms are anticipated to contribute cumulatively to an overall increase in existing stressors. However, measures currently in place are anticipated to reduce any impacts to less than significant for populations of marine birds within the PMSR.

In terms of testing and training locations within the PMSR, testing and training activities offshore are likely to impact low numbers of seabirds, given that densities of seabird averages 29.3 seabirds per square mile for at-sea transects (Mason et al., 2007). Activities nearshore and close to known nesting and roosting locations are more likely to result in higher impacts. Stressors from an increase in testing and training activities are likely to cause disturbance to marine birds primarily though acoustic disturbance and to a lesser extent physical disturbance, and potentially through injury or mortality, as detailed in the following sections.

3.9.5.2.1 Acoustic

Acoustic stressors to marine bird populations may occur during testing and training activities on the PMSR, which may lead to injury to birds as well as hearing loss, physiological stress, masking of avian calls, behavioral disturbance, and potentially long-term consequences. The analysis of acoustic stressors begins with a brief background of the potential impacts followed by the source of impacts such as noise from vessels, aircraft, and weapons. The specific details on the representative aircraft, vessel, weapons, explosive, and other noise-generating activities on the PMSR are described in Section 3.0.5 (Overall Approach to Analysis) and in subsequent sections.

3.9.5.2.1.1 Background

This section includes a brief overview of published, peer-reviewed scientific reports pertinent to impacts on marine birds from levels of noise produced by Navy activities within the PMSR. Possible impacts on avian hearing include hearing loss resulting in a temporary or permanent hearing threshold shift, auditory masking, increased predation risk, degrading communication between conspecifics, and potentially trauma to hearing organs if the sound is loud enough (Larkin et al., 1996). Birds may respond to noise in a variety of ways, depending upon the species of bird, time of year, age, levels of background/ambient noise, and other factors. Bird species that may be exposed to noise within the PMSR are generally marine birds that breed, nest, roost, forage, migrate, and winter within the coastal and off-shore waters of the SCB. These species are detailed previously and are discussed collectively since most impacts would not be species specific (unless the impact occurred over a specific species' nesting area). Birds may be exposed to noise from a variety of sources, including vessel, aircraft, and weapons, which are generally restricted in duration and extent to the immediate vicinity of the noise source. Overall, exposure to brief above-ambient levels of noise may result in several avian responses as detailed below.

A wide range of avian studies have been conducted to assess the impacts of various noise sources on different bird species. Loud noises from short-term events (e.g., instantaneous impulsive-type sounds) are known to startle nearby birds and may cause them to leave the area and can also lead to nest abandonment. Bird use of otherwise suitable habitat may be reduced due to sensitivity to noise. The degree of disturbance varies among individuals, species, and time of year. Over time, noise can change the composition of avian communities in favor of more noise-tolerant species, thereby reducing nesting species richness (number of species), although not necessarily density. Predatory birds may avoid noisy areas because it could mask their calls or make it more difficult to locate prey, thereby causing nests in noisier areas to be safer from predators (Francis et al., 2009). Noise may impact birds through changes in behavior (such as altered nesting and foraging locations and patterns), ability to communicate with conspecifics, ability to detect and recognize predators, decreased hearing sensitivity (both temporarily and permanently), increased stress that may lead to altered reproductive success, and potential interference with breeding individuals and populations (Dooling & Popper, 2007). Some bird species are sensitive, at least during the breeding season, to noise levels, and the extent of impacts from disturbance can vary from several feet to more than 2 miles (Kaseloo & Tyson, 2004).

Injury

Direct trauma to birds from noise is most likely to occur to avian auditory mechanisms, especially since the avian ear is vulnerable to airborne pressure waves (Larkin et al., 1996). There is a potential for marine birds in the immediate vicinity of loud impulsive-type sounds to experience damage to their auditory capabilities. Auditory structures are susceptible to direct mechanical injury including tympanic membrane rupture, disarticulation of the middle ear ossicles, and trauma to the inner ear structures including hair cells. However, birds are capable of regenerating auditory hair cells, and several studies have been conducted to expose birds to very high sound exposure levels (SELs) to examine hair cell damage (discussed in more detail below under hearing loss).

There are limited available data on non-auditory injury to birds from intense non-explosive sound sources. A panel of reputable scientists and Navy personnel examined the effects of pile-driving activities on marbled murrelets in the coastal waters of Washington. Marbled murrelets only occur rarely within the PMSR; however, they are a surrogate for other murrelet species (Scripps's) known to breed within the PMSR. The study recommended the auditory injury threshold (point at which injury to the ear hair cells would occur) for underwater noise levels at 202 decibels (dB) referenced to 1 micropascal squared per second (re 1 μPa^2-sec) cumulative SEL and the non-auditory injury threshold (from barotrauma) at 208 dB re 1 μPa^2-sec SEL for marbled murrelets (Science Applications International Corporation, 2011).

Additionally, the risk of barotrauma from high amplitude impulses in the air is discussed below under explosive stressors. Since air is compressible and allows energy to dissipate rapidly, in-air non-explosive sound sources are considered to have little risk of non-auditory injury to marine birds.

Hearing Loss

Hearing loss may result after cessation of intense noise exposure and may be temporary or permanent, depending upon factors such as exposure frequency, sound pressure level, temporal pattern, and duration. Impacts on birds from hearing loss may result in inability to attract mates, defend territories, and detect predators. Hearing loss can occur due to tissue damage to the auditory hair cells and their support cells. Hair cell damage has been observed in birds exposed to long sound durations that results in an initial threshold shift greater than 40 dB (Niemiec et al., 1994; Ryals et al., 1999). However, birds have the ability to regenerate hair cells in the ear (Rubel et al., 2013; Ryals et al., 1999). Intense exposures are not always fully recoverable even beyond a year post-exposure, and damage and subsequent recovery vary by species (Ryals et al., 1999). Birds may be able to protect their ears 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 during diving underwater (Dooling & Therrien, 2012).

Avian hearing loss may be quantified in terms of threshold shift, which is the amount in dB that hearing thresholds at one or more specific frequencies are elevated at some time after the noise exposure, when compared to pre-exposure noise levels. The amount of threshold shift usually decreases with increasing recovery time, or time since the noise exposure. If the threshold shift eventually returns to zero, which means the hearing threshold returns to pre-exposure levels, the threshold shift is considered a temporary threshold shift. However, if the threshold shift does not completely recover and remains elevated compared to pre-exposure levels, the shift is considered a permanent threshold shift. The amount of time post-exposure that it takes a bird to recover is important to consider since the longer it takes a bird to recover, the greater the impact on the species.

Birds have a wide range of hearing capabilities, which varies by species, but in general the optimal range is between 1 and 5 kilohertz (kHz), with the most sensitive hearing at frequencies of 2 to 4 kHz. In comparison, the optimal range for humans is from 20 hertz (Hz) to 20 kHz, a much broader range than most birds, and is most sensitive at 0.5 to 4.0 kHz (Dooling & Popper, 2007). Permanent physical damage to a bird's ability to hear can occur over time, or from short blasts of loud sounds that exceed 140 A-weighted dB (dBA) for single blasts or 125 dBA for multiple blasts, or from continuous (greater than 72 hours) noise at levels above 110 dBA (Dooling & Popper, 2007). A temporary threshold shift in hearing can last from seconds to days depending on the intensity and duration of the noise, with the shift occurring from approximately 93 dBA to 110 dBA for continuous noise. Therefore, understanding the level of noise produced by various testing and training activities is necessary to determine buffer thresholds to avoid physical damage to birds' hearing.

Only one study has been conducted thus far to document hearing loss in birds due to impulsive noise exposure. The only degree of hearing loss in a bird from an impulsive noise exposure (gunfire) was measured during an experiment on budgerigars (*Melopsittacus undulatus*) (Hashino et al., 1988). In this case, birds were exposed to two gunshots from a pistol per ear at 169 dB re 20 µPa peak sound pressure level. The gunshot frequency power spectrum had its peak at 2.8 kHz, but the threshold shift was most extensive below 1 kHz. The threshold shift recovered at frequencies above 1 kHz, while a 24 dB permanent threshold shift was sustained at frequencies below 1 kHz (Hashino et al., 1988). Since impulsive sound exposures have high peak pressures and rapid pressure rise times, impulsive exposures are more likely to result in hearing loss than non-impulsive exposures.

Physiological Stress

Anthropogenic activities have a potential to provide stressors to birds beyond those that naturally occur. Noise may also cause chronic stress, which can alter hormone levels and lead to weight loss, decreased disease resistance, and reduced reproductive success (Ortega, 2012). Studies have shown that some birds can habituate to noise following frequent exposure and cease to respond behaviorally to the noise source (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). Behavioral responses can be accompanied by a physiological response to noise such as an increased heart rate or a startle response. A startle response is a rapid reflex that is characterized by an increased heart rate and often a behavioral response, such as flying away. Habituation is a way wildlife compensate for stimuli that are perceived as harmless and prevent the expenditure of energy unnecessarily. Some species may exhibit an avoidance reaction (such as moving away from the noise source) to repeated exposure or habituate to the noise, if repeatedly exposed. Species that do not habituate and that continue to experience physiological stress may have reduced fitness, depending upon the cumulative responses to stimuli (which depend on how frequently they occur).

Masking

Masking of avian vocalization occurs when noise, either from the background or a temporary source, interferes with a bird's ability to detect or recognize another vocalization. Generally the ability of a bird's call to be heard can be masked by noise at a variety of levels above the ambient level of noise (Dooling & Popper, 2007). A bird's call may be masked by noise produced by testing and training activities, such as aircraft overflights, during launches, ordnance detonations, or while vessels are passing by, among others. Birds have been shown to shift their song frequencies in the presence of a tone at a similar frequency (Goodwin & Podos, 2013). In noisy environments, bird populations have shown altered song duration and higher frequencies to compensate for the effects of masking (Slabbekoorn & den Boer-Visser, 2006). Increased noise above ambient levels can reduce the time spent foraging near noise sources, as well as make it more difficult for birds to detect predators or find food sources (e.g., some raptor species that rely on hearing to detect prey). Birds may experience increased difficulty advertising and attracting a mate due to increased noise, and some have been shown to alter their vocalizations to compensate for masking. These include changes in song or call frequency, amplitude, song components, and even temporal shifts to avoid noisy periods (Ortega, 2012).

