Environmental Impact Statement/

Overseas Environmental Impact Statement

Point Mugu Sea Range

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3.7 Marine Mammals

3.7.1 Introduction

In this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), potential impacts on marine mammals are evaluated based on their distribution and ecology relative to the stressor or activity being considered. Activities are evaluated for their potential impact on marine mammals in general, on stocks and populations as appropriate, and on species listed under the Endangered Species Act (ESA) in the Point Mugu Sea Range (PMSR) Study Area (Study Area).

The following subsections provide introductions to marine mammal species that occur in the Study Area, including federally listed threatened or endangered species. General information relevant to all marine mammal species is provided in Section 3.7.4.1 (General Background), followed by subsections that discuss the status, habitats, population trends, predator-prey interactions, and species-specific threats. The complete analysis and summary of potential impacts of the proposed testing and training activities on marine mammals is found in Section 3.7.5 (Environmental Consequences).

Throughout this section, references are made to three regions of the Pacific Ocean. These regions, delineated by the National Oceanic and Atmospheric Administration/National Marine Fisheries Service (NMFS) Science Centers, are defined for management purposes as (1) the Eastern North Pacific, an area in the Pacific Ocean that is east of 140 degrees (°) west (W) longitude and north of the equator; (2) the Central North Pacific, north of the equator and between the International Date Line (180°W longitude) and 140°W longitude; and (3) the Eastern Tropical Pacific, an area roughly extending from the United States (U.S.)-Mexico Border west to Hawaii and south to Peru.

3.7.2 Region of Influence

The region of influence for marine mammals includes the waters of the PMSR Study Area and pinniped haulouts on land at San Nicolas Island (SNI). Many cetaceans and pinnipeds are only seasonally present in the PMSR Study Area, so discussion of those life cycle events and threats to those species and populations elsewhere are considered part of the analysis in this EIS/OEIS. Populations and population trends of pinnipeds that haul out on islands that are not within the PMSR are discussed because these data provide the best estimates of pinniped populations that are expected to be present in the Study Area.

3.7.3 Approach to Analysis

The analysis of potential impacts on marine mammals due to the Proposed Action was based on the review of scientific publications cited in this section and from recent Navy documents that analyzed potential impacts from the same or similar activities on marine mammals (U.S. Department of the Navy, 2018b, 2018c).

A list of stressors potentially affecting marine mammals or their habitat was created by categorizing the different types of activities and the aircraft, vessels, ordnance, and expended materials used during those activities. Potential impacts on marine mammals resulting from exposure to these stressors would come primarily from direct physical injury or behavioral harassment. Analysis of these stressors on marine mammals is presented in Section 3.7.5 (Environmental Consequences). Mitigation measures proposed as a result of the analysis and to reduce or avoid impacts on marine mammals are presented in Chapter 5 (Standard Operating Procedures and Mitigation).

3.7.4 Affected Environment

3.7.4.1 General Background

Marine mammals are a diverse group of approximately 130 species. Most live predominantly in the marine habitat, although some species, such as seals, spend time in terrestrial habitats (Jefferson et al., 2015; Rice, 1998). The exact number of formally recognized marine mammal species changes periodically with new scientific understanding or findings (Rice, 1998). For a list of current species classifications, see the formal list "Marine Mammal Species and Subspecies" maintained online by the Society for Marine Mammalogy (Committee on Taxonomy, 2016, 2018). In this document, the United States Department of the Navy (Navy) follows the naming conventions presented by NMFS in the applicable annual Stock Assessment Reports (SARs) for the Pacific and Alaska covering the marine mammals present in the PMSR Study Area (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c; Muto et al., 2019, 2020a).

All marine mammals in the United States are protected under the Marine Mammal Protection Act (MMPA), and some species receive additional protection under the ESA. The MMPA defines a marine mammal "stock" as "…a group of marine mammals of the same species or smaller taxon in a common spatial arrangement that interbreed when mature" (16 United States Code section 1362; for further details, see Oleson et al. (2013). As provided by NMFS guidance, "…for purposes of management under the MMPA a stock is recognized as being a management unit that identifies a demographically independent biological population" (National Marine Fisheries Service, 2016c). However, in practice, recognized management stocks may fall short of this ideal because of a lack of information or for other reasons and, in some cases, may even include multiple species in a management unit, such as with *Mesoplodon* beaked whales[1] occurring off California (Carretta et al., 2019c; Carretta et al., 2020b).

The ESA provides for listing species, subspecies, or distinct population segments of species, all of which are referred to as "species" under the ESA. The Interagency Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the ESA provides that, "… any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature" (61 *Federal Register* [FR] 4722, February 7, 1996; 81 FR 62660, September 8, 2016). In short, a distinct population segment (DPS) is a portion of a species' or subspecies' population that is both discrete from the remainder of the population and significant in relation to the entire species, with the DPS then defined geographically instead of biologically. If a population meets the criteria to be identified as a DPS, it is eligible for listing under the ESA as a separate species (National Marine Fisheries Service, 2016c). Because they are designated based on different criteria, stocks designated under MMPA do not necessarily coincide with DPSs designated under the ESA (see discussion regarding this in 85 FR 62710; Monday, October 5, 2020). In the PMSR Study Area for example, there are humpback whales from the Mexico DPS and the Central America DPS (Bettridge et al., 2015; Carretta et al., 2019c; Carretta et al., 2020b). All humpback whales along the U.S. Pacific Coast have been designated by NMFS as belonging to the California, Oregon, and Washington stock (Carretta et al., 2019c; Carretta et al., 2020b). However, a portion of the population of humpback whales from the Hawaii DPS that breed in Hawaii may also feed off Washington and Oregon, but they belong to the NMFS-designated Central North Pacific stock as described in the SAR for Alaska (Carretta et al., 2019c;

[1] In waters off the U.S. West Coast, the *Mesoplodon* species *M. carlhubbsi*, *M. ginkgodens*, *M. perrini*, *M. peruvianus*, *M. stejnegeri* and *M. densirostris* have been grouped by NMFS into a single management unit (*Mesoplodon* spp.) in the Pacific SAR (Carretta et al., 2019c).

Carretta et al., 2020b; Muto et al., 2019). The stock structure for humpback whales in the Pacific is therefore being re-evaluated by NMFS (Carretta et al., 2019c; Carretta et al., 2020b).

There are 35 marine mammal species analyzed as present in the Study Area, including 7 mysticetes (baleen whales), 22 odontocetes (toothed cetaceans), 5 pinnipeds (seals and sea lions), and 1 mustelid (southern sea otter). Presentation in this section of the EIS/OEIS is alphabetical by common name within these groupings. Among these species there are multiple marine mammal stocks managed by NMFS and the southern sea otter is managed by the U.S. Fish and Wildlife Service (USFWS) in the United States Exclusive Economic Zone (EEZ). These species and stocks are presented in Table 3.7-1 along with an abundance estimate and associated coefficient of variation value as provided by the Stock Assessment Reports and other publications having species-specific data yet to be integrated into the NMFS reports (Calambokidis & Barlow, 2020; Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c; Muto et al., 2019, 2020a; Stewart & Weller, 2021; U.S. Fish and Wildlife Service, 2017). The abundance provided is the number of animals in a stock that NMFS has estimated are present in the specific portion of U.S. waters covered by that SAR (National Marine Fisheries Service, 2016c). For example, abundance of the California, Oregon, and Washington stock of Pacific white-sided dolphins is the number of those animals present within 300 nautical miles (NM) of the U.S. Pacific coast between the U.S. borders with Canada and Mexico.

The coefficient of variation provided for each of the abundances is a statistical term that describes the variation possible in the estimate of the stock abundance. The minimum population estimate is either a direct count (e.g., pinnipeds on land) or the lower 20th percentile of a statistical abundance estimate for a stock.

For each species and stock, relevant information on their status, distribution, population trends, and ecology is presented in Section 3.7.4 (Affected Environment), incorporating the best available science in addition to the analyses provided in the most recent U.S. Pacific and Alaska Marine Mammal SARs (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c; Muto et al., 2019, 2020a), which cover those stocks present in the PMSR Study Area. As noted above, in some cases species are grouped by NMFS into a single stock due to limited species-specific information, while in other cases a single species includes multiple stocks recognized for management purposes under the MMPA.

For summaries of the general biology and ecology of marine mammals beyond the scope of this EIS/OEIS, see Berta et al. (2006); Hoelzel (2002); Jefferson et al. (2015); Reynolds and Rommel (1999); Rice (1998); Twiss and Reeves (1999). Additional species profiles and information on the biology, life history, species distribution, and conservation of marine mammals can also be found through the following organizations:

- NMFS Office of Protected Resources (includes species distribution maps)
- Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (known as OBIS-SEAMAP) species profiles
- National Oceanic and Atmospheric Administration Cetacean Density and Distribution Mapping Working Group
- International Whaling Commission
- International Union for Conservation of Nature, Cetacean Specialist Group
- The Marine Mammal Commission
- Society for Marine Mammalogy

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Table 3.7-1: Marine Mammals Within the Point Mugu Sea Range Study Area

Common Name	*Scientific Name*[1]	*Stock*[2]	*ESA/MMPA Status*[3]	*Stock Abundance*[4] *(CV)*
Order Cetacea				
Suborder Mysticeti (baleen whales)				
Blue whale	*Balaenoptera musculus*	Eastern North Pacific	Endangered/Depleted	1,647 (0.07)
Bryde's whale	*Balaenoptera brydei/edeni*	Eastern Tropical Pacific	-	unknown
Fin whale	*Balaenoptera physalus*	California, Oregon, and Washington	Endangered/Depleted	9,029 (0.12)
Gray whale	*Eschrichtius robustus*	Eastern North Pacific	-	20,850[5] na
		Western North Pacific	Endangered/Depleted	290 na
Humpback whale	*Megaptera novaeangliae*	California, Oregon, and Washington	Endangered/Depleted	2,900 na
Minke whale	*Balaenoptera acutorostrata*	California, Oregon, and Washington	-	636 (0.72)
North Pacific right whale	*Eubalaena japonica*	Eastern North Pacific	Endangered/Depleted	31 (0.226)
Sei whale	*Balaenoptera borealis*	Eastern North Pacific	Endangered/Depleted	519 (0.4)
Suborder Odontoceti (toothed cetaceans)				
Baird's beaked whale	*Berardius bairdii*	California, Oregon, and Washington	-	2,697 (0.60)
Bottlenose dolphin	*Tursiops truncatus*	California Coastal	-	453 (0.06)
		California, Oregon, and Washington Offshore	-	1,924 (0.54)
Cuvier's beaked whale	*Ziphius cavirostris*	California, Oregon, and Washington	-/S	3,274 (0.67)
Dall's porpoise	*Phocoenoides dalli*	California, Oregon, and Washington	-	25,750 (0.45)
Dwarf sperm whale	*Kogia sima*	California, Oregon, and Washington	-	unknown
Harbor Porpoise	*Phocoena phocena*	Morro Bay	-	4,200[6] unk
Killer whale	*Orcinus orca*	Eastern North Pacific Offshore	-	300 (0.1)
		Eastern North Pacific Transient/West Coast Transient[7]	-	243 unk
Long-beaked common dolphin	*Delphinus delphis bairdii*	California	-	101,305 (0.49)
Mesoplodont beaked whales[8]	*Mesoplodon spp.*	California, Oregon, and Washington	-/S	3,044 (0.54)

Table 3.7-1: Marine Mammals Within the Point Mugu Sea Range Study Area (continued)

Common Name	*Scientific Name*[1]	*Stock*[2]	*ESA/MMPA Status*[3]	*Stock Abundance*[4] *(CV)*
Order Cetacea (continued)				
Suborder Odontoceti (toothed cetaceans) (continued)				
Northern right whale dolphin	*Lissodelphis borealis*	California, Oregon, and Washington	-	26,556 (0.44)
Pygmy sperm whale	*Kogia breviceps*	California, Oregon, and Washington	-	4,111 (1.12)
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	California, Oregon, and Washington	-	26,814 (0.28)
Pygmy killer whale	*Feresa attenuata*	-	-	229 (1.11)
Risso's dolphins	*Grampus griseus*	California, Oregon, and Washington	-	6,336 (0.32)
Short-beaked common dolphin	*Delphinus delphis*	California, Oregon, and Washington	-	969,861 (0.17)
Short-finned pilot whale	*Globicephala macrorhynchus*	California, Oregon, and Washington	-	836 (0.79)
Sperm whale	*Physeter macrocephalus*	California, Oregon, and Washington	Endangered/Depleted	1.997 (0.57)
Striped dolphin	*Stenella coeruleoalba*	California, Oregon, and Washington	-	29,211 (0.20)
Order Carnivora				
Family Phocidae (true seals)				
Harbor seal	*Phoca vitulina*	California	-	30,968 na
Northern elephant seal	*Mirounga angustirostris*	California	-	179,000 na
Family Otariidae (eared seals)				
California sea lion	*Zalophus californianus*	U.S. Stock	-	257,606 na
Guadalupe fur seal	*Arctocephalus townsendi*	Mexico to California	Threatened/Depleted	20,000 na
Northern fur seal	*Callorhinus ursinus*	California	-	14,050 na

Table 3.7-1: Marine Mammals Within the Point Mugu Sea Range Study Area (continued)

Common Name	*Scientific Name*[1]	*Stock*[2]	*ESA/MMPA Status*[3]	*Stock Abundance*[4] *(CV)*
Family Mustelidae (sea otter)				
Southern sea otter	*Enhydra lutris nereis*	Southern Sea Otter	Threatened/Depleted	2,826 na

[1]Taxonomy follows (Committee on Taxonomy, 2020).

[2]Stock designations for the U.S. Exclusive Economic Zones are from the Pacific (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c) and Alaska (Muto et al., 2019, 2020a) Stock Assessment Reports prepared by National Marine Fisheries Service. The stock assessment for Southern sea otters is provided by the USFWS (U.S. Fish and Wildlife Service, 2017).

[3]Populations or stocks defined by the MMPA as "strategic" (S) for one of the following reasons: (1) the level of direct human-caused mortality exceeds the potential biological removal level; (2) based on the best available scientific information, numbers are declining and species are likely to be listed as threatened species under the ESA within the foreseeable future; (3) species are listed as threatened or endangered under the ESA; (4) species are designated as "depleted" under the MMPA. A stock is "non-strategic," and a species that is not listed as threatened or endangered is indicated by "-"in the column.

[4]Stock Abundance and Coefficient of variation (CV) are numbers provided by the Stock Assessment Reports reflecting the number of marine mammals expected to be in the portion of the U.S. EEZ covered by a particular report (Carretta et al., 2019c; Carretta et al., 2020b; Muto et al., 2019; Muto et al., 2020b), with exceptions for gray whales and harbor porpoise as otherwise noted. The stock abundance is an estimate of the number of animals within the stock. The CV is a statistical metric used as an indicator of the uncertainty in the stock abundance estimate. Data from Barlow (2016) provided the abundance and CV for pygmy killer whale, and there is no assigned stock for that species on the U.S. West Coast (Carretta et al., 2019c, 2020c).

[5]The abundance for the Eastern North Pacific stock of gray whale was taken from Stewart and Weller (2021).

[6]The abundance number is as presented in (National Marine Fisheries Service, 2021) for the Morro Bay stock of harbor porpoise.

[7]This stock is mentioned briefly in the Pacific Stock Assessment Report and referred to as the "Eastern North Pacific Transient" stock, however, the Alaska Stock Assessment Report contains assessments of all transient killer whale stocks in the Pacific, and the Alaska Stock Assessment Report refers to this same stock as the "West Coast Transient" stock (Muto et al., 2019, 2020a).

[8]The six *Mesoplodont* beaked whale species in off California are *M. densirostris, M. carlhubbsi, M. ginkgodens, M. perrini, M. peruvianus, M. stejnegeri*.

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Four main types of marine mammals are generally recognized: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses [walruses do not occur in the Study Area]), sirenians (manatees and dugongs [none of which occur in the Study Area]), and several species of marine fissipeds (marine otters and polar bears [polar bears do not occur in the Study Area]) (Jefferson et al., 2015; Rice, 1998). To maintain consistency with past Navy analysis and retain familiar terminology, we have used Mysticetes for baleen whales; Odontocetes for toothed whales, dolphins, and porpoises; and Cetaceans to be inclusive of both. Mysticetes are universally large whales (more than 15 feet [ft.] as adults) that use baleen, a fibrous structure made of keratin (a type of protein like that found in human fingernails) instead of teeth, to feed. Mysticetes typically engulf, suck, or skim the water into their mouth and then push the water out as large quantities of prey, including small schooling fish, shrimp, and zooplankton (e.g., copepods and krill) are filtered by the baleen (Heithaus & Dill, 2009). Odontocetes range in size from slightly longer than 3.3 ft. to more than 60 ft. and have teeth, which they use to capture and consume individual prey. Odontocetes are divided into several families. Detailed reviews of the different groups of cetaceans can be found in Jefferson et al. (2015) and Perrin et al. (2009a). The different feeding strategies of mysticetes and odontocetes affect their distribution and occurrence patterns (Goldbogen et al., 2015).

Pinnipeds in the Study Area are also divided into two groups: phocids (true seals) and otariids (fur seals and sea lions). Phocids lack ear flaps, their fore flippers are short and have hair, and their hind flippers are oriented towards the back of their bodies and cannot be rotated forward. Otariids have external ear flaps, long hairless or partially haired fore flippers, and hind flippers that can be rotated beneath their bodies. Pinnipeds spend a large portion of their time in the Study Area on land at haulout sites used for resting and molting, and at rookeries used for breeding and nursing young. All pinnipeds return to the water to forage. Five species of pinnipeds (California sea lion, Guadalupe fur seal, northern fur seal, northern elephant seal, and Pacific harbor seal) regularly occur in the PMSR Study Area.

Southern sea otters (*Enhydra lutris nereis*) are present in the PMSR, occupying nearshore waters along the California coastline from San Mateo County to Santa Barbara County, with a colony also present in the nearshore waters around SNI (Carretta et al., 2017c; Hatfield et al., 2018; U.S. Fish and Wildlife Service, 2017). Sea otters rarely come onto land and spend most of their life in nearshore shallow water where they regularly swim, feed, and rest.

3.7.4.1.1 Species Unlikely to Have Meaningful Presence Within the Study Area

Several species that may be present in the northern Pacific Ocean have an extremely low probability of presence in the PMSR Study Area or may occur occasionally in very small numbers. This includes species that have a remote likelihood of occurring regularly in the Study Area, but may enter the Study Area during anomalous ocean-temperature shifts. These species are considered extralimital, meaning there may be a small number of sighting or stranding records within or near the Study Area, but that the Study Area is outside species current and expected range of normal occurrence. Those species carried forward for analysis are those likely to be found in the PMSR Study Area based on the most recent data available (see, for example, Barlow (2016); Henry et al. (2020)), and do not include species that may have once inhabited or transited the area but have not been sighted in recent years (e.g., species which were extirpated from factors such as 19th and 20th century commercial exploitation). Species unlikely to be present in the Study Area include the North Pacific right whale (*Eubalaena japonica*), rough-toothed dolphin (*Steno bredanensis*), and Steller sea lion (*Eumetopias jubatus*), which have been excluded from subsequent analysis for the reasons described below.

3.7.4.1.1.1 North Pacific Right Whale (*Eubalaena japonica*)

The likelihood of a North Pacific right whale being present in the Study Area is extremely low, as in recent years this species has only been routinely observed or acoustically detected in the Bering Sea (Brownell et al., 2001; Filatova et al., 2019; National Marine Fisheries Service, 2017c; Shelden et al., 2005; Wade et al., 2011; Wade et al., 2010; Wright et al., 2019; Wright et al., 2018; Zerbini et al., 2015; Zerbini et al., 2010), with occasional sightings of individuals in the Gulf of Alaska (Matsuoka et al., 2014; Širović et al., 2015a; Wade et al., 2011), waters off British Columbia and the border with Washington State (Ford et al., 2016; Širović et al., 2015a; U.S. Department of the Navy, 2015a), and Southern California (Muto et al., 2018; WorldNow, 2017). The most recent estimated population for the eastern North Pacific right whale is between 28 and 31 individuals (Muto et al., 2019, 2020a). Although this estimate may be reflective of a Bering Sea subpopulation, the total eastern North Pacific population is unlikely to be much larger (Wade et al., 2010). (Herman et al., 1980; Reilly et al., 2008; Rowntree et al., 1980; Salden & Mickelsen, 1999). There have been only four sightings, each of a single right whale, in Southern California waters over approximately the last 30 years (in 1988, 1990, 1992, and 2017) (Brownell et al., 2001; Carretta et al., 1994; National Marine Fisheries Service, 2017c; WorldNow, 2017). Sightings off California are rare, and there is no evidence that the western coast of the United States was ever highly frequented by this species (Brownell et al., 2001; National Marine Fisheries Service, 2017c; Scammon, 1874). Historically, even during the period of U.S. West Coast whaling through the 1800s, right whales were considered uncommon to rare off California (Reeves & Smith, 2010; Scammon, 1874). For the reasons presented above, North Pacific right whales are not expected to be present during any proposed testing and training activities and as a result are considered extralimital for purposes of the analysis.