Behavioral Reactions

An increase in vessel and aircraft activity within the PMSR may cause behavioral disturbance to birds in the vicinity and surrounding areas during testing and training activities. Impacts may include direct impact on offspring survival due to brood scattering; change in foraging behavior and an increase in energetically costly behavior; and a temporary or permanent loss of suitable habitat (Kaiser & Fritzell, 1984; Keller, 1991; Korschgen et al., 1985; Mikola et al., 1994). Disturbances of nesting birds may cause abandonment of the nest, disruption of the pair bond, reduction in clutch size, increased egg mortality, abandonment of the nesting area, and increased predation of the nest. Disturbances during brood-rearing may cause exhaustion of young and an increase in losses from predation (Korschgen & Dahlgren, 1992). Disturbances during critical times of the nesting cycle may eventually cause birds to nest elsewhere, or not to nest at all (Korschgen & Dahlgren, 1992). Human disturbance may cause waterfowl to modify food habits, feed only at night, lose weight, or desert the feeding area. Waterfowl generally respond to both loud noises and rapid movements, such as boats powered by outboard motors or other threatening visible features (Korschgen & Dahlgren, 1992).

Waterbird responses to vessel traffic may be dependent on species, biological cycle (e.g., breeding, migrating, stopover, and wintering), or vessel attributes (e.g., vessel type, size, and speed). Depending on the species, birds may dive, fly, or swim out of the path of approaching vessels, and would be expected to return to their foraging areas after the vessel disturbance has passed. However, behavioral disturbance from vessels could cause additional energy expenditure, less time foraging, and potentially temporary avoidance of foraging areas during summer installation of the natural gas pipeline. Vessel traffic could cause birds to swim away, fly, dive, or otherwise avoid approaching vessels. Avoidance behaviors have been documented for multiple avian species, resulting in less time spent foraging and avoidance of areas, increased energetic expenditure, potential for predation, and other indirect impacts. However, habituation of some bird species to disturbance may occur (Stolen, 2003).

Studies in Europe have documented the spatial scale of displacement caused by vessels flushing waterbirds (Marine Managment Organisation, 2018). A compilation of studies documented displacement effects up to 1.2 miles for common scoters (*Melanitta nigra*; Marine Management Organization, 2018). One of the studies reviewed (Schwemmer et al., 2011) documented median flushing distances from vessels of 1,325 to 2,638 feet for species of scoter. Additionally, repeated short-term responses to individual disturbance events may result in longer-term avoidance of areas, and displacement. Seaducks were considered to have high displacement indices in response to transport and traffic activities, and moderate habituation to such activities (Marine Management Organization, 2018).

Avian reactions to aircraft likely include behavioral disturbance from both the noise and the visual stimulus of overflights. While species-specific reactions vary, observations of tern colonies reactions to balloon overflights suggest that visual stimulus is likely an important component of disturbance (Brown, 1990). Observations of nesting black skimmers (*Rynchops niger*) and nesting least, gull-billed (*Gelochelidon nilotica*), and common terns showed they did not modify nesting behavior in response to military fixed-wing aircraft that were engaged in low-altitude tactical flights and rotary-wing overflights (Hillman et al., 2015). In terms of noise levels, behavioral responses by crested terns (*Sterna bergii*) were observed at sound level exposures greater than 85 dBA re 20 µPa. Herring gulls (*Larus argentatus*) significantly increased their aggressive interactions within the colony and flights over the colony during aircraft overflights with sound pressure levels of 101 to 116 dBA re 20 µPa (Burger, 1981).

In contrast, raptors responded minimally to jet overflights at 110 dBA re 20 µPa, and wading birds responded minimally to propeller plane overflights at 92 dBA re 20 µPa (Ellis, 1981). Ellis (1981) determined that jet flights greater than 1,640 feet from raptors elicited no response. It was observed that raptors would typically exhibit a minor short-term startle response to sonic booms, but no long-term effect to productivity was detected (Ellis, 1981).

However, some species may be less likely to habituate to aircraft noise. In 1969, near-total failure of sooty terns (*Onychoprion fuscatus*) nesting in the Dry Tortugas in the Key West Range Complex were exposed to regular sonic booms (Austin et al., 1970). The sooty terns would react to occasional sonic booms by rising immediately in a panic flight (startle response), circle over the island, and then settle back down on their eggs. It was hypothesized that the sonic booms occurred often enough to disturb sooty tern incubation and cause nest desertion. This was never conclusively established given multiple other confounding variables; however, after curbing military sonic booms within range of the Dry Tortugas and habitat modification, similar nesting failures have not been reported since.

Based on monitoring of the Vizcaino seabird colony and Cormorant Rock on SNI before and after missile launches, cormorants tend to stay on the ground whereas gulls take to flight as a group and then settle back down (U.S. Department of the Navy, 2015b). Over the past several decades, shifts have occurred in the distribution of nesting Brandt's cormorants (and night-roosting California brown pelicans) generally away from Cormorant Rock to Vizcaino Point. While the reason for the shift may be related to predation by island foxes (*Urocyon littoralis dickeyi*) or disturbance from avian predators, disturbance by missile launches cannot be ruled out given that disturbances to marine mammals have been shown to occur (Capitolo & Tyler, 2017).

Long-Term Consequences

The long-term consequences of increased noise can include temporary or permanent loss of habitat through avoidance of breeding and foraging areas. However, no long-term consequences are anticipated from increased noise on the PMSR because noise from increased testing and training activities is not anticipated to result in a permanent increase in the ambient noise levels. Additionally, noise levels resulting from aircraft takeoffs and lands, and target and missile launches appear to temporarily disturb birds on Point Mugu and SNI. However, the disturbance has not led to any confirmed abandonment of nesting areas as birds have become acclimated to periodic increases in noise levels from routine noise events (U.S. Department of the Navy, 2002).

3.9.5.2.1.2 Vessel Noise

Testing and training activities on the PMSR would involve a wide variety of vessels that would produce different noise levels depending upon the type of craft, speed, and other variables. Generally, exposure to vessel noise would be highest around locations where vessels are concentrated and would be dispersed across the PMSR. Tables that detail the representative annual current and proposed vessel usage on the PMSR for all alternatives are located under Section 3.0.5.8.1 (Vessels). Under Alternative 1 there would be a slight increase above current baseline levels for the total number of vessel operations and activities within the PMSR. The largest increase in vessel hours comes from increased use of littoral combat ships and future frigates. Typical vessel noise from Navy ships is detailed in Section 3.0.5.5.1 (Vessel Noise). Impacts from increased vessel noise are not anticipated to result in any population-level impacts, as birds are anticipated to return to normal foraging behaviors after Navy vessels transit through an area. Additionally, seabird density is low across most of the PMSR in open-ocean areas away from near-shore environments.

Birds respond to vessel noise and vessel presence in a variety of ways. Some avian species are attracted to vessels (gulls, storm-petrels, fulmars, etc. due to the stirring up of ocean waters that bring prey items to the surface) while others avoid vessels (ducks, terns, and a variety of diving birds) (Borberg et al., 2005; Hamilton, 1958; Hyrenbach, 2001, 2006; Schwemmer et al., 2011). Vessel noise may elicit short-term behavioral responses such as swimming, flying, or diving out of the way; however, this is not likely to disrupt major behavior patterns such as migrating, breeding, feeding, or sheltering.

While sudden loud noises can startle and flush birds, Navy vessels are not expected to result in major acoustic disturbance to birds on the PMSR, especially given the major commercial shipping lanes in the area. While birds may experience masking while Navy ships are transiting the area, the noise would be temporary, and resident birds likely have habituated to some degree to noise from commercial and recreational vessel traffic. In response to vessel noise, short-term behavioral responses such as startle responses, head turning, and avoidance may occur. Repeated exposures would be limited due to the transient nature of vessels, wide range that vessels would be operating on the PMSR, and behavioral avoidance and transitory nature of birds. Because impacts on individual birds are likely to be minor and limited extent and duration, no long-term consequences or population-level impacts are anticipated from an increase in vessel noise.

Under Alternative 1, pursuant to the ESA, Navy use of vessels is anticipated to have no effect on ESA-listed California least tern foraging in nearshore waters around Point Mugu.

3.9.5.2.1.3 Aircraft Noise

Birds would be exposed to increased aircraft noise during testing and training activities from a variety of aircraft on the PMSR. Table 3.0-5 in Section 3.0.5.5.4.3 (Sonic Booms) details the annual current and proposed flight operations in the PMSR airspace. Alternative 1 would represent an increase primarily from increased use of E-2, KC-130T, and Triton (MQ-4C), and other aircraft. A detailed noise analysis from aircraft noise generated by each type of aircraft potentially operating on the PMSR is not included herein due to the array of aircraft types, flight heights, and other factors that may influence the actual noise levels on marine birds. However, a general discussion of documented impacts on birds is provided for context of potential impacts on marine bird populations based on observations at other locations. Representative aircraft noise levels are provided in Table 3.0-3 in Section 3.0.5.5.4 (Aircraft Noise).

Birds may be exposed to airborne noise from subsonic and supersonic fixed-wing aircraft overflights and helicopter operations while foraging, breeding/nesting, and migrating over open water, near-shore, and along coastal environments. Exposure to most aircraft noise would be brief while the aircraft pass overhead and infrequent, transitory, and widely dispersed across the PMSR. The avian response to aircraft noise varies widely, but may range from no startle response, stationary alter behavior (looking up and around at the noise source), exhibiting a startle response, flying away, and increased vocalizations (Bowles, 1995; Johnson & Reynolds, 2002; Larkin et al., 1996; National Park Service, 1994).

Depending upon the time of year, the response may include interfering with breeding and raising young (particularly if an entire colony flushes or is disturbed), altering habitat use, and an additional stress on avian energy budgets (which are particularly critical during molting and migration). Some birds, however, have shown habituation to aircraft noise and do not respond behaviorally (Larkin et al., 1996; National Park Service, 1994; Plumpton, 2006). At Point Mugu, required avian monitoring of air shows and regular aircraft operation has shown that birds are acclimated to regular aircraft activity but are disturbed and flushed by irregularly occurring loud aircraft that are performing during air shows or especially loud takeoffs when adjacent to avian species habitat (U.S. Department of the Navy, 2019a). Broadly, habituation is the ability for birds to learn which stimuli do not pose a danger after repeated exposure and the birds do not display any substantial signs of behavior change (Hoang, 2013). In contrast to habituation, there is a potential for birds to become more sensitive to disturbance. This reaction, known as facilitation, may occur where birds become more sensitive to low levels of disturbance (or irregular disturbance) after being exposed to other disturbances (Hoang, 2013).

Helicopters have been viewed as the most disturbing types of aircraft potentially due to their louder engines (compared to fixed-wing aircraft) and rotor vibration. In terms of flight distances from helicopters, there is no single distance that birds will flush when helicopters are too close. The type of aircraft, altitude, lateral distance, speed, number of birds in a colony, stage of nesting, and level of habituation or facilitation may all influence the distance at which birds flush from the water, ground, or off their nests. A compilation of reports assessing the distances at which helicopters caused flushing of common murres in various colonies in Central California revealed many of the disturbances occurred due to helicopters that were 400 to 500 feet away, but still occurred as far away as 1,000 feet (Hoang, 2013). Additional confounding variables to whether birds will flush from an aerial disturbance include flock size (large flocks may be more likely to flush), breeding status (non-breeding birds may be more likely to flush due to lack of invested resources), location within the colony (birds roosting along the periphery may be more likely to flush), and others (Hoang, 2013).

Specific to nesting Brandt's cormorants, Saenz et al. (2006) observed on Alcatraz Island that cormorants flushed from nests when boats and aircraft passed by closely (328 feet and 1,640 feet, respectively). These disturbances only occasionally caused abandonment of affected nests. However, especially early in the nesting season (prior to egg-laying), repeated human-caused disturbance caused abandonment of one subcolony in 1998. In 1999, prior to egg-laying, the landing of jet-ski watercraft in one area caused abandonment of all nests within the view of the landing location. Cormorants returned and laid eggs, but approximately 1 month later than the mean egg-laying date for other non-affected portions of the colony (Saenz et al., 2006). Therefore, the period prior to egg-laying is an especially sensitive time period for some species of marine birds and disturbance can cause local population declines depending on the timing of the disturbance in relation to the nesting cycle.

Some aircraft flying at higher altitudes may still cause disturbance, depending upon flight speed, as sonic booms may cause disturbance. Sonic booms may be produced during missile testing and training activities which involve chase aircraft operating at high altitudes. Sonic booms may cause seabirds to startle, but the exposure would be brief and avian reactions are anticipated to be short term. Two studies cited in Manci et al. (1988) attempted to determine potential impacts of sonic booms on seabirds. One study assessed the effects of sonic booms on seabirds on the Channel Islands and found booms were less disturbing compared to the presence of humans and helicopters. However, louder booms in the range of 80–89 dBA SEL were more disturbing than booms at 72–79 dBA SEL. Noise disturbance tests using shotgun blasts and explosives were conducted and it was determined that birds flew away from their nests without knocking their eggs out and returned within 30 seconds. Another study documented that most birds flushed within 330 feet of a carbide pest control cannon (used to simulate sonic booms), but returned within 2–10 minutes (Manci et al., 1988). Of particular concern on the Channel Islands (especially San Miguel Island) is the potential collapse of Cassin's auklet burrows due to sonic booms. A trial activity and follow-up indicated that adult Cassin's auklets rapidly re-excavate collapsed burrows, and no impacts have been reported (U.S. Department of the Navy, 2019a).

Even the temporary flushing from a colony may be detrimental depending upon the time of year, time of day, and type of species. A study conducted around the Kennedy International Airport of a herring gull (*Larus argentatus*) colony close to the airport found that differing noise levels impacted the colony differently (Burger, 1981). Noise levels were 77 dBA ambient, 91.8 dBA for subsonic jets, and 108.2 dBA for supersonic jets (Concords). The gull colony did not react significantly to noise from subsonic planes but were 12 times more likely to fly up when supersonic jets were landing. The bird flights led to fights between birds returning to their nests, which caused eggs to break. It was postulated that the herring gulls had habituated to the regular subsonic aircraft noise (aircraft landing every few minutes), but the irregular and occasional exposure to supersonic aircraft noise was infrequent enough to preclude habituation (Burger, 1981). As mentioned previously under Behavioral Reactions, above, sonic booms may have been associated with near-total failure of sooty terns nesting in the Dry Tortugas in the Key West Range Complex (Austin et al., 1970). Specific to SNI, if low aircraft overflights, launches, or other activities cause nesting Brant's cormorants to flush off their nests, there is the potential for western gulls to come in and depredate the eggs.

Various levels of airborne noise from military aircraft are provided in Table 3.0-3 in Section 3.0.5.5.4 (Aircraft Noise). Airborne noise levels for F/A-18 and F-35 aircraft can range from 143 to 148 dBA measured 43 feet from the source (U.S. Naval Research Advisory Committee, 2009). Generally, the sounds of aircraft range from 65 to 70 dBA during flyovers, and on approach and take-off, jets can generate noise levels up to 140 dBA at 25 feet (U.S. Fish and Wildlife Service, 2016b). The threshold for permanent physical damage to a bird's ability to hear can occur over time, or from short blasts of loud sounds that exceed 140 dBA for single blasts or 125 dBA for multiple blasts, or from continuous (greater than 72 hours) noise at levels above 110 dBA (Dooling & Popper, 2007). While noise levels generated by F/A-18 and F-35 aircraft are within the range of noise levels that can cause permanent physical damage to the avian ear, birds are likely to avoid the area prior to noise levels reaching injury thresholds due to behavioral avoidance.

Noise generated by unmanned aerial vehicles (UAVs) can range from 74 to 118 dBA at 1,000 feet for large UAVs to 40–70 dBA at 500–1,000 feet for smaller UAVs (U.S. Fish and Wildlife Service, 2016b). Helicopters also produce noise and an H-60 hovering at 82 feet above ground level (AGL) can produce noise levels up to 113 dBA (Bousman & Kufeld, 2005). Generally, helicopter sounds average 87 dBA at 500 feet and 78 dBA at 1,000 feet (U.S. Fish and Wildlife Service, 2016b). These noise levels are not within the permanent physical damage threshold for birds and are unlikely to cause a temporal threshold shift due to the transient nature of UAV and helicopter flights.

In summary, several EAs, BOs, and INRMPs provide various measures to reduce impacts on birds from aircraft noise. These measures have been compiled and are detailed in Chapter 5 (Standard Operating Procedures and Mitigation) and briefly highlighted here. As a general policy, aircraft do not intentionally generate sonic booms below 30,000 feet of altitude unless over water and more than 30 miles from inhabited land areas or islands. The Navy may authorize deviations from this policy for tactical mission; phases of formal training syllabus flights; or research, test, and operational suitability test flights. To reduce impacts on birds from operations of aircraft, all rotorcraft and fixed-wing aircraft operating at Point Mugu are directed to fly at or above 500 feet AGL over listed species habitat (U.S. Fish and Wildlife Service, 2016b). Additionally, the Navy does not land or hover helicopters within 1,000 feet of an active federally listed species nest on the beach or marsh (U.S. Fish and Wildlife Service, 2016b). The cumulative increase in aircraft noise from an increase in testing and training activities on the PMSR is not anticipated to result in significant impacts on marine birds because many of the aircraft operate at altitudes higher than most birds fly and would be widely dispersed across the PMSR, and birds around the airstrips at Point Mugu and SNI are likely habituated to aircraft noise.

Under Alternative 1, pursuant to the ESA, Navy use of aircraft may affect ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail. The potential increase in disturbance to these listed bird species from an increase in aircraft noise is already covered under Point Mugu's and SNI's programmatic BOs (U.S. Fish and Wildlife Service, 2016a).

3.9.5.2.1.4 Weapons Noise

Navy testing and training activities on the PMSR include firing or launching a variety of weapons including missiles, rockets, hypersonic vehicles, and various sized caliber projectiles. Noise produced by firing weapons such as launch boosters, projectile travel, and hypersonic vehicle tests are potential stressors to birds. Under Alternative 1, there would be an increase in the volume of missiles launched and ordnance expended as detailed in Table 3.0-12. There would also be an increase in aerial target launches, also included in Table 3.0-12. The increase in aerial targets is primarily from an increase in the number of BQM-177A targets, which are usually launched from Building PM-55 on Point Mugu, and GQM-163A targets, which are launched from SNI.

While sound generated by a muzzle blast is brief but intense, a bird close by could be injured or experience hearing loss due to acoustic trauma or threshold shift. Bird responses to weapons firing and projectile travel noise may include short-term behavioral or physiological responses such as alert and startle responses. Studies of impacts from weapons noise on raptors show that some species have little reaction and do not alter behavior in the presence of noise from weapons testing and training (Brown et al., 1999; Schueck et al., 2001; Stalmaster & Kaiser, 1997). Once weapons firing activities begin, any birds in the nearby vicinity are likely to disperse away from the area where weapons firing is occurring. Activities that precede firing, such as vessel movement and target placement, are likely to disperse some birds prior to initiation of firing.