3.7.4.1.1.2 Rough-Toothed Dolphin (*Steno bredanensis*)

Rough-toothed dolphins are not expected to be present in the PMSR Study Area. The range of the rough-toothed dolphin is known to occasionally include the Southern California coast during periods of warmer ocean temperatures, but there is no recognized stock for the U.S. West Coast (Carretta et al., 2019c; Carretta et al., 2020b). Several strandings were documented for this species in central and Southern California between 1977 and 2002 (Zagzebski et al., 2006). This species has not been observed during seven systematic ship surveys from 1991 to 2014 off the U.S. West Coast (Barlow, 2016). During 16 quarterly ship surveys off Southern California from 2004 to 2008, there was one encounter with a group of nine rough-toothed dolphins, which was considered an extralimital occurrence (Douglas et al., 2014).

3.7.4.1.1.3 Steller Sea Lion (*Eumetopias jubatus*)

Steller sea lions range along the north Pacific from northern Japan to California (Perrin et al., 2009b), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands (Muto et al., 2019). San Miguel Island and Santa Rosa Island were, in the past, the southernmost rookeries and haulouts for the Steller sea lions, but their range contracted northward in the 20th century, and now Año Nuevo Island off central California is currently the southernmost rookery (Muto et al., 2019; National Marine Fisheries Service, 2008; Pitcher et al., 2007). Steller sea lions pups were known to be born at San Miguel Island up until 1981 (National Marine Fisheries Service, 2008; Pitcher et al., 2007), and so, as the population continues to increase, it is anticipated that the Steller sea lions may re-establish a breeding colony on San Miguel Island in the future. In the Channel Islands and vicinity and despite the species general absence from the area, a consistent but small number of Steller sea lions (one to two individuals at a time) have been sighted in recent years. Approximately one to two adult and subadult male Steller

sea lions have been seen hauled out at San Miguel Island each year during the fall and winter over the last decade and adult and subadult males have occasionally been seen on rocks north of Northwest Point at San Miguel Island during the part of the summer in the past few years (Delong, 2019). In 2011, a vagrant Steller sea lion was observed hauled out at the Point Loma Space and Naval Warfare Systems Command facility in San Diego Bay, and a vagrant individual was observed in the water at the entrance channel during the monitoring of a pile driving project in 2015 (U.S. Department of the Navy, 2015b). Aerial surveys for pinnipeds in the Channel Islands from 2011 to 2015 encountered a single Steller sea lion at SNI in 2013 (Lowry et al., 2017). Additional sightings have included a single male that was seen hauled out on an oil production structure off Long Beach during the winter of 2015 and 2016, a Steller observed in 2018 hauled out on a buoy outside Ventura Harbor, and a lone adult female who gave birth to and reared a pup on San Miguel Island in the summer of 2017 (Delong, 2019). There have also been reports of Steller sea lions in waters off Mexico as far south as the various islands off the port of Manzanillo in Colima, Mexico (Gallo-Reynoso et al., 2020). Steller sea lions are not expected to be hauled out or otherwise present on SNI (Lowry et al., 2017; National Marine Fisheries Service, 2014a, 2019e). It is most likely that the few vagrant Steller sea lions sighted in Southern California waters would be from the Eastern Distinct Population Segment, which is not listed as threatened or endangered under the ESA.

3.7.4.1.2 Group Size

Many species of marine mammals, particularly odontocetes, are highly social animals that spend much of their lives living in groups called "pods." The size and structures of these groups are dynamic and, based on the species, can range from several to several thousand individuals. For example, aggregations of mysticete whales may form during particular breeding or foraging seasons, although they do not persist through time as a social unit. Marine mammals that live or travel in groups are more likely to be detected by observers, and group size characteristics are incorporated into the many density and abundance calculations. Group size characteristics are also incorporated into acoustic effects modeling to represent a more realistic patchy distribution for the given density (U.S. Department of the Navy, 2018d, 2019). The behavior of aggregating into groups is also important for the purposes of mitigation and monitoring since animals that occur in larger groups have an increased probability of being detected. A comprehensive and systematic review of relevant literature and data was conducted for available published and unpublished literature, including journals, books, technical reports, cruise reports, and raw data from cruises, theses, and dissertations. The results of this review were compiled into a Technical Report (U.S. Department of the Navy, 2019, 2020b), and that report includes tables of group size information by species along with relevant citations.

3.7.4.1.3 Habitat Use

Marine mammals occur in every marine environment in and around the Study Area, from bays, harbors, and coastal waters to open ocean environments. Their distribution is influenced by many factors, primarily patterns of major ocean currents, bottom relief, and water temperature, which, in turn, affect prey distribution and productivity. The continuous movement of water from the ocean bottom to the surface creates a nutrient-rich, highly productive environment for marine mammal prey in upwelling zones (Di Lorenzo et al., 2010; Jefferson et al., 2015), such as the upwelling zone in the Southern California Bight (Santora et al., 2017c); see also Section 3.3.4.1 (General Background) in Section 3.3 (Marine Habitats) in this EIS/OEIS. While most baleen whales are migratory, some species such as fin whales have been documented with an undetermined but small component of their population present within Southern California year round (Calambokidis et al., 2015; Forney & Barlow, 1998; Scales et al.,

2017b). Many of the toothed whales do not migrate in the strictest sense, but some do undergo seasonal shifts in distribution both within and outside of the PMSR Study Area, especially in Southern California (Becker et al., 2014; Becker et al., 2018; Becker et al., 2017; Forney & Barlow, 1998). In the Pacific, pinnipeds occur in coastal habitats, in waters over the continental shelves, and may migrate through the mid-ocean as far north as Alaska and the middle of the north Pacific near the International Date Line. Sea otters are the most coastal group of marine mammals and use shallow nearshore waters as habitat for reproducing, resting, and feeding.

In 2011, the National Oceanic and Atmospheric Administration convened a working group to map cetacean density and distribution within U.S. waters. The specific objective of the Cetacean Density and Distribution Mapping Working Group was to create comprehensive and easily accessible regional cetacean density and distribution maps that are time- and species-specific (National Oceanic and Atmospheric Administration, 2019b). Separately, to augment this more quantitative density and distribution mapping and provide additional context for marine mammal impact analyses, the Cetacean Density and Distribution Mapping Working Group also identified (through literature search, using data from surveys, habitat modeling, compilation of the best available science, and expert elicitation) areas of importance for cetaceans, such as reproductive areas, feeding areas, migratory corridors, and areas in which small or resident populations are located. Areas identified through this process have been termed biologically important areas (BIAs) (Ferguson et al., 2015b; Van Parijs, 2015).

These BIAs were not meant to define exclusionary zones or serve as sanctuaries or marine protected areas, and have no direct or immediate regulatory consequences (see Ferguson et al. (2015b) regarding the envisioned purpose for the BIA designations). The identification of BIAs were intended to be a "living" reference based on the best available science at the time, and were intended to be maintained and updated as new information became available. As new empirical data are gathered, these referenced areas may be calibrated to determine how closely they correspond to reality of the species' habitat uses and may be updated as necessary, including the potential addition of newly defined areas. Additionally, BIAs identified in the PMSR Study Area (Calambokidis et al., 2015) do not represent the totality of important habitat throughout the marine mammals' full range. The stated intention was to serve as a resource management tool; they were specifically not intended to serve as exclusionary areas. The currently identified boundaries should be considered dynamic and subject to change based on new information, such as "existing density estimates, range-wide distribution data, information on population trends and life history parameters, known threats to the population, and other relevant information" (Van Parijs, 2015). Products of the initial assessment process, including the U.S. West Coast BIAs, were compiled and published in March 2015 (Aquatic Mammals, 2015a, 2015b; Baird et al., 2015; Calambokidis et al., 2015; Ferguson et al., 2015b).

Twenty-eight BIAs were identified for four species off the U.S. West Coast (Calambokidis et al., 2015), with five of those areas located within or overlapping the PMSR Study Area**.** These identified seasonally used areas include feeding areas for blue whales, feeding areas for humpback whales, migration corridors for gray whales, and a small and resident population area for harbor porpoises (Calambokidis et al., 2015). These identified areas were not intended to reflect a complete list of areas where the species engage in important behavioral activities, are not equivalent to habitat or range, and likely represent only a fraction of a species' overall range (Ferguson et al., 2015b). NMFS has determined that for blue whales with regards to critical habitat, more research is needed to rigorously and specifically define the environmental features that make an area biologically important to blue whales (National Marine Fisheries Service, 2018c).

Since identification of the BIAs in 2015, numerous publications have added emphasis to the importance of incorporating the interannual variability observed in the presence of marine mammals into mitigation strategies. This is especially relevant to feeding areas designated as BIAs, some of which overlap with the PMSR, because the ephemeral presence of krill and forage fish prey sought by baleen whales does not consistently align with the statically bounded BIAs over shorter time frames (Burrows et al., 2016; Cimino et al., 2020; Deutsch et al., 2019; Fiechter et al., 2020; Hazen et al., 2018; Koehn et al., 2017; Rockwood et al., 2020; Szesciorka et al., 2020; Zaba et al., 2018).

3.7.4.1.4 Diving Behavior

All marine mammals, with the exception of polar bears, spend part of their lives underwater while traveling or feeding. Some species of marine mammals have developed specialized adaptations to allow them to make deep dives lasting over an hour, primarily for the purpose of foraging on deep-water prey such as squid. Other species spend the majority of their lives close to the surface, and make relatively shallow dives. The diving behavior of a particular species or individual has implications for the ability to visually detect them for mitigation and monitoring. In addition, their relative distribution through the water column based on diving behavior is an important consideration when conducting acoustic effects modeling. Information and data on diving behavior for each species of marine mammal were compiled and summarized in a technical report (U.S. Department of the Navy, 2017d) that provides estimates of time at depth based on available research. The dive data and group size information compiled in this technical report were developed for the Navy acoustic effects modeling used to support the analysis in this EIS/OEIS (U.S. Department of the Navy, 2019, 2020b).

3.7.4.1.5 Hearing and Vocalization

The typical terrestrial mammalian ear (which is ancestral to that of marine mammals) consists of an outer ear that collects and transfers sound to the tympanic membrane and then to the middle ear (Fay & Popper, 1994; Rosowski, 1994). The middle ear contains ossicles that amplify and transfer acoustic energy to the sensory cells (called hair cells) in the cochlea, which transforms acoustic energy into electrical neural impulses that are transferred by the auditory nerve to high levels in the brain (Møller, 2013). All marine mammals display some degree of modification to the terrestrial ear; however, there are differences in the hearing mechanisms of marine mammals with an amphibious ear versus those with a fully aquatic ear (Wartzok & Ketten, 1999). Marine mammals with an amphibious ear include the marine carnivores: pinnipeds, sea otters, and polar bears (Ghoul & Reichmuth, 2014; Owen & Bowles, 2011; Reichmuth et al., 2013). Outer ear adaptations in this group include external pinnae (ears) that are reduced or absent, and in the pinnipeds, cavernous tissue, muscle, and cartilaginous valves seal off water from entering the auditory canal when submerged (Wartzok & Ketten, 1999). Marine mammals with the fully aquatic ear (cetaceans and sirenians) use bone and fat channels in the head to conduct sound to the ear; while the auditory canal still exists it is narrow and sealed with wax and debris (Ketten, 1998).

The most accurate means of determining the hearing capabilities of marine mammal species are direct measures that assess the sensitivity of the auditory system (Nachtigall et al., 2000; Supin et al., 2001). Studies using these methods produce audiograms—plots describing hearing threshold (the quietest sound a listener can hear) as a function of frequency. Marine mammal audiograms, like those of terrestrial mammals, typically have a "U-shape," with a frequency region of best hearing sensitivity and a progressive decrease in sensitivity outside of the range of best hearing (Fay, 1988; Mooney et al., 2012; Nedwell et al., 2004; Reichmuth et al., 2013). The "gold standard" for producing audiograms is the

use of behavioral (psychophysical) methods, where marine mammals are trained to respond to acoustic stimuli (Nachtigall et al., 2000). For species that are untrained for behavioral psychophysical procedures, those that are difficult to house under human care, or in stranding rehabilitation and temporary capture contexts, auditory evoked potential methods are increasingly used to measure hearing sensitivity (e.g., Castellote et al., 2014; Finneran et al., 2009; Montie et al., 2011; Mulsow et al., 2011; Nachtigall et al., 2008; Nachtigall et al., 2007; Supin et al., 2001).

These auditory-evoked potential methods, which measure electrical potentials generated by the auditory system in response to sound and do not require the extensive training of psychophysical methods, can provide an efficient estimate of behaviorally measured sensitivity (Finneran & Houser, 2006; Schlundt et al., 2007; Yuen et al., 2005). The thresholds provided by auditory evoked potential methods are, however, typically elevated above behaviorally measured thresholds, and auditory-evoked potential methods are not appropriate for estimating hearing sensitivity at frequencies much lower than the region of best hearing sensitivity (Finneran, 2015; Finneran et al., 2016). For marine mammal species for which access is limited and therefore psychophysical or auditory evoked potential testing and training is impractical (e.g., mysticete whales and rare species), some aspects of hearing can be estimated from anatomical structures, frequency content of vocalizations, and extrapolations from related species.

Direct measurements of hearing sensitivity exist for approximately 25 of the nearly 130 species of marine mammals. Table 3.7-2 summarizes hearing capabilities for marine mammal species in the Study Area.

Table 3.7-2: Species Within Marine Mammal Hearing Groups Likely Found in the PMSR Study Area

Hearing Group	***Species Within the Study Area***
High-frequency cetaceans	Dall's porpoise
	Harbor porpoise
	Dwarf sperm whale
	Pygmy sperm whale
Mid-frequency cetaceans	Baird's beaked whale
	Common bottlenose dolphin
	Cuvier's beaked whale
	Killer whale
	Long-beaked common dolphin
	Northern right whale dolphin
	Pacific white-sided dolphin
	Risso's dolphin
	Short-beaked common dolphin
	Short-finned pilot whale
	Sperm whale
	Striped dolphin
Low-frequency cetaceans	Blue whale
	Fin whale
	Gray whale
	Humpback whale
	Minke whale
	Sei whale

Table 3.7-2: Species Within Marine Mammal Hearing Groups Likely Found in the PMSR Study Area (continued)

Hearing Group	*Species Within the Study Area*
Otariids and mustelids	California sea lion
	Guadalupe fur seal
	Northern fur seal
	Southern sea otter
Phocids	Harbor seal
	Northern elephant seal

For this analysis, marine mammals are arranged into the following functional hearing groups based on their generalized hearing sensitivities: high-frequency cetaceans (porpoises, Kogia spp.), mid-frequency cetaceans (delphinids, beaked whales, sperm whales), low-frequency cetaceans (mysticetes), otariids and mustelids in water and air (sea lions, and otters), and phocids in water and air (true seals). Note that the designations of high-, mid-, and low-frequency cetaceans are based on relative differences of sensitivity between groups, as opposed to conventions used to describe active sonar systems.

In recent Navy analyses for marine mammals effects, a single representative composite audiogram (Figure 3.7-1) was created for each functional hearing group using audiograms from published literature. For discussion of all marine mammal functional hearing groups and their derivation see technical report *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)* (U.S. Department of the Navy, 2017c). The mid-frequency cetacean composite audiogram is consistent with published behavioral audiograms of killer whales (Branstetter et al., 2017).

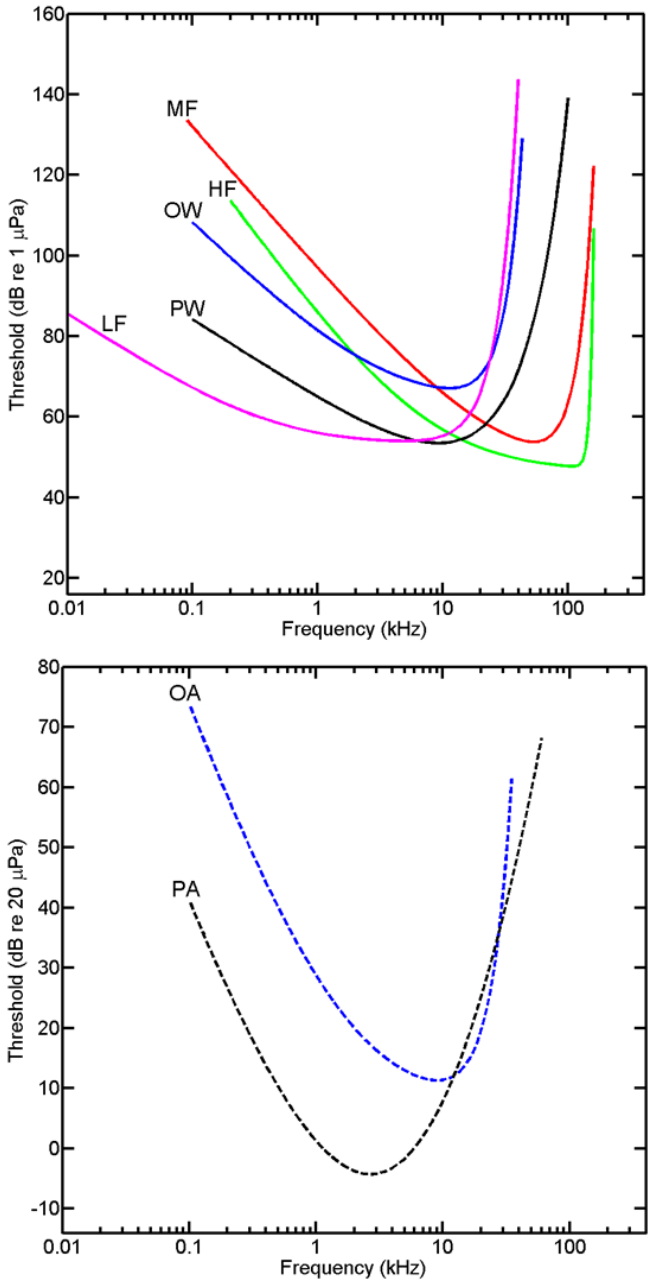
Similar to the diversity of hearing capabilities among species, the wide variety of acoustic signals used in marine mammal communication (including biosonar or echolocation) is reflective of the diverse ecological characteristics of cetacean species (see Avens, 2003; Richardson et al., 1995). This makes a succinct summary difficult (see Richardson et al., 1995; Wartzok & Ketten, 1999 for thorough reviews); however, a division can be drawn between lower-frequency communication signals that are used by marine mammals in general, and the specific, high-frequency biosonar signals that are used by odontocetes to sense their environment.

Non-biosonar communication signals span a wide frequency range, primarily having energy up into the tens of kilohertz (kHz) range. Of particular note are the very low-frequency calls of mysticete whales that range from tens of hertz to several kilohertz, and have source levels of 150–200 decibels referenced to 1 micropascal (dB re 1 µPa) (Cummings & Thompson, 1971; Edds-Walton, 1997; Širović et al., 2007; Stimpert et al., 2007; Varga et al., 2018; Wartzok & Ketten, 1999). These calls most likely serve social functions such as mate attraction, but may serve an orientation function as well (Green, 1994; Green et al., 1994; Richardson et al., 1995). Humpback whales are a notable exception within the mysticetes, with some calls exceeding 10 kHz (Zoidis et al., 2008).

Odontocete cetaceans use underwater communicative signals that, while not as low in frequency as those of many mysticetes, likely serve similar functions. The acoustic characteristics of these signals are quite diverse among species but can be generally classified as having dominant energy at frequencies below 20 kHz (Richardson et al., 1995; Wartzok & Ketten, 1999).

Odontocete cetaceans generate short-duration (200–500 microseconds), specialized clicks used in biosonar with peak frequencies between 10 and 200 kHz to detect, localize, and characterize

underwater objects such as prey (Au, 1993; Wartzok & Ketten, 1999). These clicks are often more intense than other communicative signals, with reported source levels as high as 229 dB re 1 µPa peak-to-peak (Au et al., 1974). The echolocation clicks of high-frequency cetaceans are narrower in bandwidth (i.e., the difference between the upper and lower frequencies in a sound) and higher in frequency than those of mid-frequency cetaceans (Madsen et al., 2005; Villadsgaard et al., 2007).



Notes: For hearing in water (top) and in air (bottom, phocids and otariids only). LF = low-frequency, MF = mid frequency, HF = high-frequency, OW = otariids and mustelids in water, PW = phocids in water, OA = otariids and mustelids in air, PA = phocids in air. For further information see U.S. Department of the Navy (2017c).