The firing of weapons can create a broad range of noise levels, depending upon the type, size, and number of weapons fired, among other factors. Section 3.0.5.5.5 (Weapons Noise), and Table 3.0-6 provide examples of the sound levels produced by various weapons sources. Airborne weapons noise levels from a Naval gunfire muzzle blast can reach 178 dBA directly below the gun muzzle above the water's surface (Yagla & Stiegler, 2003). In terms of missile launches from shore, noise levels from a RIM 116 surface-to-air missile launch can vary from 122 to 135 dBA 7 to 13 feet away from the launcher (U.S. Department of the Navy & Unified Port of San Diego, 2013). Most missiles would be launched from ships and marine birds are likely to avoid the area prior to launches.

Launch locations on Point Mugu occur at Building PM-55 and at Alpha, Bravo, Charlie, and Nike-Zeus pads adjacent to Holiday Beach. Building PM-55 is located adjacent to light-footed Ridgway's rail and Belding's savannah sparrow breeding habitat. Alpha, Bravo, Charlie, and Nike-Zeus pads are located adjacent to western snowy plover and California least tern occupied breeding habitat. The launching of targets and missiles from launch pads on Point Mugu and SNI generates a short blast of loud noise that may impact nearby nesting species. Noise durations at Building PM-55 on Point Mugu range from 0.56 to 27 seconds with peak noise levels ranging from 161 dBA at 50 feet to 115 dB at 3,000 feet (U.S. Fish and Wildlife Service, 2016a). Noise during launches has the potential to impact nearby nesting birds, including light-footed Ridgway's rail, Belding's savannah sparrow, California least terns, and western snowy plovers. Both California least terns and western snowy plovers nest in low numbers at Holiday Salt Panne southwest of Building PM-55. According to 2018 data, the closest light-footed Ridgway's rail nesting territory was over 1,700 feet south of Building PM-55 with western snowy plover and California least terns nests further than 2,000 feet away (U.S. Department of the Navy, 2019c). Launches from Building PM-55 occur throughout the year, and therefore nesting birds are exposed to temporary elevated noise levels during launches. While Alternative 1 would involve an increase in the number of BQM-177A targets launched, the launches would occur from multiple platforms, and there would not be a substantial increase from Building PM-55. It is anticipated that the continuation of launches from Building PM-55 during the nesting season would continue to expose nesting birds to elevated noise levels.

Launches also occur on Holiday Beach at the Alpha, Bravo, Charlie, and Nike-Zeus pads close to habitat used during the breeding season for California least terns and western snowy plovers. However, in 2018, no launches occurred during the nesting season and hence there were no impacts on nesting species (U.S. Department of the Navy, 2019c). There are multiple measures outlined in the Point Mugu programmatic BO (U.S. Fish and Wildlife Service, 2016a) to reduce impacts on nesting federally listed species if activities occur at the Holiday Beach launch pad locations during the nesting season. This includes monitoring of nest sites around launch pads and use of an alternate launch location if a listed species nest is within 500 feet of a launch location.

Launches on SNI occur from the Alpha Launch Complex and Building 807 Launch Complex. Specific to GQM-163A target launches from the Alpha Launch Complex, noise levels were recorded during five launches at the end of 2016 through September 2017 by Burke (2017) as part of pinniped monitoring. The specific noise levels at the launch location were not recorded; however, during two rapid succession launches on 3 December 2016, several monitoring sites on the western end of SNI recorded peak flat-weighted sound levels (not A-weighted) that ranged from 103 dB to 111 dB (which equates to 77–89 dBA) (Burke, 2017). The ambient noise levels at the time ranged from 66 to 75 dB (which equates to 45–56 dBA). The missiles crossed the west end of SNI at an altitude of approximately 1,850 feet above mean sea level. These launches occurred during the non-breeding season (although roosting birds were likely present) and hence no impacts on breeding seabirds occurred. Launches can exceed 100 dB along the western end of SNI over an area where roosting (California brown pelicans) and nesting seabirds (Brandt's and pelagic cormorants, western gulls, western snowy plovers, and black oystercatchers) are located. While the ambient noise levels in this area around Vizcaino Point can exceed 100 dB due to high winds, the periodic noise from launches may impact seabirds if launches occur during the breeding season. While launches from the Alpha Launch Complex can result in temporary loud noises, since the launch site is over a mile away from the nearest shoreline, and birds at Vizcaino Point have not abandoned the site due to historical launches, any additional launches are not anticipated to impact marine birds. Launches occur year round, and based on current use of Vizcaino Point by seabirds for nesting and roosting, launches have not been found to cause long-term impacts on nesting seabirds at that location.

At the Building 807 Launch Complex on SNI, the EA for the SSM-1 KAI Missile Testing at SNI (U.S. Department of the Navy, 2007) determined that sounds levels above 130 dBA may last less than

1 second during each launch event. Typically, the range of 130 to 135 dBA SEL occurs from 164 to 328 feet from the launch pad during each launch. Avian reactions to launches are generally limited to brief disturbances in the form of wing fluttering, and normal activities are resumed quickly (U.S. Department of the Army Space and Missile Command, 2003). However, personnel and activities associated with the Building 807 Launch Complex have the potential to impact seabirds due to the close proximity of nesting and roosting locations for several species (Brant's and pelagic cormorants and western gulls). Brandt's cormorants resumed nesting at Cormorant Rock Area in 2017 and 2018, hence there is a potential for disturbance to nesting cormorants (and western gulls) during missile launch operations at the Building 807 Launch Complex during the breeding season. The launch complex can accommodate several fixed and mobile launches that range from 100 to 500 feet from the nearest shoreline (U.S. Department of the Navy, 2018b). Western snowy plovers have historically nested in proximity to the Building 807 Launch Complex (but have not done so in recent years) and habitat near operational areas is surveyed to assess the potential for adverse impacts on western snowy plovers by Navy activities. Additionally, testing and training activities are monitored during launch activities to determine the response by western snowy plovers (U.S. Fish and Wildlife Service, 2001). Specific to 2018, no launches were conducted during the breeding season (1 March through 15 September) and no nests were found in the area (U.S. Department of the Navy, 2019c).

Weapons fired from the air are less likely to cause noise disturbance to birds due to elevational separation between the aircraft and avian species on the ground. While there is considerable interspecific species variation in flight altitudes, approximately 95 percent of bird flight during migration is below 10,000 feet AGL with the majority below 3,000 feet AGL and the favored altitude for smaller birds is closer to 500 to 1,000 feet AGL (Lincoln et al., 1998). Airborne weapons firing at airborne targets typically occur at high altitudes ranging from 15,000 to 25,000 feet. Noise and flight maneuvers at such altitudes are unlikely to impact birds as birds tend to not fly that high and birds at lower altitudes are unlikely to be impacted by the noise.

Large supersonic projectiles produce a bow shock that creates 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. Since most projectiles spend all or part of their travel path above levels of low-flying birds, minimal impacts are anticipated. The same would apply for hypersonic vehicle tests. Flight heights can reach elevations of 80,000 feet and can range 450–2,000 miles on the PMSR. Typical hypersonic vehicle test launches occur within W289 with an approximate corridor (debris pattern) of 50 nautical miles (NM) by 2,000 NM with a southwest heading. Tests would be conducted in airspace above the typical migration altitudes for birds and marine birds are not anticipated to be impacted.

In summary, since weapons firing occurs at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual birds are not expected to be repeatedly exposed to weapons firing, launch, or projectile noise. However, Brant's cormorants that have recently resumed nesting at Cormorant Rock may be impacted by launches from Building 807 Launch Complex during the breeding season. As detailed in the Point Mugu INRMP (U.S. Department of the Navy, 2019a), the colony will be monitored to ensure there are no population-level impacts if launches occur during the nesting season. Impacts may involve an initial startle response and a temporary displacement of foraging areas. Launches and their associated activities on Point Mugu and SNI may lead to nest abandonment of listed species, and potential crushing of nests or adults from Jet-assisted takeoff (JATO) bottles dropping into occupied listed species habitat. There is a potential for an increase in disturbance and potential take to listed bird species from an increase in launches under

Alternative 1. While there may be an increase over the baseline of what were actually launched, there is no proposed increase over what was previously consulted on in the Point Mugu 2016 BO (50 to 70 missiles/targets (approximately 12 feet long) and 1 to 10 larger missiles/targets annually from Building PM-55. Increases in proposed missiles and target launches are mainly for those launched from sea or aircraft (F-35 ops) and not from SNI and Point Mugu. The total number of launch events (40) from SNI will not increase; however, the total number of targets launched will increase due to doubles and quads being launched at the same time. Measures are included in both the Point Mugu and SNI programmatic BOs (U.S. Fish and Wildlife Service, 2001, 2016a) and in Chapter 5 (Standard Operating Procedures and Mitigation) of this EIS/Overseas EIS to minimize the potential for take of listed species. If disturbance or take were to occur, it would likely be to a minimal number of nests with take covered under the Point Mugu and SNI programmatic BOs.

Under Alternative 1, pursuant to the ESA, Navy use of weapons may affect ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail with disturbance and take already covered under Point Mugu and SNI's programmatic BOs (U.S. Fish and Wildlife Service, 2001, 2016a).

3.9.5.2.2 Explosives

Explosions in the water, near the water surface, and in the air would introduce loud, impulsive, broadband sounds into the marine environment. Explosive detonations during testing and training activities are associated with high-explosive ordnance, including, but not limited to, bombs, missiles, rockets, and naval gun shells. Table 3.0-7 in Section 3.0.5.7 (Explosive Stressors) provides a quantitative assessment of the explosive sources per alternative. Under Alternative 1, there would be a slight increase in the number of bombs detonated on the PMSR and a slight increase in the number of munitions fired.