Figure 3.7-1: Composite Audiograms for Hearing Groups Likely Found in the Study Area

In general, frequency ranges of vocalization lie within the audible frequency range for an animal (i.e., animals vocalize within their audible frequency range); however, auditory frequency range and vocalization frequencies do not perfectly align. The frequency range of vocalization in a species can therefore be used to infer some characteristics of their auditory system; however, caution must be taken when considering vocalization frequencies alone in predicting the hearing capabilities of species for which no data exist (i.e., mysticetes). It is important to note that aspects of vocalization and hearing sensitivity are subject to evolutionary pressures that are not solely related to detecting communication signals. For example, hearing plays an important role in detecting threats (e.g., Deecke et al., 2002), and high-frequency hearing is advantageous to animals with small heads in that it facilitates sound localization based on differences in sound levels at each ear (Heffner & Heffner, 1982). This may be partially responsible for the difference in best hearing thresholds and dominant vocalization frequencies in some species of marine mammals (e.g., Steller sea lions, Mulsow & Reichmuth, 2010).

3.7.4.1.6 General Threats

Marine mammal populations can be influenced by various natural factors as well as human activities. There can be direct effects, such as from disease, hunting, and whale watching, or indirect effects such as through reduced prey availability or lowered reproductive success of individuals. Research presented in Twiss and Reeves (1999) and National Marine Fisheries Service (2011a, 2011c, 2011e, 2011f) provide a general discussion of marine mammal conservation and the threats they face. As detailed in National Marine Fisheries Service (2011d), investigations of stranded marine mammals are undertaken to monitor threats to marine mammals and out of concerns for animal welfare and ocean stewardship. Investigations into the cause of death for stranded animals can also provide indications of the general threats to marine mammals in a given location (Barcenas De La Cruz et al., 2017; Bradford & Lyman, 2015; Carretta et al., 2019a; Carretta et al., 2019b; Helker et al., 2019). For the marine mammal populations present in the PMSR Study Area, data regarding human-caused mortality and injury to NMFS-managed stocks is available in a NMFS Technical Memorandum for marine mammal stocks in Alaska (Delean et al., 2020; Helker et al., 2019) and for stocks present on the U.S. west coast (Carretta et al., 2019a; Carretta et al., 2020a). The known serious injury and mortalities resulting from non-Navy human activities that these reports summarize are important context in reviewing the analysis of potential impacts that may result from the continuation of Navy testing and training in the PMSR Study Area.

The causes for strandings include infectious disease, parasite infestation, climate change, pollution exposure, trauma (e.g., injuries from ship strikes or fishery entanglements), sound (human-generated or natural), harmful algal blooms and associated biotoxins, tectonic events such as underwater earthquakes, and ingestion or interaction with marine debris (for more information see NMFS Marine Mammal Stranding Response Fact Sheet; (National Marine Fisheries Service, 2016b)). For a general discussion of strandings and their causes as well as strandings in association with U.S. Navy activity, see the technical report titled *Marine Mammal Strandings Associated with U.S. Navy Sonar* (U.S. Department of the Navy, 2017f).

3.7.4.1.6.1 Water Quality

For a comprehensive and general discussion regarding potential impacts on the ocean's water quality, see Section 3.2 (Sediments and Water Quality) in this EIS/OEIS. Chemical pollution and impacts on ocean water quality are of great concern, although their effects on marine mammals are just starting to be understood (Bachman et al., 2015; Bachman et al., 2014; Balmer et al., 2019; Cossaboon et al., 2019;

Desforges et al., 2016; Foltz et al., 2014; Godard-Codding et al., 2011; Hansen et al., 2015; Jepson & Law, 2016; Law, 2014; Peterson et al., 2015; Peterson et al., 2014; Ylitalo et al., 2009; Ylitalo et al., 2005). As noted in Section 3.0 (Introduction), there are 23 federal and four California state offshore oil and gas production platforms present near or within the PMSR Study Area (Bureau of Ocean Energy Management, 2012; California State Lands Commission, 2017). Oil and other chemical spills are a specific type of ocean contamination that can have damaging effects on some marine mammal species directly through exposure to oil or chemicals and indirectly due to pollutants' impacts on prey and habitat quality (Engelhardt, 1983; Marine Mammal Commission, 2010; Matkin et al., 2008). In the five-year period from 2013–2017 along the Pacific coast, there were 127 pinnipeds found stranded with a serious injury or mortality caused by oil or tar coating their body (Carretta et al., 2019a).

On a broader scale ocean contamination resulting from chemical pollutants inadvertently introduced into the environment by industrial, urban, and agricultural use is also a concern for marine mammal conservation and has been the subject of numerous studies (Cossaboon et al., 2019; Desforges et al., 2016; Fair et al., 2010; Krahn et al., 2007; Krahn et al., 2009; Moon et al., 2010; Ocean Alliance, 2010). For example, the chemical components of pesticides used on land flow as runoff into the marine environment and can accumulate in the bodies of marine mammals and be transferred to their young through mother's milk (Fair et al., 2010). The presence of these chemicals in marine mammals has been assumed to put those animals at greater risk for adverse health effects and potential impact on their reproductive success given toxicology studies and results from laboratory animals (Fair et al., 2010; Godard-Codding et al., 2011; Krahn et al., 2007; Krahn et al., 2009; Peterson et al., 2015; Peterson et al., 2014). Desforges et al. (2016) have suggested that exposure to chemical pollutants may act in an additive or synergistic manner with other stressors, resulting in significant population-level consequences. Although the general trend has been a decrease in chemical pollutants in the environment following their regulation, chemical pollutants remain important given their potential to impact marine mammals (Bonito et al., 2016; Jepson & Law, 2016; Law, 2014).

3.7.4.1.6.2 Commercial Industries

For a discussion of the main general commercial industries and their impacts in the vicinity of the PMSR Study Area, see Sections 3.0.5.6.1 (Vessel Noise), 3.0.5.6.2 (Explosives and Noise Resulting from Fishing Activities), and 3.0.5.6.3 (Petroleum Exploration and Extraction). Human impacts on marine mammals have received much attention in recent decades, and include fisheries interactions, including bycatch (accidental or incidental catch), gear entanglement, and indirect effects from takes of prey species; noise pollution; marine debris (ingestion and entanglement); hunting (both commercial and native practices); vessel strikes; entrainment in power plant water intakes; increased ocean acidification; and general habitat deterioration or destruction.

Fishery Bycatch

Fishery bycatch is likely the most impactful threat to marine mammal individuals and populations and may account for the deaths of more marine mammals than any other cause (Geijer & Read, 2013; Hamer et al., 2010; Northridge, 2009; Read, 2008). In 1994, the MMPA was amended to formally address bycatch. The amendment requires the development of a take reduction plan when bycatch exceeds a level considered unsustainable and will lead to marine mammal population decline. In addition, NMFS develops and implements take reduction plans that help recover and prevent the depletion of strategic stocks of marine mammals that interact with certain fisheries (National Marine Fisheries Service, 2016c). For example, data now indicates that prohibitions placed on the California

coastal set-gillnet fisheries has resulted in harbor porpoise populations rebounding quickly following those fishery restrictions (Forney et al., 2020; National Marine Fisheries Service, 2021). This rebound includes the small and resident population of Morro Bay harbor porpoise that inhabit the PMSR, which numbered about 570 animals in 1991. However, survey estimates now have the population at approximately 4,200 porpoises, an approximately seven-fold increase in that population (National Marine Fisheries Service, 2021).

At least in part as a result of the amendment, estimates of bycatch in the Pacific declined by a total of 96 percent from 1994 to 2006 (Geijer & Read, 2013). Cetacean bycatch declined by 85 percent from 342 in 1994 to 53 in 2006, and pinniped bycatch declined from 1,332 to 53 over the same time period. Fishing related injuries occurring in 2011–2015 involving the stocks of marine mammals present in the PMSR Study Area totaled 1,107 marine mammals in that five-year period (Carretta et al., 2017a; Helker et al., 2017; National Marine Fisheries Service, 2018a).

Other Fishery Interactions

Fishery interactions other than bycatch include entanglement from abandoned or partial nets, fishing line, hooks, and the ropes and lines connected to fishing gear (Allyn & Scordino, 2020; Barcenas De La Cruz et al., 2017; California Coastal Commission, 2017; California Ocean Protection Council & National Oceanic and Atmospheric Administration Marine Debris Program, 2018; Carretta et al., 2019a; Carretta et al., 2019b; Currie et al., 2017b; Díaz-Torres et al., 2016; Helker et al., 2019; Lowry et al., 2018; National Marine Fisheries Service, 2018d; National Oceanic and Atmospheric Administration, 2016a, 2018c, 2020b; National Oceanic and Atmospheric Administration Marine Debris Program, 2014a; Polasek et al., 2017; Saez, 2018; Saez et al., 2020; Santora et al., 2020; Scordino et al., 2020). The National Oceanic and Atmospheric Administration Marine Debris Program (2014b) reports that abandoned, lost, or otherwise discarded fishing gear constitutes the vast majority of mysticete entanglements, and it has been noted elsewhere that interaction with marine debris is the leading cause of mortality to threatened Guadalupe fur seals (Barcenas De La Cruz et al., 2017; Carretta et al., 2017b). For Alaska between 2012 and 2016, there were 334 fishery-related serious injuries or mortalities (Helker et al., 2019). Between 2013 and 2017 in Alaska for the endangered Western steller sea lions, there were 115 fishery-related serious injuries leading to mortality (Delean et al., 2020). For the U.S. West Coast between 2013 and 2017 there were 1,043 cases of fishery-related entanglements (Carretta et al., 2019a). In May 2017, a gray whale calf was discovered dead onshore near the mouth of the Columbia River after becoming entangled in crab pot fishing gear (Cascadia Research, 2017a). Outside of U.S. waters, NMFS has identified incidental catches in coastal net fisheries off Japan, Korea, and northeastern Sakhalin Island as a significant threat to endangered Western North Pacific gray whales (Carretta et al., 2019c; Lowry et al., 2018); this species may be seasonally present in the PMSR. Species or large whales found entangled off the U.S. West Coast in 2015 and 2016 included stocks that are present in the Study Area such as humpback, gray, blue, fin, and killer whales, with a total of 133 entanglements to those species in the two-year period (National Marine Fisheries Service, 2018d; National Oceanic and Atmospheric Administration, 2017b). In the five-year reporting period between 2013 and 2017 for Alaska and the U.S. West Coast, most humpback whale injuries and mortality were from entanglements in fishing gear totaling 169 known occurrences (Carretta et al., 2019a; Helker et al., 2019). For the large whales along the U.S. West Coast in 2018, there were reports of entangled animals involving 34 humpback whales, 11 gray whales, 1 fin whale, 1 blue whale, and 2 that were unidentified (National Oceanic and Atmospheric Administration, 2019a). In 2019 there were 17 humpback whales, 8 gray whales, and 1 minke whale unconfirmed entanglements (National Oceanic and Atmospheric

Administration, 2020b). For the identified sources of entanglement in these NMFS reports, none included Navy expended materials.

Along the U.S. West Coast, hook and line fishery and gunshot wounds are two of the primary causes of pinniped serious injuries or mortalities injuries found in strandings (Barcenas De La Cruz et al., 2017; Carretta et al., 2019c; Carretta et al., 2017b; Carretta et al., 2013; Warlick et al., 2018). Between 2013 and 2017, there were 199 known cases of marine mammals being shot (Carretta et al., 2019a). In December 2018, due to the prevalence of known pinniped shootings, National Oceanic and Atmospheric Administration (NOAA) Fisheries was working on publishing guidelines for fishermen who take actions to deter pinnipeds and other marine mammals from their catch (National Oceanic and Atmospheric Administration, 2018b). Draft guidelines were presented by NMFS on August 21, 2020, that proposed, "… allowed actions to deter marine mammals from damaging fishing gear and catch, damaging personal or public property, or endangering personal safety, as long as these measures do not result in death or serious injury of marine mammals" (85 FR 53763, Monday, August 31, 2020). This includes the use of explosive devices to deter marine mammals, which would not be in violation of the MMPA.

In waters off Southern California, Washington, and Alaska, passive acoustic monitoring efforts since 2009 have documented the routine use of non-military explosives at-sea (Baumann-Pickering et al., 2013; Bland, 2017; Debich et al., 2014; Kerosky et al., 2013; Rice et al., 2018a; Rice et al., 2015; Simonis et al., 2020; Trickey et al., 2015; U.S. Department of the Navy, 2016; Wiggins et al., 2019; Wiggins et al., 2020). Based on the spectral properties of the recorded sounds and their correspondence with known fishing seasons or activity, the source of these explosions has been linked to the use of explosive marine mammal deterrents, which as a group are commonly known as "seal bombs" (Baumann-Pickering et al., 2013; Wiggins et al., 2019; Wiggins et al., 2020). Seal bombs are intended to be used by commercial fishers to deter marine mammals, particularly pinnipeds, from preying upon their catch and to prevent marine mammals from interacting and potentially becoming entangled with fishing gear (National Marine Fisheries Service, 2015b). The sound from a seal bomb was found to have a peak source level as high as 234 dB re 1 µPa (Wiggins et al., 2020).

Off Central and Southern California, several fisheries including purse seine and set gillnet fisheries use seal bombs as deterrents (Baumann-Pickering et al., 2013; Bland, 2017; Simonis et al., 2020; Wiggins et al., 2018). Based on the number of explosions recorded over the past several years off California, Washington, and Alaska, the use of seal bombs is much more prevalent than might be expected. For example, in the seven months from May to November 2013, over 24,000 explosions identified as seal bombs were recorded at a passive acoustic monitoring site (Site "M") off Long Beach, CA (Debich et al., 2015a). Since this passive acoustic monitoring device only recorded a sample of the total time, it is reasonable to assume there were more than 24,000 seal bomb explosions in that seven-month period. By comparison, in the 12-month period from August 2012 to August 2013, there were fewer than 400 underwater explosions recorded that were a result of Navy training and testing in Southern California (Baumann-Pickering et al., 2013); similar, more recent findings for waters off San Diego are presented in Wiggins et al. (2020). Acoustic monitoring in within the Monterey Bay National Marine Sanctuary has been documented seal bomb detonations occurring up to 88 times per hour, 335 per day, and 1,188 explosions per month (Ryan, 2019a; Simonis et al., 2020). The prevalent and continued use of seal bombs seems to indicate that, while a potential threat (resulting in at least three known marine mammal injuries in the past; Carretta et al. (2019a)), the seemingly routine use of seal bombs by fishermen off Central and Southern California has likely had no significant effect on populations of marine mammals given that it is likely at least some individuals, if not larger groups of marine mammals,

have been repeatedly exposed to this explosive stressor. In the most recently reported period of monitoring in the southern portion of PMSR (2016–2017), the number of explosions attributed to seal bombs decreased, although this was suggested to reflect a shift northward for the squid fishery and a shift to other species for the remainder of the fisheries as a result of the El Niño warming (Wiggins et al., 2018).

Since 2010, the Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife have conducted a removal program for California sea lions that prey on ESA-listed Chinook salmon and steelhead stocks at Bonneville Dam (Schakner et al., 2016). This is the same population of California sea lions that seasonally inhabit the PMSR and Southern California waters. Although non-lethal pyrotechnic and rubber buckshot are used as short-term deterrents, in 2016 (for example) these state of Fish and Wildlife activities lethally removed (i.e., euthanized) 59 California sea lions (Madson et al., 2017). In December 2018, Congress signed into law the Endangered Salmon Predation Prevention Act that allows NMFS to authorize the intentional lethal taking of California sea lions on the waters of the Columbia River and its tributaries for the protection of endangered salmon. In the five-year period from 2013 to 2017, there were 124 pinniped "removals" for that purpose (Carretta et al., 2019a).

Noise

In some locations, especially where urban or industrial activities or commercial shipping is intense, anthropogenic noise can be a potential habitat-level stressor (Dunlop, 2016; Dyndo et al., 2015; Erbe et al., 2019; Erbe et al., 2020; Erbe et al., 2018; Erbe et al., 2014; Frisk, 2012; Gedamke et al., 2016; Haver et al., 2018; Hermannsen et al., 2014; Hermannsen et al., 2019; Li et al., 2015; McKenna et al., 2012; Melcón et al., 2012; Merchant et al., 2014; Merchant et al., 2012; Mikkelsen et al., 2019; Miksis-Olds & Nichols, 2016; Nowacek et al., 2015; Pine et al., 2016; Rice et al., 2018b; Szesciorka et al., 2019; Williams et al., 2014c). Noise is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, avoiding predators, and communicating with other individuals. Noise may cause marine mammals to leave a habitat, impair their ability to communicate, or cause physiological stress (Courbis & Timmel, 2008; Erbe, 2002; Erbe et al., 2016; Erbe et al., 2020; Hildebrand, 2009; Rolland et al., 2012; Sprogis et al., 2020; Tyack et al., 2011; Tyne et al., 2017; Williams et al., 2014b). Noise can cause behavioral disturbances, mask other sounds including their own vocalizations, may result in injury, and in some cases may result in behaviors that ultimately lead to death (Erbe et al., 2016; Erbe et al., 2014; Jones et al., 2017; National Research Council, 2003, 2005; New et al., 2020; Nowacek et al., 2007; Southall et al., 2009b; Tyack, 2009; Würsig & Richardson, 2009). As noted in Section 3.0 (Introduction), anthropogenic noise the PMSR Study Area is generated from a variety of sources, including commercial shipping, oil and gas production activities, commercial and recreational fishing (including fish finding sonar, fathometers, and acoustic deterrent and harassment devices), recreational boating and whale watching activities, and research (including sound from air guns, sonar, and telemetry).

Given the presence of the ports of Los Angeles/Long Beach and the vessel Traffic Separation Scheme's lanes running through the PMSR as detailed in Section 3.0.5.5.1 (Vessel Noise), commercial vessel noise is the main source of underwater anthropogenic noise in the area (Rice et al., 2018b; Wiggins et al., 2018). Redfern et al. (2017a) found that shipping channels leading to and from the ports of Los Angeles and Long Beach may have degraded the habitat for blue, fin, and humpback whales due to the loss of communication space where important habitat for these species overlaps with elevated noise from commercial vessel traffic. These shipping channels running adjacent to the coast also run adjacent to or

through portions of the Channel Islands National Marine Sanctuary and some of the designated biologically important areas for cetaceans (Calambokidis et al., 2015; Moore et al., 2018). The San Pedro Channel is where the Traffic Separation Scheme's southern entrance and exit is located for these same ports (Los Angeles and Long Beach; see Figure 3.0-1). It can be assumed that the similar concentration of commercial vessel traffic moving through the San Pedro Channel into and out of the southern corner of the PMSR Study Area also impact marine mammal communication space in a similar manner as suggested for the shipping channels to the north investigated by Redfern et al. (2017a). Broadband ambient noise levels in the Santa Barbara Channel were recorded during the passage of a large container ship and determined to be approximately 125–130 dB re 1 µPa (root mean squared), with the assumption being that ambient noise levels in and around the traffic lanes passing through the PMSR would be at least equal to if not higher than the measurement of this single ship's passage (Szesciorka et al., 2019).

In many areas of the world, oil and gas seismic exploration in the ocean is undertaken using a group of air guns towed behind large research vessels. The airguns convert high-pressure air into very strong shock wave impulses that are designed to return information off the various buried layers of sediment under the seafloor. Seismic exploration surveys last many days and cover vast overlapping swaths of the ocean area being explored. Most of the impulse energy (analogous to underwater explosions) produced by these airguns is heard as low-frequency sound, which can travel long distances and has the potential to impact marine mammals. NMFS routinely issues permits for the taking of marine mammals associated with these commercial activities, although there has not been an oil and gas seismic survey permitted off California since 1995. In January 2018, the Department of Interior issued a Draft Proposed Program to offer lease sales under the National Outer Continental Shelf Oil and Gas Leasing Program, which includes potentially seven leases in Pacific (one in Southern California). There are 39 existing developed or active leases in Southern California Planning area (Bureau of Ocean Energy Management, 2019). Drilling and oil extraction also creates underwater noise (Erbe et al., 2013; Erbe & McPherson, 2017). Currently, in the nearshore waters of the Santa Barbara Channel in the central portion of the PMSR, there are 15 existing offshore oil and gas production facilities and another seven farther to the south off the Long Beach area (Bureau of Ocean Energy Management, 2012, 2017, 2019).

Hunting

Commercial hunting, as in whaling and sealing operations, provided the original impetus for marine mammal management efforts and has driven much of the early research on cetaceans and pinnipeds (Twiss & Reeves, 1999). With the enactment of the MMPA and the 1946 International Convention for the Regulation of Whaling, hunting-related mortality has decreased over the last 40 years. Unregulated harvests are still considered to be direct threats; however, since passage of the MMPA, there have been relatively few serious calls for culls of marine mammals in the United States compared to other countries, including Canada (Roman et al., 2013). Review of uncovered Union of Soviet Socialist Republics catch records in the North Pacific Ocean indicate extensive illegal whaling activity between 1948 and 1979, with a harvest totaling 195,783 whales. Of these, 169,638 were reported (over 26,000 takes unreported) by the Union of Soviet Socialist Republics to the International Whaling Commission (Ilyashenko et al., 2014; Ilyashenko & Chapham, 2014; Ilyashenko et al., 2013, 2015). On July 1, 2019, Japan resumed commercial whaling within its EEZ (BBC News, 2019; Nishimura, 2019; Victor, 2018), but this should not affect stocks or populations of marine mammals present in the PMSR Study Area.

For U.S. waters, there is a provision in the MMPA that allows for subsistence harvest of marine mammals, primarily by Alaska Natives. Subsistence hunting by Russia and Alaska Natives also occurs in the North Pacific, Chukchi Sea, and Bering Sea, involving marine mammal stocks that may be present in the PMSR Study Area. For example, in Russian waters in 2013, there were a total of 127 gray whales "struck" during subsistence whaling by the inhabitants of the Chukchi Peninsula between the Bering and Chukchi Sea (Ilyashenko & Zharikov, 2014). These gray whales harvested in Russian waters may be individuals from either the endangered Western North Pacific stock or the non-ESA-listed Eastern North Pacific stock that may migrate through the PMSR Study Area. In 2017 at the Kuskowim River in Alaska, a gray whale was killed and harvested in what NMFS described as being an "illegal hunt" (Carretta et al., 2019a). For whales, the quotas for "aboriginal subsistence whaling" are established by the International Whaling Commission (International Whaling Commission, 2020). For example, the International Whaling Commission quotas for 2019–2025 are for a total of 980 gray whales with not more than 140 landed in any one year by native people in Chukotka (Russia) and Washington State (International Whaling Commission, 2020).

Vessel Strike

Ship strikes are also a growing issue for most marine mammals, although mortality may be a more significant concern for species that occupy areas with high levels of vessel traffic, because the likelihood of encounter would be greater (Blondin et al., 2020; Calambokidis et al., 2019; Currie et al., 2017a; Keen et al., 2019; Moore et al., 2018; Redfern et al., 2020; Redfern et al., 2013; Redfern et al., 2019; Rockwood et al., 2017; Rockwood et al., 2020; Ryan, 2019b; Schoeman et al., 2020; Scordino et al., 2020; Szesciorka et al., 2019; Van der Hoop et al., 2013; Van der Hoop et al., 2015). For example, while some risk of a vessel strike exists for all the U.S. West Coast waters, 74 percent of blue whale, 82 percent of humpback whale, and 65 percent of fin whale known vessel strike mortalities occur in the shipping lanes associated with the ports of San Francisco and Los Angeles/Long Beach (Redfern et al., 2020; Rockwood et al., 2017; Rockwood et al., 2020). While most reported marine mammal vessel strikes involve commercial vessels transiting over or near the continental shelf (Laist et al., 2001), vessel strikes also occur in coastal areas frequented by smaller vessels and may involve smaller marine mammals and other species (Schoeman et al., 2020).

Since 1995, the U.S. Navy and U.S. Coast Guard have reported all known or suspected vessel collisions with whales to NMFS. The assumed under-reporting of whale collisions by vessels other than U.S. Navy or U.S. Coast Guard makes any comparison of data involving vessel strikes between Navy vessels and other vessels heavily biased. This under-reporting of civilian vessel collisions with whales is recognized by NMFS (Bradford & Lyman, 2015). Since some marine mammals within the PMSR may seasonally migrate, threats to the population in those other waters are relevant. Within Alaska waters, there were 28 reported marine mammal vessel strikes between 2013 and 2017 (Delean et al., 2020; Helker et al., 2019), and for the U.S. West Coast in the same period there were 65 reported vessel strikes to marine mammals (Carretta et al., 2020a; Carretta et al., 2019c), which is an approximate average consistent with previous reporting periods (Carretta et al., 2018c; Carretta et al., 2017b; Carretta et al., 2016a; Delean et al., 2020; Helker et al., 2017; Muto et al., 2016). Strandings in Washington between 1980 and 2006 included 19 stranded large whales with signs of blunt force trauma or propeller wounds indicative of a vessel strike and involving fin, grey, blue, humpback, sei, and Baird's beaked whales (Douglas et al., 2008). Since 2002, 10 out of the 12 stranded fin whales in Washington have showed evidence attributed to a large ship strike (Cascadia Research, 2017b). For the most recent NMFS database covering ship

strikes off California, there were 14 known vessel strikes in 2018 and 11 strikes (as of June 2) in 2019 (National Marine Fisheries Service, 2019c).

Power Plant Entrainment

Coastal power plants use seawater as a coolant during power plant operation. Intakes into these plants can sometimes trap (i.e., entrain) marine mammals that swim too close to the intake pipe. There were 22 marine mammal power plant entrainments (all pinnipeds) reported on the U.S. West Coast between 2013 and 2017 (Carretta et al., 2019a), but have been no known entrainments since 2015 and the end of 2018 in the most recent reporting period (Carretta et al., 2020a).

3.7.4.1.6.3 Disease and Parasites

Just as in humans, disease affects marine mammal health and especially older animals. (Pascual, 2015). Occasionally disease epidemics can also injure or kill a large percentage of a marine mammal population (Keck et al., 2010; Paniz-Mondolfi & Sander-Hoffmann, 2009; Simeone et al., 2015). Recent review of odontocetes stranded along the California coast from 2000 to 2015 found evidence for morbilliviral infection in 9 of the 212 animals examined, therefore indicating this disease may be a contributor to mortality in cetaceans stranding along the California coast (Serrano et al., 2017). Examination of Southern sea otter tissue samples have detected polyomavirus, parvovirus, and adenovirus infections in 80 percent of tested animals, suggesting endemic infection is present in the population (Siqueira et al., 2017). Miller et al. (2020a) found that, in Southern sea otters that were subjected to necropsy between 1998 and 2012 (n=560), the most prominent cause of death was infectious disease.

Mass die-offs of some marine mammal species have been linked to toxic algal blooms, which occurs as larger organisms consume multiple prey containing those toxins, thereby accumulating fatal doses (McCabe et al., 2016; National Oceanic and Atmospheric Administration, 2016b). An example is domoic acid poisoning in California sea lions and northern fur seals from the diatom *Pseudo-nitzschia* spp. (Doucette et al., 2006; Fire et al., 2008; Lefebvre et al., 2016; Lefebvre et al., 2010; Torres de la Riva et al., 2009). A comprehensive study in Alaska that sampled over 900 marine mammals across 13 species, including several mysticetes, odontocetes, pinnipeds, and mustelids, found detectable concentrations of domoic acid in all 13 species and saxitoxin, a toxin absorbed from ingesting dinoflagellates, in 10 of the 13 species (Lefebvre et al., 2016). Algal toxins may have contributed to the stranding and mortality of 30 whales (fin whales and humpback whale) found around the islands in the western Gulf of Alaska and the southern shoreline of the Alaska Peninsula starting in May 2015 (National Oceanic and Atmospheric Administration, 2016b; Rosen, 2015; Savage et al., 2017; Summers, 2017). These findings from studies in Alaska are relevant to the PMSR Study Area given that some fin whales and humpback whales from stocks in the PMSR Study Area migrate to Alaska to feed.

Additionally, all marine mammals have parasites that, under normal circumstances, probably do little overall harm, but under certain conditions, can cause serious health problems or even death (Bull et al., 2006; Fauquier et al., 2009; Jepson et al., 2005; Miller et al., 2020a; Simeone et al., 2015; Ten Doeschate et al., 2017). In California toxoplasmosis (often attributed to feral cat feces in urban area storm run-off) impacts seals, sea lions, and sea otters. The most commonly reported parasitic infections were from protozoans in sea otters; other parasites known to cause disease in pinnipeds and sea otters include nematodes, hookworms, lungworms, and thorny-headed worms (Miller et al., 2020a; Simeone et al., 2015).

3.7.4.1.6.4 Climate Change

The global climate is warming and is having impacts on some populations of marine mammals (Garcia-Aguilar et al., 2018; Jefferson & Schulman-Janiger, 2018; National Oceanic and Atmospheric Administration, 2015, 2018a; Peterson et al., 2006; Salvadeo et al., 2010; Shirasago-Germán et al., 2015; Silber et al., 2017; Simmonds & Eliott, 2009; Tulloch et al., 2018). Climate change can affect marine mammal species directly by causing shifts in distribution to match physiological tolerance under changing environmental conditions (Doney et al., 2012; National Marine Fisheries Service, 2018e; Peterson et al., 2006; Silber et al., 2017), which may or may not result in net habitat loss (some can experience habitat gains). Climate change can also affect marine mammals indirectly via impacts on prey, changing prey distributions and locations, and changes in water temperature (Giorli & Au, 2017; National Marine Fisheries Service, 2020c; Peterson et al., 2006; Rockwood et al., 2020; Santora et al., 2020). Sanford et al. (2019) have noted that severe marine heatwaves in California in 2014–2016 triggered marine mammal mortality events, harmful algal blooms, and declines in subtidal kelp beds. According to the Office of National Marine Sanctuaries (2019), climate drivers are currently the most concerning aspect of a decline in water quality and ecosystem health for giant kelp, mussels, and deep-sea corals across the Southern California Bight.

Changes in prey can impact marine mammal foraging success, which in turn affects reproduction success and survival. Starting in January 2013, an elevated number of strandings of California sea lion pups were observed in five Southern California counties. Additional California counties experiencing elevated California sea lion strandings include Santa Barbara County, Ventura County, Los Angeles County, and Orange County. This unusual number of strandings, continuing into 2016, were declared an Unusual Mortality Event (UME) by NMFS (National Oceanic and Atmospheric Administration, 2017a, 2018a). Although this UME was still considered as "ongoing" through 2017, the number of strandings recorded in 2017 were at or below average (National Oceanic and Atmospheric Administration, 2017a). This is the sixth UME involving California sea lions that has occurred in California since 1991. For this 2013–2015 event, NMFS biologists indicated that warmer ocean temperatures have shifted the location of prey species that are no longer adjacent to the rookeries, which thereby impacted the female sea lions' ability to find food and supply milk to their pups (National Oceanic and Atmospheric Administration, 2017a). As a result, this confluence of natural events causes the pups to be undernourished, and many are subsequently found stranded dead or emaciated due to starvation. In 2015, an UME was declared for Guadalupe fur seals along the entire California coast because of an eight-fold increase over the average historical number of strandings (approximately 12 per year) (National Marine Fisheries Service, 2019a; National Oceanic and Atmospheric Administration, 2018a). This event continued into 2017, although the number of animals involved declined in 2017; in April 2017 an additional seven Guadalupe fur seals stranded associated with this UME, with these latest strandings still being investigated. The initial assumption was that the cause for the increase in strandings was a change in the prey base due to warming conditions, but to date there has been no subsequent cause or other information in that regard provided by NMFS (National Oceanic and Atmospheric Administration, 2015, 2018a). In a similar occurrence for gray whales and since January 2019, an elevated number of gray whale strandings has occurred along the west coast of North America from Mexico through Alaska resulting in NMFS declaring a UME for this species (National Marine Fisheries Service, 2019b; National Oceanic and Atmospheric Administration, 2020a). This is similar to a previous UME for gray whales that occurred in 1999-2000.

Likely also due to changing prey distributions, data tagging efforts in July 2016 focusing on blue and fin whales had to be shifted north to central California waters when the majority of blue, fin, and humpback

whales encountered in Southern California waters were found to be too thin or otherwise in poor body condition to allow for them to be tagged (Oregon State University, 2017). In central California waters, the researchers identified good numbers of blue, fin, and humpback whales in better condition and indicative of a good feeding area that was likely to be sustained that season (Oregon State University, 2017).

Harmful algal blooms may become more prevalent in warmer ocean temperatures with increased salinity levels such that blooms will begin earlier, last longer, and cover a larger geographical range (Edwards, 2013; Moore et al., 2008). Warming ocean waters have been linked to the spread of harmful algal blooms into the North Pacific where waters had previously been too cold for most of these algae to thrive. Most of the mysticetes found in the PMSR Study Area spend part of the year in the North Pacific. The spread of the algae and associated blooms has led to mortality in marine mammals in locations where algae-caused biotoxicity had not been previously known (Lefebvre et al., 2016).

Climate change may indirectly influence marine mammals through changes in human behavior, such as increased shipping and oil and gas extraction, which benefit from sea ice loss (Alter et al., 2010). Ultimately impacts from global climate change may result in an intensification of current and on-going threats to marine mammals (Edwards, 2013). In addition, the ability of marine mammals to alter behaviors may serve as a buffer against measurable climate change–induced impacts and could delay or mask any adverse effects until critical thresholds are reached (Baker et al., 2016).

Marine mammals are influenced by climate-related phenomena, including storms and other extreme weather patterns such as the 2015–2016 El Niño in the ocean off the U.S. West Coast (see for example, Santora et al. (2020)). Generally, not much is known about how large storms and other weather patterns affect marine mammals, other than that mass strandings (when two or more marine mammals become beached or stuck in shallow water) sometimes coincide with hurricanes, typhoons, and other tropical storms (Bradshaw et al., 2006; Marsh, 1989; Rosel & Watts, 2008) or other oceanographic conditions. There have also been correlations in time and space between strandings and the occurrence of earthquakes. However, there has been no scientific investigation demonstrating evidence for or against a relationship between earthquakes and the occurrence of marine mammal strandings. Indirect impacts may include altered water chemistry in estuaries (low dissolved oxygen or increased nutrient loading), causing massive fish kills (Burkholder et al., 2004) and thereby changing prey distribution and availability for cetaceans (Stevens et al., 2006). Human responses to extreme weather events may indirectly affect behavior and reproductive rates of marine mammals. For example, Miller et al. (2010) reported an increase in reproductive rates in bottlenose dolphins in the Mississippi Sound after Hurricane Katrina, presumably resulting from an increase in fish abundance due to a reduction in fisheries landings, a decrease in recreational and commercial boat activities (National Marine Fisheries Service, 2007b), and an increase in the number of reproductively active females available during the breeding seasons following the storm. Smith et al. (2013) supplemented the findings from this study and documented a marked increase in foraging activity in newly identified foraging areas that were observed during the two-year study period after the storm.

Habitat deterioration and loss is a major factor for almost all coastal and inshore species of marine mammals, with effects ranging from depleting a habitat's prey base and the complete loss of habitat (Ayres et al., 2012; Kemp, 1996; Pine et al., 2016; Rolland et al., 2012; Smith et al., 2009; Veirs et al., 2015; Williams et al., 2014a). Many researchers predict that if oceanic temperatures continue to rise with an associated effect on marine habitat and prey availability, then either changes in foraging or life history strategies, including poleward shifts in many marine mammal species distributions, should be

anticipated (Alter et al., 2010; Fleming et al., 2016; Ramp et al., 2015; Salvadeo et al., 2015; Silber et al., 2017; Sydeman & Allen, 1999). Poloczanska et al. (2016) analyzed climate change impact data that integrates multiple climate influenced changes in ocean conditions (e.g., temperature, acidification, dissolved oxygen, and rainfall) to assess anticipated changes to a number of key ocean fauna across representative areas. In relation to the PMSR Study Area, Poloczanska et al. (2016) included the California Current Ecosystem in their assessment. Their results predict a northward expansion in the distribution of zooplankton, fish, and squid, all of which are prey for many marine mammal species. Examples from the 2018 NMFS California Current Ecosystem survey consistent with that hypothesis were notable northern shifts in the summer/fall distribution and abundance of short-beaked common dolphins and blue whales from their 1996 to 2014 multi-year average in response to changing ocean conditions (Becker et al., 2020a).

Concerns over climate change modifying the U.S. West Coast upwelling patterns, increasing levels of hypoxia, and ocean acidification have generated targeted research and monitoring efforts at selected "Sentinel Sites" (Lott et al., 2011); the Channel Islands National Marine Sanctuary is one of these monitored sites. There remains scientific uncertainty about how or if such changes will affect marine mammals and their prey, but acidification of the ocean could potentially impact the mobility, growth, and reproduction of calcium carbonate-forming organisms such as crustaceans and plankton, which are the direct prey of some marine mammals, as well as an important part of the overall food chain in the ocean, and can alter the propagation of sound underwater (Lynch et al., 2018; Rossi et al., 2016).

3.7.4.1.6.5 Marine Debris

Approximately 80 percent of marine debris in the ocean come from land-based sources (California Ocean Protection Council & National Oceanic and Atmospheric Administration Marine Debris Program, 2018; Thiel et al., 2018). In a seafloor survey off Southern California where the Navy has routinely trained and tested for decades, urban refuse (beverage cans, bottles, household items, and construction materials) constituted approximately 88 percent of the identified debris observed (Watters et al., 2010). Without improved waste management and infrastructure in underdeveloped coastal countries worldwide, the cumulative quantity of plastic waste available to enter the ocean from land is predicted to increase by an order of magnitude by 2025 (Jambeck et al., 2015). Marine debris is a global threat to marine mammals (National Oceanic and Atmospheric Administration Marine Debris Program, 2014a). A literature review by Baulch and Perry (2014), found that 56 percent of cetacean species are documented as having ingested marine debris. Interactions between marine mammals and marine debris, including derelict fishing gear and plastics, are significant sources of injury and mortality (Baulch & Perry, 2014). Comparing the Baulch and Perry review with that conducted by an earlier investigation (Laist, 1997), the percentage of marine mammal species with documented records of entanglement in or ingestion of marine debris has increased from 43 to 66 percent over the past 18 years (Bergmann et al., 2015). Ingestion of marine debris by marine mammals is a less well-documented cause of mortality than entanglement, but it is a growing concern (Bergmann et al., 2015; Jacobsen et al., 2010; Paul, 2019; Puig-Lozano et al., 2018). Baulch and Perry (2014) found that ingestion of debris has been documented in 48 cetacean species, with rates of ingestion as high as 31 percent in some populations. Attributing cause of death to marine debris ingestion is difficult (Laist, 1997), but ingestion of plastic bags and Styrofoam has been identified as the cause of injury or death of minke whales (De Pierrepont et al., 2005) and deep-diving odontocetes, including beaked whales (Baulch & Perry, 2014; Paul, 2019; Puig-Lozano et al., 2018), pygmy sperm whales (Sadove & Morreale, 1989; Stamper et al., 2006; Tarpley & Marwitz, 1993), and sperm whales (Jacobsen et al., 2010; Sadove & Morreale, 1989). As noted

elsewhere, without improved waste management and infrastructure in undeveloped coastal countries worldwide, the cumulative quantity of plastic waste available to enter the ocean from land is predicted to increase by an order of magnitude by 2025 (Jambeck et al., 2015).

Marine mammals migrating from California north to Alaska or south to Mexican waters and beyond also encounter threats outside the PMSR Study Area (Díaz-Torres et al., 2016; Thiel et al., 2018). In Alaska from 2011 through 2015, records of approximately 3,700 human-marine mammal interactions were reviewed by NMFS and determined to have resulted in 440 entanglement/entrapment-related marine mammal serious injury or mortality to various species (Helker et al., 2017). For example, between 2013 and 2017, the most common cause of serious injuries leading to mortality for the Eastern U.S. stock of Steller sea lions was entanglement in marine debris or fishery gear (totaling 186 sea lions). Likely reflecting fishery practices across the north Pacific, in the Northwest Hawaiian Islands where there have been active efforts at marine debris removal since 1996 and where the NOAA marine debris team has removed 848 metric tons of derelict fishing nets and debris, NOAA estimates an additional 52 metric tons of derelict fishing gear collects on the shallow coral reefs and shores there every year (National Oceanic and Atmospheric Administration, 2018c).

On the U.S. West Coast for the marine mammal stocks that are present in the Study Area, marine debris resulted in mortalities to 129 marine mammals in the five-year period from 2013 to 2017 (the majority California sea lions), 2 gray whales, and 1 each of the following species: humpback whale, minke whale, bottlenose dolphin, long-beaked common dolphin, and harbor porpoise (Barcenas De La Cruz et al., 2017; Carretta et al., 2019a; Carretta et al., 2016a). From 2013 through 2017, there were 10 blue whales, 54 humpback whales, and 6 sperm whales entanglements documented for those ESA-listed species (Carretta et al., 2019a). Marine debris documented off the Mexican Central Pacific coast (Díaz-Torres et al., 2016) and waters farther south (Thiel et al., 2018) also have the potential to impact marine mammals that migrate through the PMSR, such as the ESA-listed humpback whale distinct population segments from Mexico and Central America and the stock of blue whales along the U.S. West Coast that move at least as far south as the Costa Rica Dome[2] located off the west coast of Central America.