The released energy from an explosion can produce a shock wave at a high rate that can be both injurious and deadly to birds in the immediate vicinity. A wide range of impacts on marine birds may occur, including temporary or permanent hearing loss, auditory masking, physiological stress, changes in behavior, injury, and mortality. If a bird is in close proximity during an explosive detonation, the high-pressure levels and sound impulse may result in barotrauma and damage their ears. Detonations in air or at the water surface may injure birds while in flight or on the water through impact from explosive fragments, and blast waves. Experiments were conducted to expose small, medium, and large-bodied birds to blast waves in air to determine the injurious exposure levels (Damon et al., 1974). Results indicated that peak pressure exposure of 5 pounds per square inch (psi) would not produce blast injuries, 10 psi would produce slight to extensive injuries, and 20 psi would produce 50 percent mortality (Damon et al., 1974). One of the experiments exposed flying pigeons to a 64-pound net explosive weight explosion. Birds at 44 to 126 feet from the blast exhibited no signs of injury while serious injuries were sustained at ranges less than 40 feet. The range to no injury threshold (determined as 5 psi) for in-air explosives varied from 21 feet for a 5-pound explosive weight to 57 feet for a 100-pound explosive weight (Damon et al., 1974; Swisdak, 1978).

Birds in the immediate vicinity of an explosive blast are anticipated to experience mortality from direct strike by explosive fragmentation. The risk to birds would decrease with distance and would vary greatly depending upon the location of the explosion. In-water explosions would have shorter distances due to drag on fragments that would reduce their velocity to non-hazardous levels (Swisdak & Montanaro, 1992). It is anticipated that most birds will vacate an area after the initial detonation, if a series of subsequent detonations occur.

In summary, both temporary and permanent hearing loss may occur due to exposure of intense sound, depending upon the location of the bird during the explosive detonation. Additionally, physiological stress, masking, and behavioral reactions may occur to some degree, but it would depend upon the species; location of the detonation in relation to foraging, nesting, and avian roosting areas; and the number of subsequent detonations. Most events would be limited in duration and widely dispersed (and generally away from known concentrations of seabirds such as around SNI), thus providing time for birds to vacate the area and not be exposed to repeated explosive detonations. A few individual birds in the immediate vicinity of an explosion may be impacted, but population-level effects are not anticipated. A slight increase would occur in the number of munitions; however, because the increase would be minor, no measurable increase would be anticipated in impacts on marine birds above current baseline levels.

Under Alternative 1, pursuant to the ESA, Navy use of explosives is anticipated to have no effect on ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail.

3.9.5.2.3 Energy

This section discusses the potential impacts on marine birds from DE stressors such as in-air electromagnetic devices and high-energy lasers. In-air electromagnetic devices include communication transmitters, radars, and electronic countermeasure transmitters. Most of the transmissions from in-air electromagnetic devices would be at low power during routine surveillance, communications, and navigation. High-power settings are used for a small number of activities, including ballistic missile defense testing, missile and rocket testing, radar and other system testing, and signature analysis operations.

In-air electromagnetic effects can be categorized as thermal (able to cause damage by heating tissues) or non-thermal. Thermal effects are more likely to occur near high-power systems and may cause birds to temporarily avoid the area receiving the electromagnetic radiation until the stressor ceases (Manville, 2016; Nicholls & Racey, 2007, 2009). Given the dispersed nature of Navy testing and training activities while at sea and the relatively low-level and dispersed use of the systems at sea, the chance that in-air electromagnetic devices would cause thermal damage to individual birds is low. In some cases, individual birds exposed to levels of electromagnetic radiation that cause discomfort would likely avoid and leave the immediate area of testing and training activities. Finally, the strength of any avoidance response would decrease with increasing distance from the in-air electromagnetic device, and no long-term or population-levels impacts would occur.

DE tests have not been conducted on San Nicolas Island to date. On SNI, one of the DE test facility target sites is located at Bomber Cove in close proximity to where California brown pelicans roost and Brandt's cormorants nest (U.S. Department of the Navy, 2015a). The Tender Point shooter site is located near a western snowy plover roosting and nesting area. The *Environmental Assessment Directed Energy Test Facilities at San Nicolas Island* (U.S. Department of the Navy, 2015a) and subsequent BO (U.S. Fish and Wildlife Service, 2012) analyzed impacts on western snowy plover and all applicable mitigation measures in the BO and Chapter 5 (Standard Operating Procedures and Mitigation) of this EIS/Overseas EIS would be followed. Another DE target site is the Standoff Land Attack Missile operational area and other scattered locations around SNI (U.S. Department of the Navy, 2010a). The *Environmental Assessment Point Mugu Sea Range Countermeasures Testing and Training* (U.S. Department of the Navy, 2014) and subsequent BO (U.S. Fish & Wildlife Service, 2014) detail the level of events that were authorized and measures to reduce impacts on birds. The use of the DESIL would not increase above the level previously authorized. While the exact timing, duration, and location of laser use from the DESIL is not detailed, marine birds that are foraging in nearshore waters may be temporarily in the line of fire, especially if flying back and forth during foraging between the ocean and beaches on Point Mugu throughout the nesting season. In 2018 the closest western snowy plover nest was over 1,000 feet west of the DESIL, and the closest California least tern nests were over 5,000 feet to the northwest (U.S. Department of the Navy, 2019c). While these nest locations are not particularly close to the DESIL, there is a low potential for a western snowy plover or California least tern foraging along the shoreline or over the ocean to be in the line-of-sight for a laser fired from the DESIL, depending upon the angle of firing.

Prior to any laser firing, the Navy requires standard procedures to ensure that no persons, wildlife, reflective surfaces, or non-target obstructions of any sort are present within the hazard area (which is specific to the type of laser being fired) between the laser and the target (U.S. Department of the Navy, 2010a, 2014). The path from the laser to the target is monitored by observers with binoculars or remote cameras as necessary to ensure that the laser is not fired if and when wildlife are within the nominal hazard zone identified in the risk hazard assessment (U.S. Department of the Navy, 2010a). A bird in flight or at a far distance may not be detectable, but the likelihood of a bird crossing the laser beam at the instant it is fired is remote. In addition, a bird would have to remain in the fixed beam for many seconds before it would experience impacts, which is unlikely since a bird flying through the beam would receive less than a second of exposure (U.S. Department of the Navy, 2014).

One additional potential impact from lasers is the use of an intensely bright optical beacon on an aerial or surface target used by atmospheric characterization systems. Depending upon how and when the optical beacon is used, it has a potential to disorient marine birds if used during periods of inclement weather with a low cloud ceiling. Marine birds have been documented colliding with illuminated structures after becoming disoriented as further detailed below in Section 3.0.5.8 (Physical Disturbance and Strike Stressors). Since Alternative 1 would have the same anticipated level of DE days as previously authorized, no increase in risk to marine birds from current levels would occur.

Under Alternative 1, pursuant to the ESA, Navy use of electromagnetic devices and lasers may affect ESA-listed western snowy plover and California least tern; however, these effects are already covered under the Countermeasures Testing and Training BO (U.S. Fish & Wildlife Service, 2014) and the *Environmental Assessment Directed Energy Text Facilities at San Nicolas Island* (U.S. Department of the Navy, 2015a). The Navy's use of electromagnetic devices and lasers is anticipated to have no effect on light-footed Ridgway's rail.

3.9.5.2.4 Physical Disturbance and Strike

Physical disturbances to marine birds may involve short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the area, and increased energy expenditure. These disturbances may result in abnormal behavior, growth, or reproductive impacts on nesting birds, including flushing from nests and temporary avoidance of habitat (Andersen et al., 1989; Komenda-Zehnder et al., 2003). The temporary displacement of birds from foraging areas is an energetic cost for birds (Velando & Munilla, 2011); however, they are expected to return to the disturbance area after vessels have passed through and individual bird fitness is not anticipated to be compromised.

While birds hear and see approaching vessels (and avoid them to the extent feasible), a potential for avian injury or mortality from vessel collision is possible while birds are foraging, resting, or flying low along the water's surface. Flushing of seabirds is expected to be greatest from fast-moving, agile vessels. Several factors may converge to determine the potential for avian injury or mortality, including time of day, speed of approaching vessels, height of vessels and vessel configuration, type of lighting on vessels, bird health, and weather, among other factors. While most birds are expected to avoid approaching vessels, during periods of inclement weather, some birds may be attracted to vessels (due to disorientation from lighting), potentially resulting in injury and mortality. Some avian species have been documented colliding with a variety of structures (including vessels) during nocturnal migration. This includes species of waterbirds, seabirds, and passerines. Bird mortality typically occurs on cloudy, overcast, or foggy nights with reduced visibility and low cloud ceilings when birds are flying at lower altitudes (Ove Arup & Partners Hong Kong Ltd, 2002). Rain or other precipitation can cause refraction and reflection of light by rain droplets, which can disorient birds and cause them to collide with vessels. Additional factors such as the moon phase and passage of cold fronts can influence the potential for collision. One potential reason for increased injury and mortality during overcast nights with reduced visibility is that birds become spatially disoriented by bright lights due to cloud cover obscuring their navigational reference points, such as the moon and stars (Greer et al., 2010). Even though birds may not collide with vessels, the disorientation from night-time lighting can cause birds to fly in circles around the light source, become exhausted, and drop to the ground. Additionally, mortality may occur from hypothermia, predation of incapacitated birds, and collision with the ground. Night-time lighting can also disrupt breeding activities (for both passerines and seabirds) and increase predation (Greer et al., 2010).

Aircraft strikes have a potential to cause injury and mortality to avian species and are well documented on Point Mugu and other installations. From 2006 through 2015, the Navy Bird/Animal Aircraft Strike Hazard program documented 10,496 bird strikes (combined for all installations) with the majority occurring during the fall period from September through November (Naval Safety Center, 2017). The potential for bird strike is greatest in foraging and resting areas, in migration corridors at night, and at low altitudes during periods around dawn and dusk. Birds are often attracted to airports due to nearby adjacent foraging and nesting resources. Based on civilian aircraft-wildlife damaging strikes from 1990 through 1999, approximately 97 percent involved common, large-bodied birds or large flocks of small birds. Almost 70 percent of these incidents involved gulls, waterfowl, and raptors (Federal Aviation Administration, 2003). More recently, Dolbeer et al. (2013) analyzed wildlife strikes to civil aircraft in the United States from 1990 through 2012 and confirmed that species of gulls accounted for the highest number of strikes followed by pigeons/doves, raptors, and waterfowl. Not all strikes resulted in aircraft damage. Although the number of reported wildlife strikes has risen steadily, the number of reported damaging strikes has declined from 764 in 2000 to 606 in 2012 (Dolbeer et al., 2013).