An estimated 75 percent or more of marine debris consists of plastic (California Coastal Commission, 2017; Derraik, 2002; Hardesty & Wilcox, 2017). High concentrations of floating plastic have been reported in the central areas of the North Atlantic and Pacific Oceans (Cozar et al., 2014). Plastic pollution found in the oceans is primarily dominated by particles smaller than 1 centimeter, commonly referred to as microplastics (Hidalgo-Ruz et al., 2012). Other researchers have defined microplastics as particles with a diameter ranging from a few micrometers up to 5 millimeters and not readily visible to the naked eye (Andrady, 2015). Most microplastic fragments and fibers found throughout the oceans result from the breakdown of larger items, such as clothing, packaging, and rope and have accumulated in the pelagic zone and sedimentary habitats (Thompson et al., 2004). Results from the investigation by Browne et al. (2011) have also suggested that microplastic fibers are discharged in sewage effluent resulting from the washing of synthetic fiber clothes. DeForges et al. (2014) sampled the Northeast Pacific Ocean in areas in and near the coastal waters of British Columbia, Canada, and found microplastics (those 62–5,000 micrometers in size) were abundant in all samples with elevated concentrations near urban centers; a finding that should be applicable to all urban centers such as those in the PMSR Study Area. Besseling et al. (2015) documented the first occurrence of microplastics in the

[2] The Costa Rica Dome is an area of deep ocean upwelling in the Eastern Tropical Pacific, centered approximately 500 km off the west of Costa Rica and Nicaragua. The size of the roughly elliptical area varies from approximately 300 to 1,000 km in an east-west direction and is an area of high productivity and known wintering location for blue whales.

intestines of a humpback whale; while the primary cause of the stranding was not determined, the researchers found multiple types of microplastics ranging in sizes from 1 millimeter to 17 centimeters. There is still a large knowledge gap about the negative effects of microplastics, but it remains a concern (Besseling et al., 2015). Specifically, the propensity of plastics to absorb and concentrate dissolved pollutant chemicals, such as persistent organic pollutants, is a concern because microfauna may be able to digest plastic nanoparticles, facilitating the delivery of dissolved pollutant chemicals across trophic levels and making them bioavailable to larger marine organisms, such as marine mammals (Andrady, 2015; Carlos de Sá et al., 2018; Gallo et al., 2018; Nelms et al., 2018).

Marine mammals as a whole are subject to the various influences and factors delineated in this section. If specific threats to individual species in the Study Area are known, those threats are described below in individual species accounts.

3.7.4.2 Mysticete Cetaceans Expected in the Study Area

3.7.4.2.1 Blue Whale (*Balaenoptera musculus*)

3.7.4.2.1.1 Status and Management

The world's population of blue whales can be separated into three subspecies, based on geographic location and some morphological differences. In the PMSR Study Area, the subspecies *Balaenoptera musculus* is present. The blue whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range, but there is no designated critical habitat for this species (Carretta et al., 2019c, 2020c; Muto et al., 2019, 2020a).

3.7.4.2.1.2 Habitat and Geographic Range

Blue whales inhabit all oceans and typically occur near the coast and over the continental shelf, though they are also found in oceanic waters, having been sighted, acoustically recorded, and satellite tagged in the eastern tropical Pacific (Ferguson, 2005; Stafford et al., 2004); (Barlow, 2016; Bradford et al., 2013; Hamilton et al., 2009b; Klinck et al., 2015; Stafford et al., 2001).

The Eastern North Pacific Stock of blue whales includes animals found in the eastern north Pacific from the northern Gulf of Alaska to the eastern tropical Pacific (Carretta et al., 2019c, 2020c). Based on habitat models derived from line-transect survey data collected between 1991 and 2009 off the U.S. West Coast, relatively high densities of blue whales are predicted off Southern California during the summer and fall (Barlow et al., 2009; Becker et al., 2010; Becker et al., 2016; Forney et al., 2012). Data from year-round surveys conducted off Southern California from 2004 to 2019 show that the majority of blue whales were sighted in summer and fall, with only single sightings in winter and spring (Campbell et al., 2015; Trickey et al., 2020). In the Southern California Bight in summer and fall, the highest densities of blue whales occurred along the 200-meter (m) isobath in waters with high surface chlorophyll concentrations (Redfern et al., 2013). Offshore of Southern California, blue whales have been documented in sightings and tracked (using satellite tags) as occurring from nearshore shallow waters close to the coast, as well as far from the coast in deep ocean waters (>2,000 m) and well beyond the continental shelf (Barlow, 2016; Calambokidis & Barlow, 2004, 2013; Douglas et al., 2014; Mate et al., 2016, 2017; Širović et al., 2004; Trickey et al., 2020). This species has also frequently been heard on passive acoustic recording devices in Southern California, with the most detections occurring in the July to December time frame, although with fewer detections in all months except June (Baumann-Pickering et al., 2018; Debich et al., 2015b; Lewis & Širović, 2018; Rice et al., 2017; Rice et al., 2018b; Rice et al., 2020; Širović et al., 2016; Širović et al., 2015b). Based on approximately 3 million detections in the

waters of the Southern California Bight between 2006 and 2012, Širović et al. (2015b) found that blue whale vocalizations were more common at coastal sites and near the northern Channel Islands and generally heard between June and January, with a peak in September. There was large variation in the spatial distribution among blue whales tagged in Southern California in 2014 and 2015, with the distance to shore ranging from less than 1 kilometer (km) up to 884.8 km and blue whale movement along the Pacific coastline extending south to 7.4 degrees north latitude and north to 50 degrees north latitude just off British Colombia, Canada and as far south as Ensenada, Mexico (Irvine et al., 2019; Mate et al., 2015b).

Tagging data from blue whales in 2014, 2015, and 2016 off Southern California waters indicated year-to-year variation in the highest use areas within the Southern California Bight (Mate et al., 2016, 2017; Mate et al., 2018b; Mate et al., 2015b). In 2014, the area of highest use for blue whales was between Point Dume and Mugu Canyon, out to approximately 30 km from shore (Becker et al., 2018; Irvine et al., 2019; Mate et al., 2015b). Most of this highest use area is to the east and inshore of the PMSR boundary and the range areas where the majority of activities occur. Area of highest use in 2015 was off the west end of San Miguel Island, but in 2016 there were very few blue whales present in the Southern California Bight when the high use area shifted to Point Arena in Northern California to the north of San Francisco (Irvine et al., 2019; Mate et al., 2017).

Most baleen whales spend their summers feeding in productive waters near the higher latitudes and winters in the warmer waters at lower latitudes (Širović et al., 2004). Blue whales in the eastern north Pacific are known to migrate between higher latitude feeding grounds of the Gulf of Alaska and the Aleutian Islands to lower latitudes, including Southern California; Baja California, Mexico; and the Costa Rica Dome (Calambokidis & Barlow, 2004; Calambokidis et al., 2009a; Calambokidis et al., 2009b; Mate et al., 2016, 2017; Mate et al., 2015b; Palacios et al., 2019). The West Coast is known to be a blue whale feeding area for the Eastern North Pacific stock during summer and fall (Bailey et al., 2009; Calambokidis et al., 2009a; Calambokidis et al., 2019; Calambokidis et al., 2015; Mate et al., 2015b; Palacios et al., 2019). Photographs of blue whales off California that have been matched to individuals photographed off the Queen Charlotte Islands in northern British Columbia and the northern Gulf of Alaska (Calambokidis et al., 2009a) and satellite tag data have also demonstrated this link between these areas (Mate et al., 2017; Mate et al., 2015b). These animals have shown site fidelity, returning to their mother's feeding grounds on their first migration (Calambokidis & Barlow, 2004), and exhibit strong foraging site fidelity, even when conditions are not conducive to successful foraging in less than optimal years (Cascadia Research, 2019; Palacios et al., 2019). However, a sufficient density of prey is necessary to balance the energy requirements of their lunge feeding strategy (Frisch-Jordan et al., 2019; Goldbogen et al., 2015; Hazen & Goldbogen, 2015; Irvine et al., 2019; Mate et al., 2019; Palacios et al., 2019; Straley et al., 2017; Szesciorka et al., 2020), and there are in daily, seasonal, interannual, and decadal variability in the locations and density of krill at a given feeding location (Brinton & Townsend, 2003; Cimino et al., 2020; Deutsch et al., 2015; Fiechter et al., 2020; Keister et al., 2011; Rockwood et al., 2020; Santora et al., 2017a; Santora et al., 2020; Santora et al., 2017c; Santora et al., 2011; Zaba et al., 2018), which influence how long they remain within a given feeding area.

Blue whales in Southern California are generally feeding during their seasonal presence along the U.S. West Coast (Abrahms et al., 2019a; Bailey et al., 2009; Calambokidis et al., 2009a; Calambokidis et al., 2015; Mate et al., 2015b). Three of nine feeding areas for blue whales identified by Calambokidis et al. (2015) along the U.S. West Coast partially overlap the Point Mugu Sea Range in the summer to fall (June through October) feeding season as defined for these BIAs (Figure 3.7-2). An increase in the ocean

temperatures off Southern California over the period between 2008 and 2017 has, however, resulted in blue whales in recent years arriving in April when they used to start the feeding season in June, although they are still generally departing out of California/U.S. waters heading south toward the eastern tropical Pacific by the end of October (Mate et al., 2017; Szesciorka et al., 2020).

The area covering 1,743 square kilometers (km^2) and designated the "Point Conception/Arguello" blue whale feeding area (Calambokidis et al., 2015) is farthest to the north within the PMSR. There are four oil production platforms and the Eastbound Lane for Traffic Separation Scheme through the Santa Barbara Channel leading to the ports of Los Angeles/Long Beach present within this BIA (Figure 3.7-2), with two of those platforms and vessels creating noise with the potential to disturb feeding blue whales in that BIA. Approximately 87 percent of this BIA is within the PMSR Study Area boundary.

Immediately to the south (approximately 2 NM distance) is a second blue whale BIA, covering 1,981 km^2 and designated the "Santa Barbara Channel and San Miguel" blue whale feeding area (Calambokidis et al., 2015), which has a 61 percent overlap with the PMSR Study Area. The Westbound Lane for Traffic Separation Scheme leading from the ports of Los Angeles/Long Beach is present within this BIA (Figure 3.0-1); see also Redfern et al. (2019).

A third blue whale BIA covering 427 km^2 is located just to the north of SNI and was designated the "San Nicolas Island" feeding area (Calambokidis et al., 2015); this BIA is completely within the PMSR Study Area boundary.

Blue whales feed almost exclusively on various types of zooplankton, especially krill (Jefferson et al., 2015). However, it has recently been shown that blue whales in the Indian Ocean can locate and feed on dense swarms of other larger prey when present (De Vos et al., 2018). Researchers have suggested that blue whales in Southern California waters, which includes the PMSR, tend to return to the same feeding areas each year either due to the persistence of foraging hotspots or due to learned behavior (Abrahms et al., 2019a; Becker et al., 2018; Calambokidis et al., 2009a; Calambokidis et al., 2009b; Calambokidis et al., 2015; Irvine et al., 2014). This would suggest that the identified feeding BIAs may be good indicators for where blue whales will be found despite year-to-year changes in prey availability. Santora et al. (2011) found that between 2000 and 2009 in the PMSR Study Area, concentrations of krill were inversely correlated with oceanographic upwelling, such as occurs off Point Conception, or locations of strong offshore transport, and instead were found aggregated at the edges of such locations. The blue whale BIAs are only partially associated with identified high-density krill and other forage fish locations (Santora et al., 2017b; Santora et al., 2017c; Santora et al., 2011).

The blue whale feeding areas identified in waters extending from Point Conception to the Mexico border represent only a fraction of the total area within those waters where habitat models predict high densities of blue whales (Calambokidis et al., 2015; Ferguson et al., 2015b). Additionally, while those identified areas tend to have the highest blue whale density from July through October when averaged over multiple years, the areas are associated with ephemeral prey distributions that are less predictable when considering short time frames and smaller areas (Abrahms et al., 2019b; Becker et al., 2018; Ferguson et al., 2015b; Fiechter et al., 2020; Hazen et al., 2016; Hazen et al., 2018; Rockwood et al., 2020; Santora et al., 2020; Zaba et al., 2018). As a result of interannual variability, the designated feeding areas may not reflect the highest density or certain presence of blue whales in a given area in any one season or within the short time period involving most Navy testing and training events.

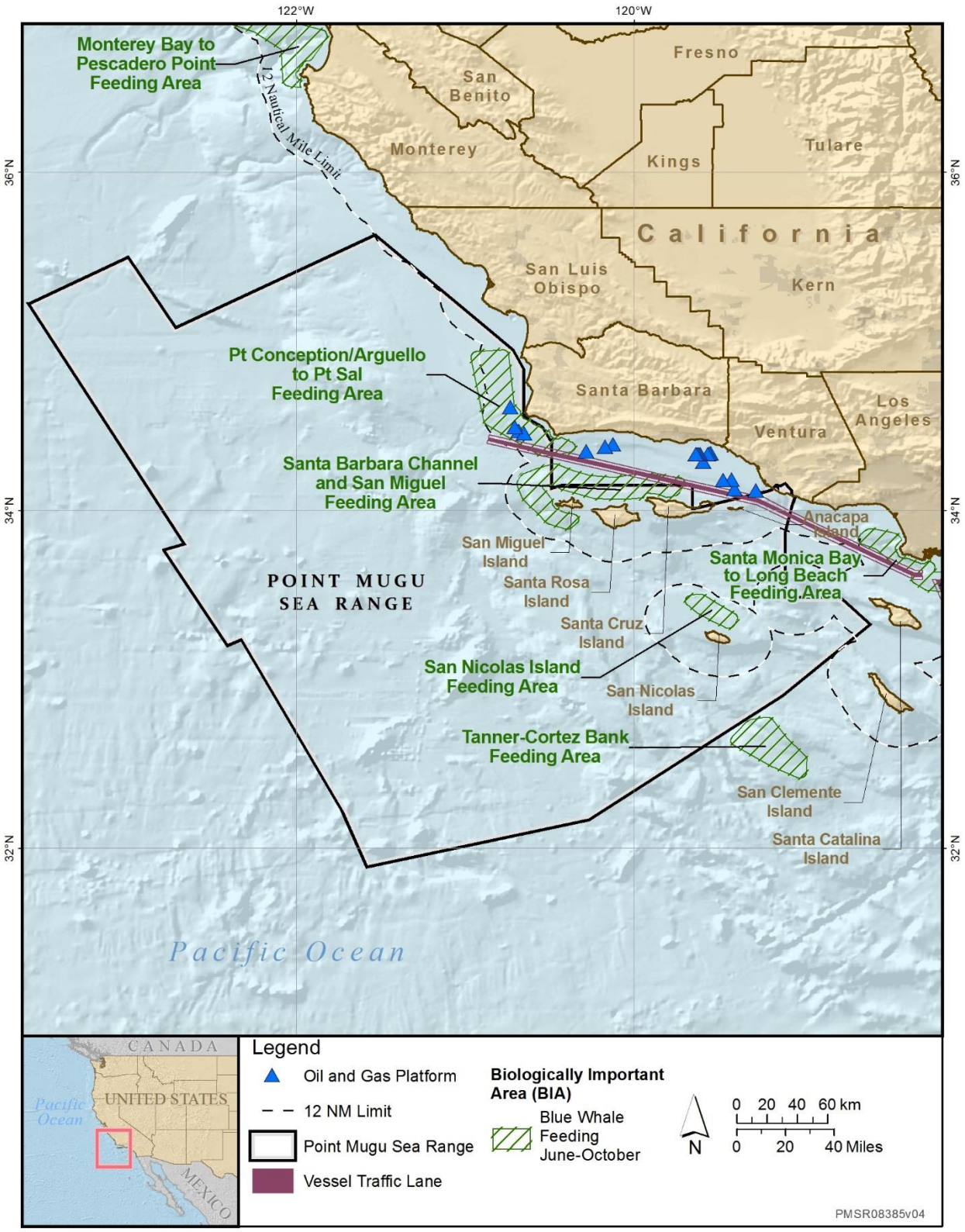


Figure 3.7-2: Blue Whale Biologically Important Feeding Areas Identified in the Vicinity of the PMSR Study Area (per Calambokidis et al. 2015)

Although limited by the relatively small sample sizes, this season-to-season variability in the use of the feeding areas has been demonstrated at the level of individual blue whales by satellite tags. Location data from tags deployed on 171 blue whales between 1993 and 2008 demonstrated home range and core area presence (Irvine et al., 2014) over a larger area than reflected by the two designated blue whale feeding area boundaries. Tags were also deployed on blue whales off Southern California in 2014, 2015, and 2016 (Mate et al., 2017; Mate et al., 2015b).

In 2014, the San Diego and the Santa Monica Bay to Long Beach BIAs (located outside and to the south and east of the PMSR) were the most heavily used areas by the tagged individuals, whereas the Santa Barbara Channel and San Miguel Island BIA and the Point Conception/Arguello BIA were the most heavily used by tagged individuals in 2015. In 2016 researchers found Santa Barbara Channel and San Miguel Island and the Point Conception/Arguello BIAs minimally used by any blue whales, and the whales encountered in those BIAs and elsewhere in Southern California were too thin or otherwise in poor body condition to meet the tagging protocols (Oregon State University, 2017). Tagging efforts were therefore shifted to Central California waters where the researchers identified good numbers of blue, fin, and humpback whales in better condition, which was likely indicative of better prey availability in those more northern waters during that season (Oregon State University, 2017). The SNI BIA and the Tanner/Cortez Banks BIA were used only minimally by tagged blue whales in 2014, 2105, and 2016 (Mate et al., 2017). It is due to the recognized variability in the presence of blue whales in any given area such as a BIA, which is believed to be driven largely by krill as available prey in a location (Barlow et al., 2020; Fiechter et al., 2020; Hazen et al., 2016; Hazen et al., 2018; Rockwood et al., 2020; Santora et al., 2020; Szesciorka et al., 2020; Zaba et al., 2018), that Navy includes real-time detection and action as part of the dynamic mitigation measures as detailed in Chapter 5 (Standard Operating Procedures and Mitigation) of this EIS/OEIS. These mitigation measures (such as those presented in Table 5.3-5 as actions taken when a lookout detects a marine mammal in one of the mitigation zones around a moving vessel) are in addition to static geographically based mitigation where such measures are both effective and practicable to implement.

3.7.4.2.1.3 Population Trends

Widespread whaling over the last century is believed to have decreased the global blue whale population to approximately 1 percent of its pre-whaling population size at its lowest point (Branch, 2007; Monnahan, 2013; Monnahan et al., 2014; Rocha et al., 2014; Širović et al., 2004). Since that time, off the Pacific Coast, the blue whale population has increased between 1979–80 and 1991 (Barlow, 1994) and between 1991 and 1996 (Barlow, 1997). Calambokidis et al. (2009a) suggested that when feeding conditions off California are not optimal, blue whales may move to other regions to feed, including waters farther north. In 2005–2006, during a period of cooler ocean temperatures, blue whales were distributed more widely throughout Southern California waters than in previous years (Peterson et al., 2006). There had been a northward shift in blue whale distribution within waters off California, Oregon, and Washington (Abrahms et al., 2019a; Bailey et al., 2009; Barlow, 2010, 2016; Calambokidis et al., 2009a; Irvine et al., 2014; Širović et al., 2015b). In retrospect, it would seem that the interannual variability in the presence and distribution of blue whales off California was seen in some years as changes in abundance rather than a redistribution of the population, as more recently documented and now part of the expected variation in local abundances (Becker et al., 2018; Hazen et al., 2016; Rockwood et al., 2020; Santora et al., 2020).

Mark-recapture estimates reported on by Calambokidis et al. (2009a) “indicated a significant upward trend in abundance of blue whales” at a rate of increase just under 3 percent per year for the U.S. West

Coast blue whale population in the Pacific (see also Calambokidis and Barlow (2013)). Although still listed as endangered under the ESA and as noted in the National Marine Fisheries Service (2020d) Recovery Plan for the species, the most current information suggests that the population in the PMSR Study Area may have recovered and has been at a stable level following the cessation of commercial whaling in 1971 (Calambokidis & Barlow, 2020; Campbell et al., 2015; Carretta et al., 2019c; Carretta et al., 2015; International Whaling Commission, 2016; Monnahan, 2013; Monnahan et al., 2014; National Marine Fisheries Service, 2018c; Širović et al., 2015b; Valdivia et al., 2019). Based on a comparison of sighting records from the 1950s to 2012 in the Southern California Range Complex that is immediately south of the PMSR Study Area, Smultea (2014) determined that blue whales ranked sixth in occurrence among cetaceans which, "…represents a clear relative increase from historical records." The current best overall estimate of abundance for blue whales along the U.S. West Coast is provided by photo identification data gathered between 2015 and 2018 along the U.S. West Coast (Calambokidis & Barlow, 2020). This estimate, which includes the Mexico DPS and the Central America DPS in n = 1,898 (coefficient of variation [CV] = 0.08), is higher than the abundance (n = 1,496) in the 2019 Pacific SAR.

3.7.4.2.1.4 Predator and Prey Interactions

Blue whales feed almost exclusively on various types of zooplankton, especially krill (Jefferson et al., 2015); however, it has recently been shown that blue whales can locate and feed on dense swarms of other larger prey when present (De Vos et al., 2018). In Southern California, tagged blue whales have been recorded feeding from the surface to depths approaching 300 m (Goldbogen et al., 2013).

Blue whales have been documented to be preyed on by killer whales; 25 percent of photo-identified whales in the Gulf of California carry rake scars from killer whale attacks (Jefferson et al., 2008b; Pitman et al., 2007; Sears & Perrin, 2009).

3.7.4.2.1.5 Species-Specific Threats

Blue whales are susceptible to entanglement in fishing gear and ship strikes (Calambokidis et al., 2019; McKenna et al., 2015; Redfern et al., 2020; Redfern et al., 2013; Redfern et al., 2019; Rockwood et al., 2017; Rockwood et al., 2020; Szesciorka et al., 2019). There were 10 known blue whale entanglements in the two-year period between 2016 and 2017 off the U.S. West Coast (Carretta et al., 2019a). There have been no Navy vessel strikes to blue whales in at least the last 15 years (Carretta et al., 2017b; National Marine Fisheries Service, 2015c, 2019c). Available data from NMFS indicate that, in waters off California between 1991 and 2010, there were 14 ship strikes involving blue whales (Berman-Kowalewski et al., 2010; Calambokidis, 2012; Calambokidis et al., 2009a; Laggner, 2009; Monnahan et al., 2015; National Marine Fisheries Service, 2011f, 2019c). Between 2007 and 2011 in waters of the U.S. West Coast, 10 blue whales died from vessel strikes (Carretta, 2013; Carretta et al., 2016a). Blue whale mortality and injuries attributed to ship strikes in California waters were zero in the reporting period covering 2011–2015, but there has been one strike mortality in California waters in each year, for a total of four non-Navy blue whale ship strike deaths between 2016 and 2019 (Carretta et al., 2019a; Carretta et al., 2018a; Carretta et al., 2017b; National Marine Fisheries Service, 2019c). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.2.2 Bryde's Whale (*Balaenoptera brydei/edeni*)

3.7.4.2.2.1 Status and Management

This species is not listed under the ESA. Bryde's whales occurring off the U.S. West Coast are assigned to the Eastern Tropical Pacific stock (Carretta et al., 2019c, 2020c).

3.7.4.2.2.2 Habitat and Geographic Range

Bryde's whales occur primarily in offshore oceanic waters of the north Pacific (Barlow et al., 2006; Bradford et al., 2017). Bryde's whales in some areas of the world are sometimes seen very close to shore and even inside enclosed bays (Baker & Madon, 2007; Best, 1996). Long migrations are not typical of Bryde's whales, although limited shifts in distribution toward and away from the equator, in winter and summer, have been observed (Best, 1996; Cummings, 1985). Bryde's whales were previously only occasionally sighted in the waters off Southern California (Barlow, 2016; Carretta et al., 2010; Jefferson et al., 2014; Smultea, 2012; Smultea et al., 2011), but sightings and acoustic monitoring indicate an increase in the area so that the presence of the species is no longer considered anomalous (Carretta et al., 2019c; Carretta et al., 2017c; Debich et al., 2015a; Kerosky et al., 2012; Smultea, 2014; Smultea et al., 2012; Smultea et al., 2010). The peak in recorded Bryde's whale vocalizations has varied but generally occurs between late July and November in Southern California (Debich et al., 2015a; Debich et al., 2015b; Kerosky et al., 2012).

3.7.4.2.2.3 Population Trends

There are no data on trends in Bryde's whale abundance along the U.S. West Coast (Carretta et al., 2019c). The species has not been detected in NMFS surveys off California for over 20 years prior to a single sighting during a 2014 survey (Barlow, 2016), followed by eight encountered in the 2018 NMFS survey (Henry et al., 2020). Acoustic data suggests that the seasonal presence (summer to early winter) of Bryde's whale in the Southern California Bight has been increasing over the last decade (Kerosky et al., 2012), which is consistent with aerial surveys around San Clemente Island between August 2006 and September 2010 having encountered five individual Bryde's whales (Smultea, 2012) and sightings of the species during the 2014 and 2018 surveys as noted previously.

3.7.4.2.2.4 Predator and Prey Interactions

Bryde's whales primarily feed on schooling fish and are lunge feeders. Prey includes anchovy, sardine, mackerel, herring, krill, and other invertebrates, such as pelagic red crab (Baker & Madon, 2007; Nemoto & Kawamura, 1977). Bryde's whales have been observed using "bubble nets" to herd prey (Kato & Perrin, 2009). Bubble nets are used in a feeding strategy where the whales dive and release bubbles of air that float up in a column and trap prey inside, where they lunge through the column to feed. Bryde's whales are known to be prey for killer whales, as evidenced by an aerial observation of 15 killer whales attacking a Bryde's whale in the Gulf of California (Weller, 2009).

3.7.4.2.2.5 Species-Specific Threats

A Bryde's whale from the Eastern Tropical Pacific stock was seriously injured as a result of a commercial vessel strike off Washington in 2010 (Carretta et al., 2019c). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.2.3 Fin Whale (*Balaenoptera physalus*)

3.7.4.2.3.1 Status and Management

The fin whale is listed as depleted under the MMPA and endangered under the ESA throughout its range, but there is no designated critical habitat for this species. Fin whale population structure in the Pacific Ocean is not well known (Archer et al., 2019a). During the 20th century more fin whale were taken by industrialized whaling than any other species (Rocha et al., 2014). In the North Pacific, NMFS recognizes three fin whale stocks: (1) a Northeast Pacific stock in Alaska; (2) a California, Oregon, and Washington stock; and (3) a Hawaii stock. Although some fin whales migrate seasonally (Falcone et al.,

2011; Mate et al., 2016; Mate et al., 2018b; Mate et al., 2015b), NMFS does not recognize fin whales from the Northeast Pacific stock as being present in Southern California.

3.7.4.2.3.2 Habitat and Geographic Range

The fin whale is found in all the world's oceans and is the second-largest species of whale (Jefferson et al., 2015). Fin whales prefer temperate and polar waters and are scarcely seen in warm, tropical waters (Archer et al., 2019b; Reeves et al., 2002a). This species has been documented from 60° North (N) to 23°N. Fin whales have frequently been recorded in waters within Southern California and are present year round (Barlow & Forney, 2007; Campbell et al., 2015; Irvine et al., 2019; Jefferson et al., 2014; Mate et al., 2016, 2017; Mizroch et al., 2009; Rice et al., 2020; Širović et al., 2016; Širović et al., 2004; Širović et al., 2017; Širović et al., 2015b; Smultea, 2014; Trickey et al., 2020; Varga et al., 2018). As demonstrated by satellite tags and discovery tags,[3] fin whales make long-range movements along the entire U.S. West Coast (Falcone et al., 2011; Mate et al., 2015b; Mizroch et al., 2009). However, photo-identification studies of fin whales off the U.S. West Coast suggest that not all fin whales undergo long-range seasonal migrations, but instead make short-range seasonal movements in spring and fall (Falcone et al., 2011; Falcone & Schorr, 2011). Seven tags were deployed on fin whales in Southern California in August 2014, 2015, and 2017 (Irvine et al., 2019; Mate et al., 2018b; Mate et al., 2015b). The movements of these whales were highly variable, ranging from nearshore waters less than 1 km from the California coast to approximately 232 km offshore, and moving as far north as the Oregon border with California and as far south as Central Baja Mexico (Irvine et al., 2019; Mate et al., 2015b). Satellite tags deployed on 13 fin whales off Central California in 2016 and one in 2017 had only three of those individuals move into the PMSR for a period of time lasting approximately one day, eight days, and 44 days for each (Mate et al., 2017; Mate et al., 2018b).

Fin whales are not known to have a specific habitat and are highly adaptable, following prey, typically off the continental shelf (Azzellino et al., 2008; Panigada et al., 2008; Scales et al., 2017b). Off the U.S. West Coast, fin whales typically congregate in areas of high productivity, allowing for extended periods of localized residency that are not consistent with the general baleen whale migration model (Scales et al., 2017b).

Based on predictive habitat-based density models derived from line-transect survey data collected between 1991 and 2009 off the U.S. West Coast, relatively high densities of fin whales are predicted off Southern California during the summer and fall (Barlow et al., 2009; Becker et al., 2012a; Becker et al., 2010; Becker et al., 2016; Forney et al., 2012). Aggregations of fin whales are present year round in Southern and central California (Campbell et al., 2015; Douglas et al., 2014; Forney & Barlow, 1998; Forney et al., 1995; Jefferson et al., 2014; Scales et al., 2017b; Trickey et al., 2020), although their distribution shows seasonal shifts. In 2005–2006, during a period of cooler ocean temperatures, fin whales were encountered more frequently than during normal years (Peterson et al., 2006). Sightings from year-round surveys off Southern California from 2004 to 2013 show fin whales farther offshore in summer and fall and closer to shore in winter and spring (Campbell et al., 2015; Douglas et al., 2014).

As was done for other species, a scientific review process (Ferguson et al., 2015b) was undertaken to identify BIAs for fin whales occurring along the U.S. West Coast. Survey and acoustic data indicates that

[3] As a means of data collection starting in the 1930s, discovery tags having a serial number and return address were shot into the blubber of the whale by scientists. If that whale was later harvested by the whaling industry and the tag "discovered" during flensing, it could be sent back to the researchers, providing data on the movement of individual whales.

fin whale distributions shift both seasonally as well as annually (Baumann-Pickering et al., 2018; Calambokidis et al., 2019; Calambokidis et al., 2015; Douglas et al., 2014; Jefferson et al., 2014; Peterson et al., 2006; Rice et al., 2018b; Širović et al., 2017; Širović et al., 2015b; Trickey et al., 2020). Definitive areas of biological importance for fin whales have not yet been identified due to poor knowledge of fin whale population structure and biases inherent in different sampling methods that revealed high concentrations of fin whales in both coastal and offshore regions (Calambokidis et al., 2015).

3.7.4.2.3.3 Population Trends

For the U.S. West Coast, Moore and Barlow (2011) predict continued increases in fin whale numbers over the next decade, and suggest that fin whale densities are reaching "current ecosystem limits." Based on a comparison of sighting records from the 1950s to 2012, Smultea and Jefferson (2014) also showed an increase in the relative abundance of fin whales inhabiting Southern California. Širović et al. (2015b) used passive acoustic monitoring of fin whale calls to estimate the spatial and seasonal distribution of fin whales in the Southern California Bight. An increase in the number of calls detected between 2006 and 2012 also suggests that the population of fin whales off the U.S. West Coast may be increasing. Based on 18 aerial surveys conducted between 2008 and 2013, fin whales were one of the most common large whales in the Southern California Range Complex, which is adjacent to the southern boundary of the PMSR Study Area (Jefferson et al., 2014). In the adjacent Southern California Range Complex during the three-year period from 2016 to 2018, fin whales were more frequently sighted in 2018 than in the two previous survey years combined (Schorr et al., 2019). Increasing numbers of fin whales documented in coastal waters between Vancouver Island and Washington State may reflect recovery of populations in the North Pacific (Towers et al., 2018). These findings and the trend for an increase in population, appear consistent with the highest-yet abundances of fin whales in the 2014 and 2018 NMFS surveys of the U.S. West Coast (Barlow, 2016) Becker et al., 2020a).

3.7.4.2.3.4 Predator and Prey Interactions

This species preys on small invertebrates such as copepods as well as squid and schooling fishes, such as capelin, herring, and mackerel (Goldbogen et al., 2006; Jefferson et al., 2008a). The fin whale is not known to have a significant number of predators. However, in regions where killer whales are abundant, some fin whales exhibit attack scars on their flippers, flukes, and flanks, suggesting predation by killer whales (Aguilar, 2009).

3.7.4.2.3.5 Species-Specific Threats

Fin whales are susceptible to both ship strikes and entanglement in fishing gear (Carretta et al., 2019a; Carretta et al., 2017b; National Marine Fisheries Service, 2018a; Saez, 2018). Based on reports from 2014 to 2018 for waters off the U.S. West Coast, a minimum of three fin whales were seriously injured by entanglement in fishing gear (Carretta et al., 2020a). Based on satellite tags deployed on 10 fin whales in Southern California waters (2013–2015), it was determined those individuals spent roughly one-third of the time immediately below the surface regardless of time of day (Keen et al., 2019), and thus at a depth where they could be struck while also less visible to vessel operators. Available data from NMFS indicate that, in waters off California between 1991 and 2019, there were 25 known and reported ship strikes involving fin whales (National Marine Fisheries Service, 2011f, 2019c). In the most recently reported five-year period, between 2013 and 2017 along the U.S West Coast, there were eight known and reported ship strikes to fin whales (Carretta et al., 2019a). In Southern California and over the last decade, there were only two Navy ship strikes, both involving fin whales in 2009, but not within

the PMSR and not involving activities being considered as part of the Proposed Action. Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.2.4 Gray Whale (*Eschrichtius robustus*)

3.7.4.2.4.1 Status and Management

There are two north Pacific populations of gray whales: the Western subpopulation and the Eastern subpopulation designated in the Pacific SAR (Carretta et al., 2019c, 2020c; Cooke, 2019; Muto et al., 2019; Weller et al., 2013). Both populations (stocks) could be present in the PMSR Study Area during their northward and southward migration (Calambokidis et al., 2015; Carretta et al., 2019c; Cooke et al., 2015; Moore & Weller, 2018; Sumich & Show, 2011; Weller et al., 2013; Weller et al., 2012). The current stock structure for gray whales in the Pacific has been in the process of being re-examined for a number of years and remains uncertain as of the most recent Pacific SAR (Carretta et al., 2019c, 2020c). Genetic data reveal mixed stock aggregations of gray whales in the North Pacific Ocean and indicate that current population structure is not reflected by the current eastern and western stock or DPS designations based on geography (Brüniche-Olsen et al., 2018; Carretta et al., 2020b).

The Western subpopulation, which was previously also known as the western north Pacific or the Korean-Okhotsk population, has been designated the Western North Pacific stock and is considered depleted (Carretta et al., 2017c; Cooke, 2019; Cooke et al., 2015; Weller et al., 2013; Weller et al., 2002). This subpopulation is endangered and should be very few in number in the Study Area given the small population and their main wintering areas in waters off Russia and Asia (Mate et al., 2015a; Moore & Weller, 2013; Weller et al., 2013; Weller et al., 2012). Recent analysis of the data available for 2005 through 2016 estimates the combined Sakhalin Island and Kamchatka populations are increasing (Cooke, 2019). There has been no designated critical habitat for this species.

The Eastern North Pacific subpopulation (also known as the California-Chukchi population) has recovered from whaling exploitation, is not considered depleted, and was delisted under the ESA in 1994 (Carretta et al., 2020c; Swartz et al., 2006). A few hundred gray whales that feed along the Pacific coast between southeastern Alaska and Northern California throughout the summer and fall are known as the Pacific Coast Feeding Group (Calambokidis et al., 2002; Calambokidis et al., 2017b; Carretta et al., 2017c; Mate et al., 2013; Weller et al., 2013). The group has been identified as far north as Kodiak Island, Alaska (Gosho et al., 2011), and has generated uncertainty regarding the stock structure of the Eastern North Pacific population (Carretta et al., 2017c; Weller et al., 2013; Weller et al., 2012). Photo-identification, telemetry, and genetic studies suggest that the Pacific Coast Feeding Group is demographically distinct from the Eastern North Pacific population (Calambokidis et al., 2017b; Calambokidis et al., 2010; Frasier et al., 2011; Lagerquist et al., 2018; Mate et al., 2010). In 2012–2013, the Navy funded a satellite tracking study of Pacific Coast Feeding Group gray whales (Mate, 2013). Tags were attached to 11 gray whales near Crescent City, California in fall 2012. Good track histories were received from 9 of the 11 tags, which confirmed an exclusive nearshore (< 19 km) distribution and movement along the Northern California, Oregon, and Washington coasts (Mate, 2013). Although the duration of the tags was limited, none of the Pacific Coast Feeding Group whales moved south beyond Northern California, and so individuals from this group are not expected to be present in the PMSR Study Area. The Pacific Coast Feeding Group is not currently managed as a distinct stock in NMFS Stock Assessment Reports, but this may change in the future if new information supports such a designation (Carretta et al., 2019c, 2020c).

3.7.4.2.4.2 Habitat and Geographic Range

Most of the science dealing with gray whale migrations and distribution is not specific to either of the two recognized gray whale sub-populations, but where possible that distinction has been specified in the following sections.

Gray whales of the Western North Pacific stock primarily occur in shallow waters over the U.S. West Coast, Russian, and Asian continental shelves and are considered to be one of the most coastal of the great whales (Jefferson et al., 2015; Jones & Swartz, 2009). Feeding grounds for the population are the Okhotsk Sea off Sakhalin Island, Russia, and in the southeastern Kamchatka Peninsula (in the southwestern Bering Sea) in nearshore waters generally less than 225 ft. deep (Jones & Swartz, 2009; Weller & Brownell, 2012). The breeding grounds consist of subtropical lagoons in Baja California, Mexico, and suspected wintering areas in southeast Asia (Alter et al., 2009; Jones & Swartz, 2009; Mate et al., 2015a; Urban-Ramirez et al., 2003; Weller et al., 2013; Weller et al., 2012). In surveys of the northern feeding grounds, the largest number of Western North Pacific gray whales was observed in late-August and early-September (Meier et al., 2007), suggesting those few gray whales that may migrate down the U.S. west coast will not be in PMSR or California in general during those months.

Whales of the Eastern North Pacific stock primarily occur in shallow waters over the continental shelf of North America and Mexico and are considered to be one of the most coastal of the great whales (Jefferson et al., 2015; Jones & Swartz, 2009). Feeding grounds are generally less than 225 ft. deep (Jones & Swartz, 2009), and the main feeding areas are located in the Chukchi Sea, Bering Sea, Gulf of Alaska, the Pacific Northwest, and Northern California (Calambokidis et al., 2017b; Lagerquist et al., 2018; Mate et al., 2010; Mate et al., 2013; Mate et al., 2015a; Weller et al., 2013; Weller et al., 2012). The main breeding grounds consist of subtropical lagoons in Baja California, Mexico (Alter et al., 2009; Jones & Swartz, 2009; Urban-Ramirez et al., 2003).

Some gray whales make the longest annual migration of any mammal (15,000–20,000 km roundtrip; (Guazzo et al., 2019; Jefferson et al., 2015; Jones & Swartz, 2009; Mate, 2013; Mate et al., 2010; Mate et al., 2015a; Mate & Urban-Ramirez, 2003; Muir et al., 2015; Weller et al., 2013; Weller et al., 2002; Weller et al., 2012). Gray whales migrate along the Pacific coast twice a year between October and July (Calambokidis et al., 2015). Although they generally remain mostly over the shelf during migration, some gray whales may be found in more offshore waters to the west of San Clemente Island and the Channel Islands (Calambokidis et al., 2015; Guazzo et al., 2019; Mate & Urban-Ramirez, 2003; Schorr et al., 2019; Smultea, 2014; Sumich & Show, 2011). Recordings from a hydrophone array deployed offshore of central California (near Monterey) show that gray whales are acoustically active while migrating and that this acoustic behavior and their swimming behavior during migration changes on daily and seasonal time scales (Guazzo et al., 2017). A year-long (2013–2014) survey effort in the nearshore waters off San Diego, south of the PMSR Study Area encountered gray whales in January, February, and in the April–June time frame (Graham & Saunders, 2015). In aerial surveys occurring in December and April each year, gray whales were the third-most encountered large cetacean in Southern California (Smultea, 2014).

The main gray whale migrations that pass through the PMSR Study Area can be loosely categorized into three phases (Calambokidis et al., 2015; Rugh et al., 2008). Calambokidis et al. (2015) note these migration phases are not distinct, the timing for a phase may vary based on environmental variables, and a migration phase typically begins with a rapid increase in migrating whales, followed by moderate numbers over a period of weeks, and then slowly tapering off. A southward migration from summer

feeding areas in the Chukchi Sea, Bering Sea, Gulf of Alaska, and the Pacific Northwest begins in the fall (Calambokidis et al., 2015; Mate et al., 2013; Mate et al., 2015a). This Southbound Phase includes all age classes as they migrate primarily to the nearshore waters and lagoons of Baja, Mexico as a destination. During this southward migration, the whales generally are within 10 km of the coast (Calambokidis et al., 2015), although there are documented exceptions where migrating gray whales have bypassed the coast by crossing sections of the open ocean (Mate, 2013; Mate et al., 2015a; Mate & Urban-Ramirez, 2003; Rice & Wolman, 1971).