Navy data indicate that bird strikes occur most often within the airfield environment (Naval Air Station Jacksonville, 2012). Dolbeer (2006) reported that approximately 95 percent of aircraft-wildlife strikes occurred on or near airports, especially when aircraft were below 3,500 feet in altitude. Approximately 95 percent of avian flight during migration occurs below 10,000 feet with the majority below 3,000 feet (U.S. Geological Survey, 2006). In a study that examined almost 39,000 bird and aircraft collisions, the majority (74 percent) occurred below 500 feet, with the collisions recorded at elevations as high as 12,139 feet (Dobson, 2010). Encounters with birds are more likely during aircraft take-offs and landings compared to low-altitude flights. However, for rotary-wing military aircraft, wildlife strikes happened more frequently when aircraft were traveling en route (flying above 1,000 feet AGL) or engaged in terrain flight (flying less than 1,000 feet AGL) compared to hovering, on approach, landing, taxiing, taking-off, or climbing out (Washburn et al., 2014).

Overall, the potential for bird strikes to occur in offshore areas are relatively low since testing and training activities are widely dispersed and generally above 3,000 feet (for fixed-wing aircraft) where bird densities are low. Additionally, the Naval Aviation Safety Program Instruction, Chief of Naval

Operations Instruction 3750.6R identifies measures to evaluate and reduce or eliminate bird/aircraft hazards to aircraft, aircrews, and birds. It also requires the reporting of all strikes when damage or injuries occur from bird/aircraft strikes. Additionally, the Navy implements standard operating procedures for aircraft safety and all Navy flying units report all bird strikes through the Web-Enabled Safety System Avian Mishap and Hazard Reporting System. A bird-air-strike hazard program has been implemented at Point Mugu (U.S. Department of the Navy, 2009) to reduce the potential for avian strikes with aircraft (U.S. Department of the Navy, 2019a). From 1997 through 2007, at least 345 bird/aircraft strikes were reported at Point Mugu with several caused by species of waterbirds (U.S. Department of the Navy, 2009). Specific to Point Mugu in 2017, several airstrikes with birds and various aircraft were documented, including two with great blue herons (*Ardea herodias*), one with an unknown species of gull (*Larus* sp.), one with an American coot (*Fulica americana*), and one with a Forster's tern (*Sterna forsteri*) (U.S. Department of the Navy, 2018b). While there is currently no bird-air-strike hazard management plan specifically for SNI, a bird-air-strike hazard program is conducted on the island by the U.S. Department of Agriculture (U.S. Department of the Navy, 2015b).

The widely dispersed area in which bombs and missiles would be used on the PMSR, coupled with the often patchy distribution of seabirds (Fauchald et al., 2002; Haney, 1986; Schneider & Duffy, 1985), suggests the likelihood of ordnance striking a seabird would be low. Human activity involved in the placement of targets, vessel and aircraft movements, and clearance regulations would likely cause birds to leave a target area prior to testing and training activities. However, depending upon the amount of time since placement of targets, there is a potential for birds to return to the area after initially being flushed, and injury or mortality to birds from ordnance has a low potential to occur.

JATO bottles (current inventory is being used up and replaced the rocket-assisted takeoff bottles) are used for target launches at Point Mugu and SNI. Launches from Point Mugu occur from Building PM-55 (and from the Alpha, Bravo, Charlie, and Nike-Zeus pads) and JATO bottles may travel from 155 to 2,000 feet with an average distance of 700 to 1,500 feet (U.S. Department of the Navy, 2002). The bottles typically land in the same general area of Mugu Lagoon and the adjacent salt marsh habitat (which is occupied by several sensitive marine bird species such as light-footed Ridgway's rail and Belding's savannah sparrow). In 2018, light-footed Ridgway's rails were located primarily east of L Avenue, and most JATO bottles fall to the west of this location, where light-footed Ridgway's rail nests are not regularly found (U.S. Department of the Navy, 2019c). Additionally, JATO bottles have been falling closer to occupied western snowy plover and California least tern occupied habitat at Holiday Salt Panne. The eastern edge of Holiday Salt Panne is approximately 1,900–2,000 feet west of Building PM-55 and is occupied by several pairs of nesting western snowy plover and California least tern. In 2018, there were nine western snowy plover nests and 12 California least tern nests within Holiday Salt Panne (U.S. Department of the Navy, 2019c).

Currently the JATO bottles are removed from light-footed Ridgway's rail habitat between L and M Streets on Point Mugu during the non-breeding season. Thus far, seven JATO bottle cleanup events have removed approximately 1,800 bottles. The *Final Environmental Impact Statement/Overseas Environmental Impact Statement Point Mugu Sea Range* (U.S. Department of the Navy, 2002) calculated the potential for several avian species (California brown pelican, California least tern, Belding's savannah sparrow, and light-footed Ridgway's rail) to be hit by JATO bottles falling and landing on birds. Based on calculations in U.S. Department of the Navy (2002), the probability of a JATO bottle striking an individual bird was insignificant when considered as an individual or annual event. The cumulative impacts of JATO bottles are still considered low given that birds are mobile and may move out the way, especially after a launch event. Thus far, sensitive avian populations on Point Mugu do not appear affected by JATO bottles landing in occupied habitat, although JATO bottles have been landing closer to occupied nesting habitat for western snowy plover and California least tern. Thus far, no avian mortality events have been documented from JATO bottles falling and striking birds (Ferrara, 2019). Birds react differently to potential threat stimuli, and while California least terns may fly away or flush off their nests during a launch event, a western snowy plover may simply hunker down and potentially be crushed by a falling JATO bottle. If California least tern adults flush off their nests during a launch event, there is a low potential for their eggs or young to be crushed by a falling JATO bottle. Under Alternative 1, there would be an increase in launches of the BQM-177A aerial target, but this increase would be spread across several platforms and there is no anticipated substantial increase in launches specifically from Building PM-55. JATO bottles are less frequently used on SNI and do not land in sensitive avian habitat.

In summary, marine bird populations at Point Mugu, SNI, and on the PMSR have not experienced population declines directly related to military testing and training activities. While there may be individual impacts on a few birds from physical disturbance and strike, measures are in place to reduce the potential for disturbance and strike as outlined in Chapter 5 (Standard Operating Procedures and Mitigation). Thus far, no birds have been killed by JATO bottles and the potential remains less than significant, even with the increase in testing and training activities. All impacts are anticipated to remain below noticeable levels and result in no population-level impacts.

Under Alternative 1, pursuant to the ESA, Navy testing and training activities may affect ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail through physical disturbance and strike. These potential effects are already covered under Point Mugu and SNI's programmatic BOs (U.S. Fish and Wildlife Service, 2001, 2016a).

3.9.5.2.5 Ingestion from Military Expended Materials

Marine birds have a potential to be exposed to a variety of military expended materials in the form of non-explosive practice munitions (small and medium caliber), fragments from explosive munitions, and expended materials other than munitions such as chaff, flare components, expendable targets, and others. Once testing and training activities begin, marine birds are likely to leave the area and most military expended material would quickly settle to the bottom of the ocean prior to being ingested. Both non-explosive practice munitions and fragments from high-explosive munitions rapidly sink through the water column and settle on the bottom. Because munitions are not used nearshore and due to their density, they are unlikely to accumulate in the nearshore benthic and intertidal foraging areas. These munitions and fragments would likely be inaccessible or attractive as potential food items to diving birds that feed on fish and hence are anticipated to pose no risk to marine birds.

Some fragments that do not sink, such as chaff, plastic end caps and pistons from flares, Styrofoam, fragments from targets, and other floating material may pose an ingestion hazard, particularly for tubed-nosed seabirds such as shearwaters, petrels, fulmars, and other birds in the family Procellariiformes. These birds utilize a highly developed sense of smell to find food that is distributed in patches offshore and across the open ocean. Tube-nosed marine birds are attracted to dimethyl sulfide, which is produced by damaged cell walls of algae consumed by marine herbivores, such as krill. Savoca et al. (2016) demonstrated that seabirds that utilize dimethyl sulfide as a foraging cue consumed plastic nearly six times more frequently than seabirds that were not attracted to dimethyl sulfide. Algae growing on common types of plastic debris can produce dimethyl sulfide within three weeks and create an "olfactory trap" (Savoca et al., 2016).

Impacts on birds that ingest plastic items can include blocked digestive tracts, blockage of digestive enzymes, lowered steroid hormone levels, delayed ovulation, reproductive failure, nutrient dilution, exposure to harmful chemicals, altered appetite satiation, and starvation (Azzarello & Van Vleet, 1987). Many species of seabirds are known to ingest floating plastic debris because plastic is mistaken for prey; hence, the incidence of plastic ingestion is related to a bird's feeding mode and diet (Henry et al., 2011; Provencher et al., 2014). Seabirds that use foraging strategies such as pursuit-diving, surface-seizing, and dipping such as petrels and shearwaters tend to accumulate more plastic than other species (Azzarello & Van Vleet, 1987; Moser & Lee, 1992; Provencher et al., 2014). There are many well documented cases of birds ingesting floating plastic debris and other foreign material while feeding on the ocean's surface (Auman et al., 1997; Yamashita et al., 2011). There is mounting evidence that physical and toxicological impacts from plastic ingestion by seabirds are widespread among species and increasing (Kain et al., 2016; Wilcox et al., 2015). Some seabirds use plastic and other marine debris for nest building, which may lead to ingestion (Votier et al., 2011). The indirect ingestion of plastic through consumption of lower tropic levels that have ingested plastic is also an increasing concern.

Overall, the ingestion of plastic by seabirds can lead to a variety of impacts from blocked intestinal tracts, laceration of the digestive tract, reduced digestive capability, reduction in hunger, dehydration, negative body weight, digestion of toxic contaminants, and starvation (Auman et al., 1997; Azzarello & Van Vleet, 1987; Pierce et al., 2004; Ryan, 1987; Sievert & Sileo, 1993). Species such as storm-petrels, shearwaters, fulmars, and others that feed by picking prey from the water's surface are at the greatest risk to ingestion. Species that feed their young by regurgitation have a potential to pass plastic on to their chicks.

Testing and training activities on the PMSR may produce target-related material fragments that do not rapidly sink to the ocean floor such as Styrofoam and plastic fragments. Ingestion of flare compression pads or pistons (1.3 inches in diameter and 0.13 inch thick) (U.S. Department of the Air Force, 1997) may result in gastrointestinal obstruction or reproductive complications. This could be lethal to individual seabirds, especially those with small gizzards, and species that do not regurgitate solid indigestible material from their food.

Impacts from ingestion of chaff, however, are not anticipated to pose an injury or mortality risk to seabirds. Ingestion of chaff fibers is not anticipated to cause physical damage to a bird's digestive tract because the fibers are small (ranging in length from 0.25 to 3 inches with a diameter of about 40 micrometers), flexible, and only small quantities could reasonably be ingested due to the dispersed nature of chaff. Chaff fibers are not expected to be toxic to seabirds because intestinal adsorption of orally ingested aluminum salts is poor and excreted by the body (Scheuhammer, 1987). Additionally, it is unlikely that a bird would ingest a toxic dose of chaff based on anticipated environmental concentration of chaff (since it is specifically designed to spread out over a large area). Therefore, impacts of chaff on seabirds are anticipated to be less than significant.

Under Alternative 1, there would be an increase in the number of aerial targets launched and a slight increase in surface targets used. While the majority of targets would be recovered, small fragments dispersed during testing and training activities may increase the amount of debris that seabirds are exposed to across the PMSR. This may lead to an increase in the number of seabirds exposed to lethal and sublethal impacts of ingestion. While most testing and training activities would not be located close to shore or near SNI, where seabirds congregate to feed, there may be detrimental impacts on some individual seabirds. An increase in aerial and surface targets would contribute to the cumulative amount of marine debris on the PMSR and may cause individual seabird injury or mortality. However, the number of flare and chaff expenditure events would be reduced slightly from current baseline numbers, and hence ingestion impacts on marine birds from these sources would be lower than current levels. Impacts from ingestion of military expended materials are not expected to cause population-level effects. Western snowy plover, California least tern, and light-footed Ridgway's rail typically forage in near shore, estuarine, beach, and intertidal environments where chaff and other military expended material is unlikely to be located or accumulate. Additionally, as detailed in the *Environmental Assessment Point Mugu Sea Range Countermeasures Testing and Training (U.S. Department of the Navy, 2014)* and subsequent BO (U.S. Fish & Wildlife Service, 2014), ingestion of plastic debris is unlikely to occur and not expected to result in negative impacts on marine birds.

Under Alternative 1, pursuant to the ESA, Navy testing and training activities are anticipated to have no effect on ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail from ingestion of military expended materials.

3.9.5.2.6 Entanglement

Under Alternative 1, several types of decelerators/parachutes would be used in activities that include aerial targets (drones) (see Section 3.0.5.9, Entanglement Stressors). Aerial targets use large (between 30 and 50 feet in diameter) and extra-large (80 feet in diameter) decelerators/parachutes with suspension lines that vary in length from 40 to 70 feet (large size) to 82 feet (extra-large). Each of the large decelerator/parachutes has up to 28 lines, and the extra-large decelerator/parachutes have up to 64 lines. 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 and their suspension lines could be encountered by marine birds; if encountered, they have the potential to entangle marine birds in the Study Area at the water's surface or in the water column. Risk factors for entanglement of marine birds include bird size (and life stage), sensory capabilities, and foraging methods. Most entanglements discussed in the literature are attributable to marine bird entrapment with fishing gear or other non-military materials that float, are suspended at the surface, or are very difficult to see and avoid (such as fishing line).

Under Alternative 1, at-sea targets are usually remotely operated airborne and surface traveling units, many of which are designed to be recovered for reuse. Whenever possible, the decelerator/parachute is recovered along with the target. The long suspension lines of large and extra-large decelerators/parachutes have a potential to pose an entanglement risk to marine birds if the birds land on the parachute and happen to get a suspension line wrapped around a leg, neck, wing, or other body part. If a marine bird dives into the water in close proximity to a parachute (to forage for fish that may be attracted to the surface-floating parachute), there is a potential for a suspension line to become wrapped around a body part. It is extremely unlikely that a decelerator/parachute would land directly on a marine bird since birds are able to move out of the way prior to the decelerator/parachute landing on the water. The decelerator/parachute could settle to the bottom and become buried in soft sediment, which would stabilize the canopy and suspension lines and reduce the potential for reintroduction as an entanglement risk.

In summary, the risk of entanglement to marine birds from decelerators/parachutes is low since most aerial targets are recovered. Any decelerators/parachutes that remain on the water's surface may provide an attractant to marine birds, especially if they are foraging nearby. The suspension lines may become wrapped around various parts of a bird's body, which may lead to injury or mortality through drowning. This is considered a low potential due to the low numbers of aerial targets that are not recovered. Furthermore, most targets land a considerable distance from shore out at sea, where marine bird densities are generally lower. Finally, California least terns forage in near shore waters and are unlikely to encounter decelerators/parachutes, which are typically used far from shore.

Under Alternative 1, pursuant to the ESA, Navy testing and training activities are anticipated to have no effect on ESA-listed at-sea foraging California least tern through entanglement.

3.9.5.3 Alternative 2

A comparison of operational tempo proposed for each alternative, and proposed types and level of activities, are provided in Section 2.2.3 (Alternatives Carried Forward), and specific numbers for PMSR operations are provided in Table 2-1.

3.9.5.3.1 Acoustic

Impacts on marine birds from acoustic stressors such as vessel, aircraft, and weapons noise are likely to result in behavioral disturbance to nesting, roosting, foraging, and migrating birds. Impacts would be highest during the breeding season, when birds are most sensitive to stressors, have invested resources into breeding, and have been shown to vacate breeding areas if they are not habituated to the acoustic disturbance. No population level impacts are anticipated, as no new launch locations are proposed. Existing use of established launch pads along with protective measures for nearby nesting species has not resulted in any localized population declines. While Brandt's cormorants and California brown pelicans vacated a historically known breeding and roosting site in close proximity to Building 807 Launch Complex on SNI, the reason for leaving the area and shifting to Vizcaino Point may have been related to several factors other than adjacency to a launch location. The Navy has closed the south side of SNI to all military activities to protect various species, including western snowy plovers, Brandt's cormorants, western gulls, and California brown pelicans. Nesting areas for sensitive avian species are closed during the breeding season, and monitoring around Alpha, Bravo, Charlie, and Nike-Zeus pads and Building 807 Launch Complex are conducted to ensure no negative impacts on nesting western snowy plovers in the vicinity prior to launches. Additional measures outlined in Chapter 5 (Standard Operating Procedures and Mitigation) and the USFWS programmatic BOs for Point Mugu and SNI, reduce the potential for impacts on marine birds.

3.9.5.3.1.1 Vessel Noise

There would be the same number of events and vessel usage under Alternative 2 compared to Alternative 1 (Table 2-1). This represents an increase in vessel usage over current baseline levels. An increase in testing and training events would increase the potential for behavioral disturbance to marine birds from vessel noise. Most vessels involved in testing and training activities would be located offshore, far from terrestrial breeding habitat. Therefore, impacts on breeding locations from vessel noise are unlikely. Some birds foraging in off-shore waters (especially during the breeding season when feeding young) would be temporarily displaced while vessels are transiting the area but would return once vessels had passed by. Since there is a small population of California least terns in Ventura County, and they are unlikely to be foraging in the immediate area of vessel operations, the potential for impacts is low. Therefore, no impacts on populations of marine birds are anticipated from the increase in vessel activity.

Under Alternative 2, pursuant to the ESA, Navy use of vessels is anticipated to have no effect on ESA-listed California least tern.

3.9.5.3.1.2 Aircraft Noise

Similar to Alternative 1, marine birds have a potential to be negatively impacted by aircraft noise, depending upon a variety of variables from aircraft type, flight altitude, weather conditions, time of year, species of bird, and level of habituation/facilitation among others. As detailed in Table 2-1, there would be an increase in annual baseline Point Mugu-based flight operations conducted in the PMSR airspace. Aircraft already fly regular flight patterns around Point Mugu and SNI and maintain a 500-foot AGL clearance when flying over federally listed species habitat. Therefore, birds are used to aircraft around these locations. Farther from shore within the PMSR, the density of marine birds decreases and the potential for noise impacts is reduced. Additionally, aircraft often operate at altitudes much higher than the average altitude of avian migration, thereby de-conflicting use of the airspace. Birds are most likely to experience behavioral disturbance during low-level flights in close proximity to land; however, aircraft are required to fly no lower than 500 feet AGL when flying over federally listed species habitat. There are no anticipated population-level impacts on marine birds from an increase in aircraft noise under Alternative 2.

Under Alternative 2, pursuant to the ESA, Navy use of aircraft may affect ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail. The potential increase in disturbance to these listed bird species from an increase in aircraft noise is already covered under Point Mugu's programmatic BO (U.S. Fish and Wildlife Service, 2016a).

3.9.5.3.1.3 Weapons Noise

An increase in weapons use (including launching of aerial targets and use of surface targets) (as shown on Table 2-1) under Alternative 2 would increase the potential for disturbance to marine bird populations. As detailed under Alternative 1, there is a potential for barotrauma and damage to avian auditory organs if they are present in close proximity during weapons firing. This is unlikely due to the presence of humans in the area prior to weapons firing.