In the PMSR Study Area, migrating gray whales may transit much farther offshore from the mainland as some are routinely seen to the west of San Nicolas and San Clemente Islands (Aquatic Mammals, 2015b; Ferguson et al., 2015b; Mate & Urban-Ramirez, 2003; Sumich, 1984; Van Parijs et al., 2015). The northward migration for the Eastern North Pacific stock to the feeding grounds in Arctic waters, Alaska, the Pacific Northwest, and Northern California occurs in two phases (Calambokidis et al., 2015). Northbound Phase A consists mainly of adults and juveniles that lead the beginning of the north-bound migration from late January through July, peaking in April through July. Newly pregnant females go first to maximize feeding time, followed by adult females and males, then juveniles (Jones & Swartz, 2009). The Northbound Phase B consists primarily of cow-calf pairs that begin their northward migration later (March to July) remaining on the reproductive grounds longer to allow calves to strengthen and rapidly increase in size before the northward migration (Jones & Swartz, 2009; Urban-Ramirez et al., 2003).

The gray whale migration area (south of Point Conception), the migration corridors (north of Point Conception), the potential presence buffer area, and the months (October through July) these four sections of the Pacific coastal waters were designated as cumulatively in use, were identified by Calambokidis et al. (2015) as biologically important areas for gray whales. A portion of the gray whale potential presence migration area and the migration routes off Southern California pass through the waters of the PMSR (Figure 3.7-3).

It is important to note that these designated gray migration corridors extend along the entire length of the North America U.S. EEZ in the Pacific and exclude the continuation of those migration corridors outside of the U.S. EEZ that are equally as important (such the migration corridor segments continuing into Russian, Canadian, and Mexican waters (see Aquatic Mammals (2015b); (Ferguson et al., 2015a); Ferguson et al. (2015b); Van Parijs et al. (2015) regarding the limits to the areas identified). Unlike the remainder of the U.S. West Coast areas where phases of migration occur within specific distances from the shore, in waters south of Point Conception the entire migration corridor is used during each migration phase (Calambokidis et al., 2015). The following bullets summarize the phases and months for the gray whale migrations as detailed in Calambokidis et al. (2015) for the corridors along the U.S. West Coast:

- Southbound corridor – October–March
- Northbound Phase A corridor – January–July; peaking April–July
- Northbound Phase B corridor – March–July
- Potential presence area – October–July

These identified migratory months presented by Calambokidis et al. (2015) characterize the majority of a gray whale migration phase start from feeding locations in northern waters or from breeding locations in Mexico. For example, the first whales departing northern waters (on the Southbound Phase) have been documented as showing up off Granite Canyon, California (the shore-based counting location south of Carmel) in early December for decades (Durban et al., 2017; Laake et al., 2012).

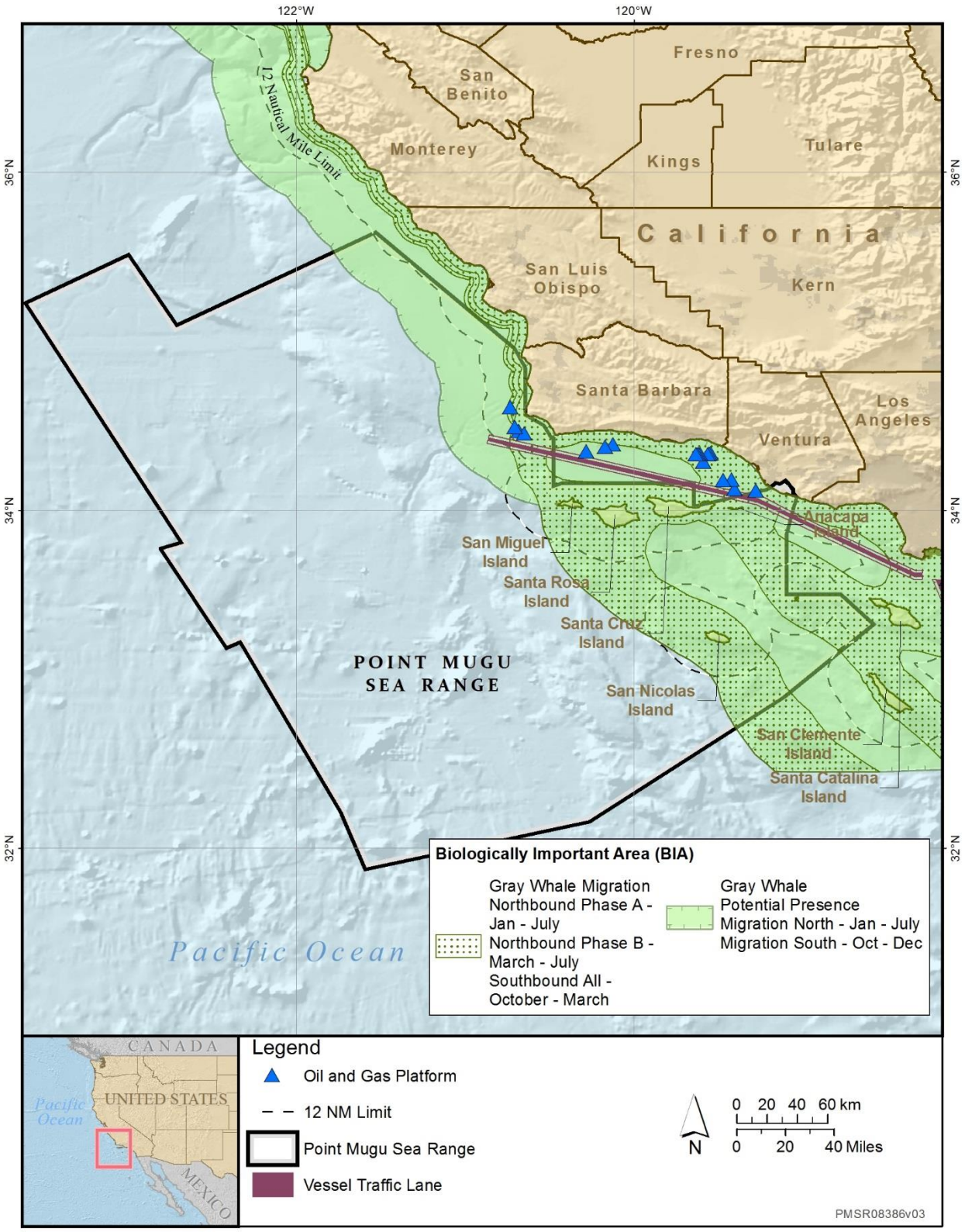


Figure 3.7-3: Gray Whale Biologically Important Area Migration Corridors Identified in the Vicinity of the PMSR Study Area (per Calambokidis et al. 2015)

A year-long (2013–2014) survey effort in the nearshore waters off San Diego, south of the PMSR Study Area encountered gray whales in January, February, and in the April–June time frame (Graham & Saunders, 2015). In December and April each year, gray whales are the third-most encountered large cetacean in Southern California (Smultea, 2014). Sightings from a shore based station and acoustic recordings during 7 migration seasons (2008−2009 to 2014−2015) detected whales migrating southbound off Southern California from the first of December (at the start of data collection) and overlapping with the return migration northward peaking in March and the end of April/start of May, but with some individuals still detected in June when the data collection ended (Guazzo et al., 2019). Additionally, the National Oceanic and Atmospheric Administration's website containing data records for marine mammals from the Cetacean Density and Distribution Mapping Working Group (see Ferguson et al. (2015b) and National Oceanic and Atmospheric Administration (2019a)) shows the recorded presence of gray whales in the Southern California Bight in every month of the year except June, October, and November, but other area-specific investigations have cumulatively documented gray whale presence in all but October (Durban et al., 2017; Guazzo et al., 2017; Hildebrand et al., 2018; Soldevilla et al., 2006). These gray whales present in the PMSR area outside the normal or main migration period patterns, are likely transient non-breeding juveniles and not a significant portion of any gray whale the population. Therefore and for purposes of the analysis presented in this document, the Navy assumes that small numbers of gray whales may be present year round and that larger numbers would be migrating through the PMSR Study Area in the winter and spring.

Mate and Urban-Ramirez (2003) reported an average gray whale speed of approximately 5.2 kilometers per hour (km/hr.) based on a tagged migrating animal. Subsequent satellite tag data from seven additional gray whales provided by Mate et al. (2015a) showed migration swim speeds ranged from 0.6 km/hr. to 6.6 km/hr., which remains within the average previously suggested. At this average swim speed, and based on data in Sumich and Show (2011) for migrating gray whales in the PMSR Study Area, it should take approximately 58 hours for a gray whale to cross through the PMSR Study Area (approximately 300 km). It is assumed they will do this twice a year during their annual southbound and northbound migration legs.

3.7.4.2.4.3 Population Trends

The Western North Pacific stock of gray whales was once considered extinct, but now small numbers are known to exist (Bröker et al., 2020; Carretta et al., 2019c; Cooke, 2019; Cooke et al., 2015; International Union for Conservation of Nature (IUCN), 2012; International Whaling Commission, 2014; Mate et al., 2015a; Nakamura et al., 2017; Weller et al., 2013).

The combined Sakhalin Island and Kamchatka populations are estimated to be increasing from 2005 through 2016 at an average rate between 2 and 5 percent annually (Cooke, 2019; Cooke et al., 2015). A recent increase in the occurrence of gray whales off Japan (Nakamura et al., 2017), is also consistent with a positive population growth for Western North Pacific gray whales. Bröker et al. (2020) have documented that in the Western North-Pacific (WNP) gray whale feeding grounds off Sakhalin Island from 2002–2014, they photo-identified a total of 243 individuals in the population.

At least 12 members of the Western North Pacific stock have been detected in waters off the Pacific Northwest (Mate et al., 2013; Moore & Weller, 2018; Weller & Brownell, 2012). NMFS reported that 18 Western North Pacific gray whales have been identified in waters far enough south to have passed through Southern California waters (National Marine Fisheries Service, 2014b), and although some gray whales have been shown to make mid-ocean migrations (Mate et al., 2015a), the Navy assumes

migration to and from Southern California would include passage through the PMSR Study Area for both gray whale subpopulations.

The Eastern North Pacific stock and population of gray whales has been generally increasing, although this trend has been punctuated by occasional declines that have coincided with UMEs (Stewart & Weller, 2021). Monitoring over the last 30 years has provided data that have indicated the Eastern North Pacific abundance is within the range of its optimum sustainable population, which is consistent with a population approaching the carrying capacity of the environment (Carretta et al., 2020c; Carretta et al., 2018a; Carretta et al., 2017c; Durban et al., 2016; Stewart & Weller, 2021). Starting in January of 2019 and continuing into 2020, an elevated number of gray whale strandings occurred along the west coast of North America from Mexico through Alaska, which prompted NMFS to declare those strandings an UME (Carretta et al., 2020b; National Marine Fisheries Service, 2019b; National Oceanic and Atmospheric Administration, 2020a). As of July 8, 2020, the strandings totaled 352 known individuals along their migratory corridor (National Oceanic and Atmospheric Administration, 2020a). Preliminary findings for several of the whales indicated signs of emaciation, although the findings were not consistent across the subset of the whales examined and additional future research will be required to better identify factors resulting in the UME (National Marine Fisheries Service, 2019b; National Oceanic and Atmospheric Administration, 2020a). Recently reported research used drone photogrammetry to assess the condition of gray whales while foraging along the Oregon coast from June to October over the three-year period between 2016 and 2018 (Lemos et al., 2020). The body condition of whales had been found to correlate with environmental changes and hypothesized prey availability in prior years, so that low upwelling years between 2016 and 2018 carried over to result in the UME starting in 2019 (Lemos et al., 2020). This is consistent with the hypothesis involving a lack of sufficient prey availability in the known feeding areas in the North Pacific, especially given that monitoring over the last 30 years has provided data indicating the Eastern North Pacific population and stock is within range of its optimum sustainable population (Carretta et al., 2017c); see also Lemos et al. (2020) regarding discussion of gray whales at carrying capacity. Although the time series of abundance estimates for Eastern North Pacific gray whales since 1967 has recorded generally increasing numbers, this trend has been punctuated by occasional declines that have coincided with UMEs (Stewart & Weller, 2021). Consistent with the 2019 gray whale UME, a new abundance of 20,580 Eastern North Pacific gray whales has been estimated based on individuals counted while migrating southward past the shore-based station at Granite Canyon, California, between December 2019 and February 2020 (Stewart & Weller, 2021).

3.7.4.2.4.4 Predator and Prey Interactions

Gray whales are primarily bottom feeders. Their prey includes a wide range of invertebrates living on or near the seafloor; these occur during the summer in dense colonies on the continental shelf seafloor off Northern California, Oregon, Washington, Canada, Alaska, and the arctic (Burnham & Duffus, 2018; Calambokidis et al., 2015; Ferguson et al., 2015a; Swartz et al., 2006). The whales filter amphipods and other crustaceans with their baleen plates. The whales carry most of the sediment with them when they surface to breathe, creating mud plumes in their wake (Jefferson et al., 2015; Jones & Swartz, 2009). Gray whales occasionally engulf fishes, herring eggs, cephalopods, and crab larvae (Jefferson et al., 2015; Jones & Swartz, 2009; Newell & Cowles, 2006). Although generally fasting during the migration and calving season, opportunistic feeding (on whatever food is available) may occur in or near the calving lagoons or in the shallow coastal waters along the migration path (Jones & Swartz, 2009).

3.7.4.2.4.5 Species-Specific Threats

Gray whales have historically been harvested by subsistence hunters in Alaska and Russia. The International Whaling Commission sets catch limits on the annual subsistence harvest for these areas. Subsistence hunting by Russia and Alaska Natives occurs in the North Pacific, Chukchi Sea, and Bering Sea. For example, in Russian waters in 2013, there were a total of 127 gray whales "struck" during subsistence whaling by the inhabitants of the Chukchi Peninsula between the Bering and Chukchi Sea (Ilyashenko & Zharikov, 2014). These gray whales harvested in Russian waters may be individuals from either the endangered Western North Pacific stock or the non-ESA-listed Eastern North Pacific stock that may migrate through the Study Area. In 2010, a gray whale discovered dead onshore in Humboldt, California, had two embedded harpoons in its flesh; one of these harpoons had 10 m of rope attached (Carretta et al., 2014). In 2017, at the Kuskowim River in Alaska, a gray whale was killed and harvested in what NMFS described as being an "illegal hunt" (Carretta et al., 2019a).

Gray whales are also susceptible to entanglement in fishing gear and ship strikes (Carretta et al., 2017b; National Marine Fisheries Service, 2018a; Saez, 2018; Saez et al., 2020; Scordino et al., 2020; Weller et al., 2013). In the five-year period from 2013 to 2017, a minimum of 51 gray whales are known to have been entangled in fishing gear off the U.S. West Coast (Carretta et al., 2019a). In the two-year period of 2018-2019, there were 19 confirmed entangled gray whales investigated along the U.S. West Coast (National Oceanic and Atmospheric Administration, 2020b). Available data from NMFS indicate that in waters off California between 1991 and 2010, there had been 30 reported ship strikes involving gray whales (National Marine Fisheries Service, 2011f); more recently in the five-year period from 2013 to 2017, there were a minimum of seven known gray whale ship strikes (Carretta et al., 2019a). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

Unpublished data obtained from NMFS indicated 72 gray whales stranded in California between 2010 and 2015 (National Marine Fisheries Service, 2016f, 2016g, 2016h). This data provided does not attribute cause to these strandings, which could have arisen from any number of natural causes (predation, starvation, etc.) or from anthropogenic causes (such as marine debris entanglement). Approximately 32 percent of the strandings between 2010 and 2015 occurred in 2015 during a period of eastern Pacific elevated sea surface temperatures prior to onset of an extreme El Niño. None of the California gray whale strandings corresponded with any Navy activities in the PMSR Study Area. Starting in January of 2019, an elevated number of gray whale strandings occurred along the west coast of North America from Mexico through Alaska that, as of May 2019, totaled 148 known individuals, which prompted NMFS to declare those strandings an Unusual Mortality Event (National Marine Fisheries Service, 2019b). Preliminary findings for several of the whales indicated signs of emaciation although the findings were not consistent across the subset of the whales examined and additional future research will be needed to better identify factors resulting in the UME (National Marine Fisheries Service, 2019b).

3.7.4.2.5 Humpback Whale (*Megaptera novaeangliae*)

3.7.4.2.5.1 Status and Management

Humpback whales that are seasonally present in the PMSR Study Area are from two DPSs given they represent populations that are both discrete from other conspecific populations and significant to the species of humpback whales to which they belong (National Marine Fisheries Service, 2016a). These DPSs are based on animals identified in breeding areas in Mexico, and Central America (Bettridge et al., 2015; Calambokidis et al., 2017a; Carretta et al., 2019c, 2020c; Muto et al., 2019; National Marine Fisheries Service, 2016e; Wade et al., 2016). Presentation of information is provided in the following

subsections for the Mexico DPS and the Central America DPS, which are both seasonally present in the PMSR Study Area. Humpback whales of the Mexico DPS are listed as threatened, and those from the Central America DPS are listed as endangered under the ESA (National Marine Fisheries Service, 2016a). Critical habitat has not been designated for any ESA-listed humpback whales (Carretta et al., 2020c).

In the PMSR Study Area, the California, Oregon, Washington stock of humpback whales is assumed to consist of only animals from the Mexico DPS and the Central America DPS (National Marine Fisheries Service, 2016d, 2016i). The stock is considered depleted under the MMPA (Carretta et al., 2019c, 2020c; National Marine Fisheries Service, 2016a, 2016i).

3.7.4.2.5.2 Habitat and Geographic Range

During shipboard surveys conducted quarterly in the northern portion of the PMSR from 2016 to 2019, humpback whales were observed year round (Trickey et al., 2020). The habitat requirements of wintering humpback whales appear to be controlled by the conditions necessary for calving, such as warm water (75–80 degrees Fahrenheit [F] or 24–28 degrees Celsius [C]) and relatively shallow, low-relief ocean bottom in protected areas, nearshore, or created by islands or reefs (Clapham, 2000; Craig & Herman, 2000; Smultea, 1994). In breeding grounds, females with calves occur in significantly shallower waters than other groups of whales, and breeding adults use deeper more offshore waters (Ersts & Rosenbaum, 2003; Smultea, 1994). Breeding and calving areas for the Mexico DPS and for the Central America DPS are both located far to the south of the PMSR Study Area in waters off Mexico and Central America.

Over broad areas and long time scales (multiple years and tens of kilometers) marine mammal scientists have been able to predict average distributions for some species, such as humpback whales, within the recognized range of interannual variability that has been observed (Barlow, 2016; Becker et al., 2020b; Becker et al., 2016; Becker et al., 2018; Becker et al., 2017; Redfern et al., 2020; Redfern et al., 2019; Rockwood et al., 2020; Szesciorka et al., 2020). Off the U.S. West Coast, humpback whales are more abundant in shelf and slope waters (<2,000 m deep) and are often associated with areas of high productivity (Becker et al., 2012a; Becker et al., 2010; Becker et al., 2016; Calambokidis et al., 2019; Campbell et al., 2015; Forney et al., 2012; Redfern et al., 2013). While most humpback whales migrate, data has demonstrated that humpback whales occur year round off Southern California (Campbell et al., 2015; Dohl et al., 1983; Forney & Barlow, 1998).

Humpback migrations are complex and cover long distances (Barlow et al., 2011; Calambokidis et al., 2009b; Calambokidis et al., 2017b; Lagerquist et al., 2008; Mate et al., 1998; Mate et al., 2018a; Mate et al., 2017). Although the majority of humpback whale sightings are in nearshore and continental shelf waters, humpback whales frequently travel through deep oceanic waters during migration (Calambokidis et al., 2001; Clapham, 2000; Clapham & Mattila, 1990; Mate et al., 1998; Mate et al., 2018c). Humpback whales migrating from breeding grounds in Mexico and Central America on their way to feeding grounds at higher latitudes may cross the PMSR Study Area farther offshore (Lagerquist et al., 2008; Mate et al., 2018b). Some of the California, Oregon, and Washington stock of humpback whales is expected to use portions of the waters within the PMSR Study Area as a summer feeding ground (Calambokidis et al., 2015). In quarterly surveys undertaken in the 10-year period between 2004 and 2013 off Southern California, humpback whales were generally encountered in coastal and shelf waters with the largest concentration occurring in relatively shallow waters, north of Point Conception (Campbell et al., 2015). During winter and spring, a substantially greater proportion of the humpback whale population is found farther offshore than during the summer with (in all seasons) the majority of

the population found north of the Channel Islands (Becker et al., 2017; Calambokidis et al., 2017a; Campbell et al., 2015; Forney & Barlow, 1998). Based on aerial survey data collected between 2008 and 2012 in the Southern California Range Complex, Smultea and Jefferson (2014) determined that humpback whales ranked eighth in relative occurrence of cetaceans and concluded that this species has clearly increased their representation in the Navy's Southern California Range Complex over the last several decades. Calambokidis et al. (2015) reported that peak occurrence during migration occurs in the PMSR Study Area from December through June. Based on acoustic data gathered off Monterey Bay between August 2015 and July 2018, the peak occurrence began and ended earlier (November through January) than indicated by the previous data, with the entire seasonal migration occurring between September through May in this area located immediately north of the PMSR (Ryan et al., 2019).