The number of aerial target launch events and surface targets usage would increase compared to baseline levels. Therefore, an increase in weapons noise is anticipated from launching and use of aerial and surface targets. Most aerial targets would be launched from Building PM-55 and to a lesser extent from the Alpha Launch Complex on SNI. Use of surface targets is likely to be spread out across the PMSR.

Impacts on birds would vary depending upon the location of targets, launch locations, and ordnance expenditure locations. Targets launched from Point Mugu from Alpha, Bravo, Charlie, and Nike-Zeus pads have a potential to impact nesting western snowy plovers and California least terns. Launches from Building 807 Launch Complex have a potential to impact nearby nesting Brandt's and pelagic cormorants, and western gulls, and roosting California brown pelicans. Launches from Building 807 Launch Complex are launched in a southwest direction with an approximate 30-degree wide azimuth that passes in close proximity over Cormorant Rock, where Brant's cormorants and other birds have begun renesting and California brown pelicans roost. Launches from the Alpha Launch Complex on SNI are likely to have little impact on seabirds, regardless of the time of year, because the launch pad is over a mile inland and most targets are high above nesting and roosting areas by the time the target reaches the western tip of the island.

In summary, since weapons firing occurs at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual birds are not expected to be repeatedly exposed to weapons firing, launch, or projectile noise. Impacts may involve an initial startle response and a temporary displacement of foraging areas after which avian activity is anticipated to return to pre-disturbance levels. Given the measures detailed in Chapter 5 (Standard Operating Procedures and Mitigation) and standard practices to ensure no federally listed bird species are nesting within 500 feet of launch locations, an increase in weapons noise may temporarily disturb birds in the immediate vicinity during testing and training activities but is not anticipated to result in population-level impacts on marine birds. Launches and activities associated with launches on Point Mugu and SNI may lead to nest abandonment of listed species, and potential crushing of nests or adults from JATO bottles dropping into occupied listed species habitat. Brandt's cormorants resumed nesting at Cormorant Rock Area in 2017 and 2018; hence, there is a potential for disturbance to nesting cormorants (and western gulls) during missile launch operations at Building 807 Launch Complex during the breeding season. As detailed in the Point Mugu INRMP (U.S. Department of the Navy, 2019a), the colony will be monitored to ensure there are no population-level impacts if launches occur during the nesting season. If disturbance or take were to occur, it would likely be to a minimal number of nests with take covered under the Point Mugu and SNI programmatic BOs. Overall, impacts are anticipated to be short term, infrequent, and no long-term consequences to individuals are expected.

Under Alternative 2, pursuant to the ESA, Navy use of weapons may affect ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail with the disturbance and take already covered under Point Mugu and SNI's programmatic BOs (U.S. Fish and Wildlife Service, 2001, 2016a).

3.9.5.3.2 Explosives

Tables 2-1 and 2-2 detail the annual number of proposed ordnance use under Alternative 2. There would be an increase in the number of bombs used and a similar number of munitions launched compared to baseline levels. The amount of gun ammunition expended and missiles launched would increase. Most missiles would be launched from aircraft or ships, and most detonations would occur in waters greater than 200 feet in depth and greater than 3 NM from shore.

An increase in explosions may cause temporary disturbance and injury/mortality to nearby marine birds. Both temporary and permanent hearing loss may occur due to exposure to intense sound, depending upon the location of the bird during the explosive detonation. Physiological stress, masking, and behavioral reactions may occur to some degree, but it would depend upon the species; location of the detonation in relation to foraging, nesting, and avian roosting areas; and the number of subsequent detonations. Most events would be limited in duration and widely dispersed (and generally away from known concentrations of seabirds such as around SNI), thus providing time for birds to vacate the area and not be exposed to repeated explosive detonations. A few individual birds may be impacted, but population-level effects are not anticipated.

Under Alternative 2, pursuant to the ESA, Navy use of explosives is anticipated to have no effect on ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail.

3.9.5.3.3 Energy

The number of DE days would remain the same compared to the authorized numbers, as detailed in Table 2-2. Impacts from these activities were previously analyzed under several EAs (U.S. Department of the Navy, 2010a; U.S. Department of the Navy & Unified Port of San Diego, 2013). DE activities originating from the DESIL and occurring on the PMSR would be the same types of activities and tempo previously analyzed under the *Environmental Assessment Point Mugu Sea Range Countermeasures Testing and Training* (U.S. Department of the Navy, 2014) and subsequent BO (U.S. Fish & Wildlife Service, 2014). In-air electromagnetic energy as part of the Proposed Action would be widely dispersed throughout the Study Area. All high-energy laser weapons testing, which may impact birds if they pass through the laser at the time it is fired, is monitored by observers with binoculars or remote cameras as necessary to ensure that the laser is not fired if and when wildlife are within the nominal hazard zone identified in the risk hazard assessment (U.S. Department of the Navy, 2010a). A bird in flight or at a far distance may not be detectable, but the likelihood of a bird crossing the laser beam at the instant it is fired is remote. Additional measures to reduce potential impacts on marine birds (including federally listed marine birds) are detailed in the previously referenced EAs, BOs, and in Chapter 5 (Standard Operating Procedures and Mitigation). No population-level impacts on marine birds are anticipated.

Under Alternative 2, pursuant to the ESA, Navy use of electromagnetic devices and lasers may affect ESA-listed western snowy plover and California least tern; however, these effects are already covered under the Countermeasures Testing and Training BO (U.S. Fish & Wildlife Service, 2014). The Navy's use of electromagnetic devices and lasers is anticipated to have no effect on light-footed Ridgway's rail.

3.9.5.3.4 Physical Disturbance and Strike

The potential for birds to experience injury/mortality from testing and training activities on the PMSR is anticipated to increase slightly above baseline given the increase in missile and other ordnance expenditure. While individual impacts may occur to a few birds from physical disturbance and strike, measures are in place to reduce the potential for disturbance and strike to known breeding and roosting areas as outlined in Chapter 5 (Standard Operating Procedures and Mitigation). Thus far, no birds have been killed by JATO bottles and the potential remains slim, even with the increase in testing and training activities. All impacts are anticipated to remain below noticeable levels and result in no population-level impacts.

Under Alternative 2, pursuant to the ESA, Navy testing and training activities may affect ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail through physical disturbance and strike. These effects are already covered under Point Mugu and SNI's programmatic BOs (U.S. Fish and Wildlife Service, 2001, 2016a).

3.9.5.3.5 Ingestion

Under Alternative 2, there would be an increase in the number of aerial and surface targets used (Table 2-1). While the majority of targets would be recovered, small fragments that are dispersed during testing and training activities may increase the amount of debris that seabirds are exposed to across the PMSR. This may lead to an increase in the number of seabirds exposed to lethal and sublethal impacts of ingestion. An increase in aerial and surface targets would contribute to the cumulative amount of marine debris on the PMSR and may cause individual seabird injury or mortality. However, impacts are not expected to cause population-level effects.

The number of flare and chaff expenditure events would be reduced from current baseline levels; hence, ingestion impacts on marine birds from these sources would be lower than current levels.

Under Alternative 2, pursuant to the ESA, Navy testing and training activities are anticipated to have no effect on ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail from ingestion of military expended materials.

3.9.5.3.6 Entanglement

The number of aerial targets proposed for use under Alternative 2 would be slightly lower than under Alternative 1, per Table 2-1. Potential impacts on marine birds from becoming tangled in a decelerator/parachute from an aerial target, and then getting injured or drowning are minor. Most aerial targets land in the ocean far away from any nearshore marine bird foraging areas, where marine bird densities are low, and most targets are recovered. Therefore, the potential impact from entanglement by decelerators/parachutes for marine birds is low, and no population-levels impacts are anticipated.

Under Alternative 2, pursuant to the ESA, Navy testing and training activities are anticipated to have no effect on ESA-listed at-sea foraging California least tern through entanglement.

3.9.5.4 Indirect Effects

Indirect effects include impacts on marine bird habitat and prey availability. These impacts are generally less quantitative and may include impacts on sediment and water quality, and on marine vegetation, invertebrates, and fish. Disturbances to the marine environment are most likely to impact prey sources for marine birds. Impacts from explosions and physical disturbance may cause fish to temporarily abandon certain areas and alter marine bird prey availability in the immediate vicinity of testing and training activities. Impacts on marine bird fish and invertebrate prey from explosives, explosive byproducts, unexploded ordnance, metals, and chemicals would likely be negligible because marine birds have a wide variety of prey available to them, and localized impacts are not anticipated to degrade the marine environment. Some fish in the immediate vicinity of a testing and training activity may experience trauma or a startle reflex. The sound from underwater explosions may startle and disrupt schooling fishes in close proximity to an explosion (Popper et al., 2014; Wright, 1982), which may make them more visible to avian predators (Kastelein et al., 2008). This may result in additional injury to marine birds if they are attracted to an area to forage on fish and then exposed to subsequent testing and training activities. Since testing and training activities are transient and widely spread out across the PMSR they have a potential to only impact fish in the local area around testing and training activities during each event. No long-term impacts onto the marine environment are anticipated and therefore no long-term impacts on marine bird prey species are expected.

No physical impacts on marine bird habitat are anticipated from any testing and training activities apart from JATO bottles falling into Mugu Lagoon and the surrounding areas. Since some of these bottles are removed when possible, no long-term impacts onto marine bird habitat are anticipated. No physical impacts are anticipated to occur on SNI, since ground disturbance is not proposed. Indirect impacts onto sediments, water, and air quality would be discountable since testing and training activities are temporary and distributed widely across the PMSR, and marine bird populations are dispersed spatially and temporally. Therefore, no long-term or population-level impacts are anticipated.

Pursuant to the ESA, Navy testing and training activities may affect ESA-listed western snowy plover, California least tern, and light-footed Ridgway's rail from indirect effects under either action alternative.

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