There are two biologically important humpback whale feeding areas that were identified in 2015 that overlap a portion of the PMSR Study Area (Calambokidis et al., 2015). In their designation, these feeding areas (Figure 3.7-4) were identified as the Morro Bay to Point Sal feeding area (in use from April to November) and the Santa Barbara Channel–San Miguel feeding area (in use from March to September) (Calambokidis et al., 2015). Satellite tags deployed on 87 humpback whales off the Pacific coast of the U.S. between 2004 and 2017 indicated humpback whales were present within the PMSR Study Area from as late as December in some years (Mate et al., 2018c). Satellite tags deployed in the summer of 2017 on 14 humpback whales off California indicated they are highly mobile and traveled on average approximately 37 km per day (Mate et al., 2018c). Passive acoustic monitoring at Monterey Bay California from 2015-2018 demonstrated that the timing of humpback whales feeding and migration in that area is variable with detections generally occurring from September through May (Ryan et al., 2019). Location data from satellite tags also has demonstrated that in some cases the feeding BIAs do not represent the core area of humpback whale presence for at least for the time and sample of the population represented by humpback whales that were tagged and otherwise present in or around the PMSR Study Area (Mate et al., 2018c). In 2014, 2015, and 2016, humpback whales were more commonly sighted in coastal waters of Santa Monica Bay, and from Long Beach south to waters off Dana Point (Calambokidis et al., 2017a), which are locations south of and nearer to shore than the waters within the PMSR and the identified BIAs. The variable use of the Santa Barbara Channel–San Miguel feeding BIA was also evident, corresponding to the 2014–2016 increase in ocean temperatures off California that resulted in the changes to the nominal distribution and availability of krill and anchovy (Fiechter et al., 2020; Santora et al., 2020; Zaba et al., 2018) and the distribution of humpback whales in 2014, resulting in a much higher density off Central California than a nominal year (Becker et al., 2018). Similar high ocean temperatures in 2016 also corresponded to a documented scarcity of healthy humpback whales in the Santa Barbara Channel–San Miguel feeding BIA and vicinity. However, more humpback whales were found further north off Central California and in better condition, which investigators suggested was indicative of good feeding areas that were likely to be sustained in that region in that anomalous year (Oregon State University, 2017).

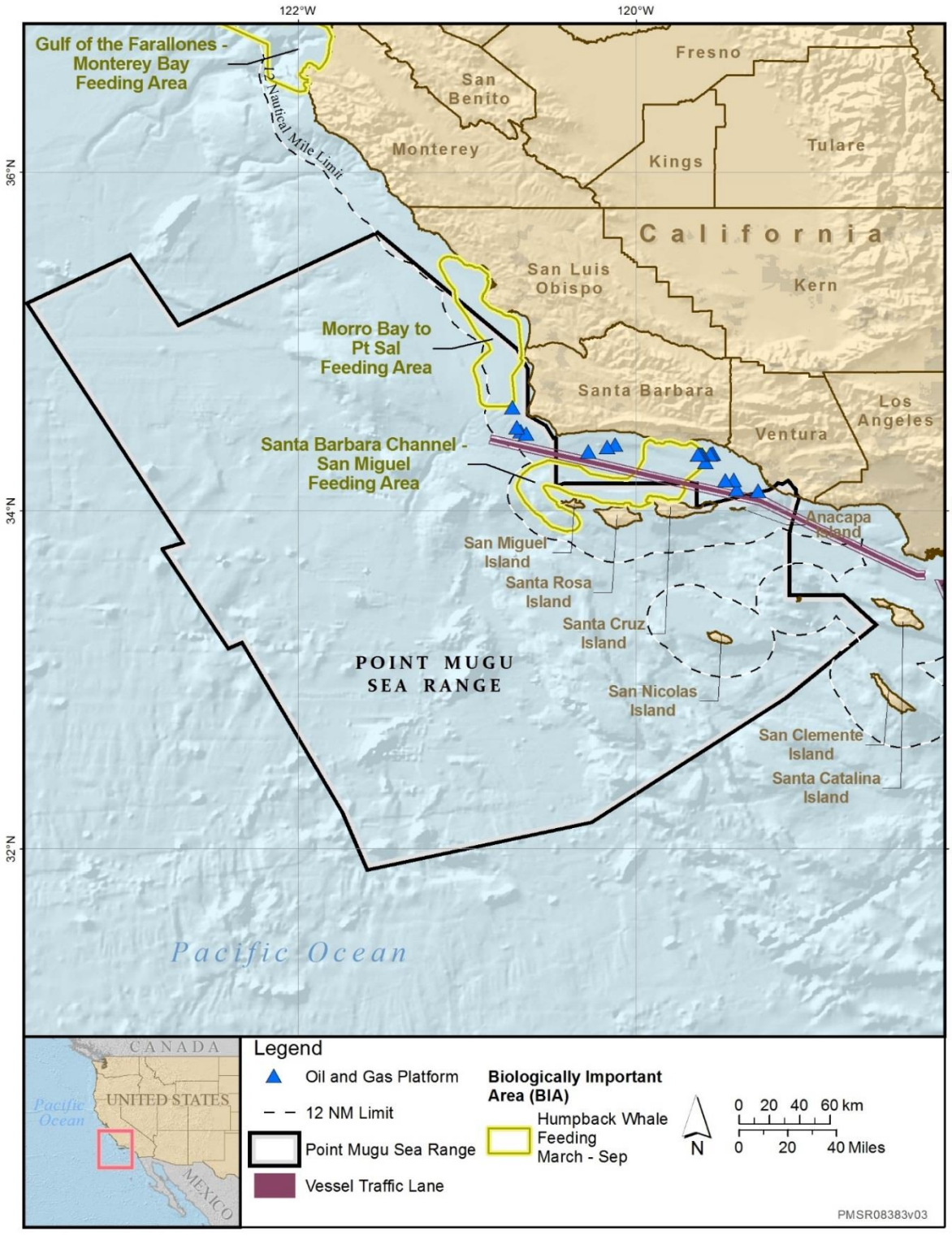


Figure 3.7-4: Humpback Whale Biologically Important Feeding Areas Identified in the Vicinity of the PMSR Study Area (per Calambokidis et al. 2015)

On October 9, 2019, in the Federal Register (84 FR 54378), NMFS issued a proposed rule to designate critical habitat for humpback whales within the U.S. EEZ, specifically for the endangered Western North Pacific DPS and Central America DPS and the threatened Mexico DPS, pursuant to section 4 of the ESA. The essential feature for the critical habitat as defined by National Marine Fisheries Service (2019d) is: "Prey species, primarily euphausiids and small pelagic schooling fishes of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth." NMFS has noted that prey as an essential feature may require special management considerations or protections as a result of ecosystem shifts driven by climate change, commercial fisheries, and pollution (National Marine Fisheries Service, 2019d). Only critical habitat for the Central America and Mexico DPSs overlaps with the PMSR. On April 21, 2021, NMFS issued a final rule to designate critical habitat for the Western North Pacific DPS, Central America DPS, and the Mexico DPS pursuant to section 4 of the ESA (86 FR 21082). The critical habitat areas identified in the proposed rule and overlapping with the PMSR are units (or areas) 17, 18, and 19. However, in finalizing the critical habitat, NMFS excluded unit 19, because avoiding likely economic and national security impacts outweighed the benefits of designating the unit as critical habitat. The final critical habitat for humpback whales in the vicinity of the PMSR is shown in Figure 3.7-5. In additional, NMFS expanded on the initial definition of the essential feature (i.e., prey) of critical habitat for all three DPSs by identifying specific species of prey relevant to each DPS and region. For the Central America DPS, the following prey species are listed: Euphausiids (*Thysanoessa, Euphausia, Nyctiphanes,* and *Nematoscelis*) and small pelagic schooling fishes, such as Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), and Pacific herring (*Clupea pallasii*). For the Mexico DPS, prey species include all species listed for the Central America DPS and three more small pelagic fishes: capelin (*Mallotus villosus*), juvenile walleye pollock (*Gadus chalcogrammus*), and Pacific sand lance (*Ammodytes personatus*). A subset of the same prey species are listed for the Western North Pacific DPS; however, critical habitat for this DPS does not occur in the vicinity of the PMSR. Prey species common to all three DPSs are euphausiids (i.e., krill) in the genera *Thysanoessa* and *Euphausia* and Pacific herring.

Humpback whales are generalists, taking a variety of prey while foraging and also switching between target prey depending on what is most abundant in the system (Fleming et al., 2016; Szabo, 2015; Witteveen et al., 2014). Consistent with the designated critical habitat, the humpback whales' diet is dominated by euphausiids and small pelagic fishes, such as northern anchovy, Pacific herring, Pacific sardine, and capelin (Fleming et al., 2016; Gabriele et al., 2017; Keen et al., 2017; Santora et al., 2010; Straley et al., 2017; Szabo, 2015; Witteveen & Wynne, 2017). Like other large mysticetes, they are a "lunge feeder," taking advantage of dense prey patches and engulfing as much food as possible in a single gulp. All feeding behavior seem to involve patches of prey with sufficient density to support feeding bouts (Frisch-Jordan et al., 2019; Mate et al., 2019). The size of individual krill seems to be an aspect of prey quality for the species (Burrows et al., 2016; Santora et al., 2010; Szabo, 2015). For example, Santora et al. (2010) found that different species of baleen whales aggregated to krill hotspots that were differentiated by the size of individual krill, with humpback whales having preference for small (<35 millimeters) juvenile krill.

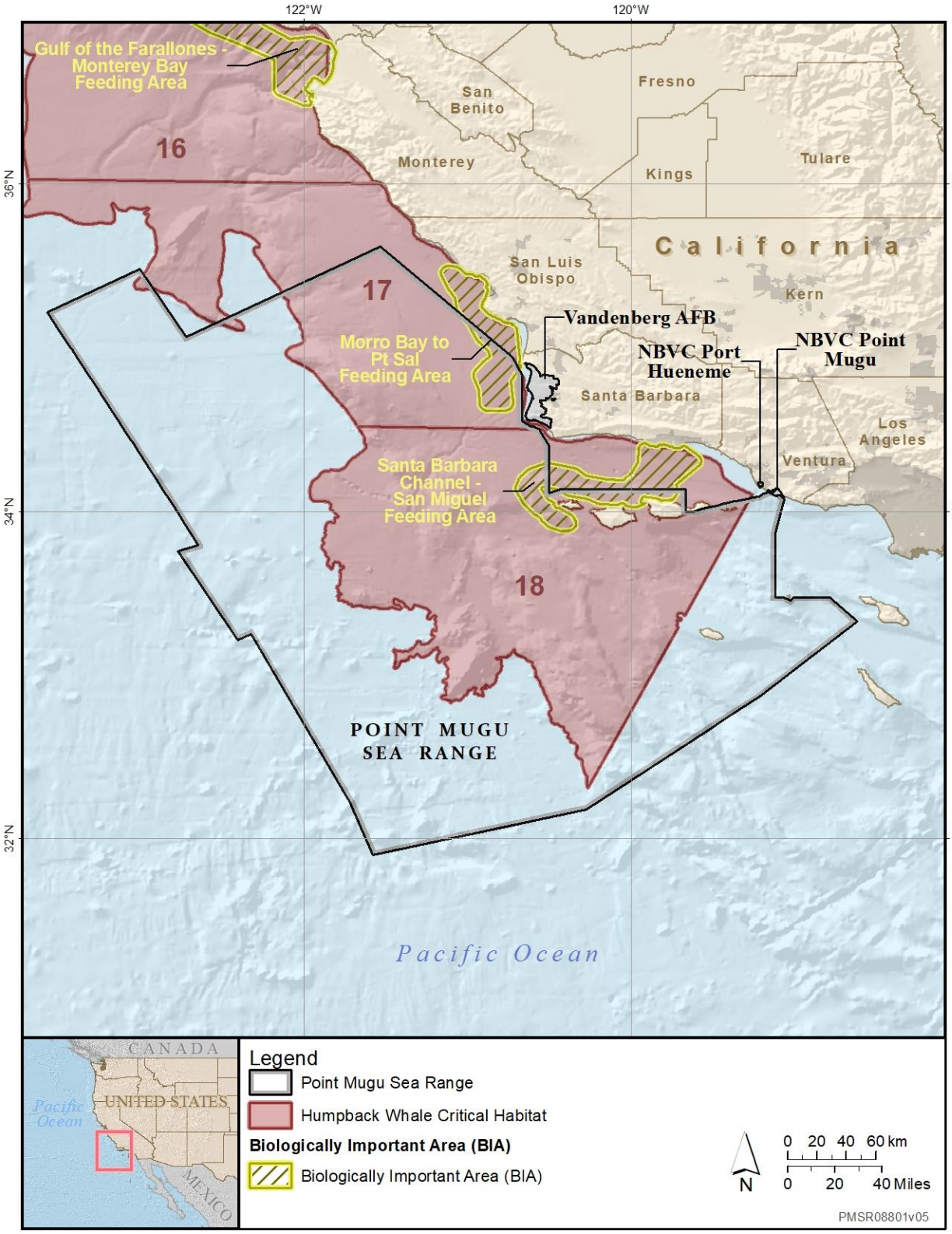


Figure 3.7-5 Humpback Whale Critical Habitat in the Vicinity of the PMSR Study Area

In the California Current Ecosystem, changing oceanographic factors (i.e., upwellings, temperatures, winds, salinity) result in seasonal, interannual, and decadal variability in the locations and density of krill and forage fish (Brinton & Townsend, 2003; Cimino et al., 2020; Deutsch et al., 2015; Fiechter et al., 2020; Keister et al., 2011; Rockwood et al., 2020; Santora et al., 2017a; Santora et al., 2020; Santora et al., 2017c; Santora et al., 2011; Zaba et al., 2018). As a result, the location, timing, and intensity of prey aggregations can vary greatly both seasonally and from year to year. Given that concentrations of prey tend to be spatially and temporally ephemeral at scales on the order of tens of meters to kilometers and hours to days (Fiechter et al., 2020; Hazen et al., 2018; Rockwood et al., 2020; Santora et al., 2020; Zaba et al., 2018), the presence of feeding humpback whales and prey as an essential feature of the critical habitat are also highly variable over these small scales.

The critical habitat overlaps with the humpback whale feeding BIAs designated in 2015 (Calambokidis et al., 2015), but at PMSR it extends farther offshore to incorporate the maximum extent of the predicted humpback abundance in cooler months (Becker et al., 2016; Becker et al., 2017) and farther inshore to incorporate distributions derived from satellite telemetry data for 13 humpback whales (Mate et al., 2018c). Although the location, timing, and intensity of humpback whale prey vary greatly (Fiechter et al., 2020; Santora et al., 2020; Santora et al., 2017c; Santora et al., 2011; Zaba et al., 2018), static spatial management strategies such as the designation of critical habitat can effectively mitigate risks associated with fixed large and long-term actions such as established commercial vessel traffic lanes (associated with ship strikes) or within fishery regulations (associated with entanglement) (Moore et al., 2018; Redfern et al., 2020; Redfern et al., 2019; Rockwood et al., 2017; Rockwood et al., 2020; Santora et al., 2020). Given the recognized interannual variability in humpback whale distributions, the high mobility of the species, and the ephemeral presence of their prey, static management strategies (such as seasonal avoidance of an area with static boundaries) may not be appropriate for small area/short timeframe activities (D'Aloia et al., 2019; Dwyer et al., 2020; Hazen et al., 2018; Hyrenbach et al., 2000; Lewison et al., 2015; Maxwell et al., 2020; Oestereich et al., 2020; Perez-Jorge et al., 2015; Scales et al., 2017a), such as those activities associated with the Navy's Proposed Action.

In the proposal, NMFS considered 19 Regions/Units of habitat as critical habitat for the listed humpback whale DPSs. These 19 areas include almost all coastal waters off California, Oregon, Washington, and Alaska in the Pacific. The NMFS designated, named and numbered habitat "regions/units" are shown on Figure 3.7-5. As shown on that figure, there is overlap between the PMSR Study Area and portions of proposed critical habitat designated Regions/Units 17, 18, and 19.

Region/Unit 17 has been referred to by NMFS as the "Central California Coast Area," which covers an area of 6,697 square nautical miles (NM^2) extending from 36° 00' to 34° 30' north latitude. Within those north and south boundaries, Region/Unit 19 begins at the 30 m depth contour out to the 3,700 m depth contour. This region's area includes waters off of southern Monterey county, San Luis Obispo, and Santa Barbara counties. This is the northern most portion of proposed humpback whale critical habitat overlapping with the PMSR and includes the Morro Bay to Point Sal feeding area described above. This region/unit of habitat is characterized by NMFS as having a very high conservation value (84 FR 54378).

Region/Unit 18 has been referred to by NMFS as the "Channel Islands Area," which covers an area of 9,799 NM^2 extending from 34° 30' north latitude, south to a boundary line seaward to the southeast from Oxnard, CA. This region's area includes waters off of Santa Barbara and Ventura counties. Within those boundaries extending from the coast, Region/Unit 19 begins at the 50 m depth contour and

includes the waters out to the 3,700 m depth contour. Coastal waters managed by the Navy,[4] as addressed within the NBVC Point Mugu Integrated Natural Resources Management Plan (INRMP) and SNI INRMP, are not included in the proposed designation as these areas were determined by NMFS to be ineligible for designation as critical habitat under section 4(a)(3)(B)(i) of the ESA (84 FR 54378). The Navy does not anticipate national security impacts resulting from a critical habitat destination in the portion of Region/Unit 18 that overlaps with the PMSR. This region/unit of habitat is characterized by NMFS as having a high conservation value (84 FR 54378).

Region/Unit 19 has been referred to by NMFS as the "California South Coast Area," which covers 12,966 NM^2 extending from the southern boundary of Region 18 (at Oxnard, CA), south to the border between the U.S. and Mexico EEZs. Within those north and south boundaries, Region/Unit 19 begins at the 50 m depth contour out to the 3,700 m depth contour. This unit includes waters off of Los Angeles, Orange, and San Diego counties. This region/unit of habitat is characterized by NMFS as having a low conservation value and therefore excluded it from further consideration as critical habitat for both the Mexico DPS and the Central America DPS (84 FR 54378). The Navy has also concluded that designation of Region/Unit 19 as critical habitat could lead to requirements for additional mitigations (avoidance, limitations, etc.) that could hinder Navy activities, and thereby impact military readiness and national security and therefore requested that exclusion of Region/Unit 19 from any critical habitat designation. NMFS agreed that designation of Region/Unit 19 would likely have national security impacts that outweigh the benefits of designating this low conservation value area and so, based on consideration of national security and economic impacts, NMFS has excluded this area from further consideration as critical habitat (84 FR 54378).

3.7.4.2.5.3 Population Trends

Although recent estimates show variable trends in the number of humpback whales along the U.S. West Coast, the overall trend is consistent with a growth rate of between 7.5 and 8.2 percent for the California, Oregon, and Washington stock (Calambokidis & Barlow, 2020). This population trend is consistent with the highest-yet abundance estimates of humpback whales based on the 2014 (Barlow, 2016) and the 2018 (Becker et al., 2020a; Henry et al., 2020) NMFS surveys, and other corresponding investigations (Calambokidis & Barlow, 2020; Calambokidis et al., 2017a; Carretta et al., 2019c; Smultea, 2014). For the DPSs in Mexico and Central America, photo-identification data collected between 2004 and 2006 are the main basis for the estimates specific to those populations (Bettridge et al., 2015; Calambokidis & Barlow, 2020; National Marine Fisheries Service, 2016a; Wade et al., 2016). The current best overall estimates of abundance of humpback whales along the U.S. West Coast has been provided by photo identification data gathered between 2015 and 2018 along the U.S. West Coast (Calambokidis & Barlow, 2020). This estimate, which includes the Mexico DPS and the Central America DPS in n = 4,973 (CV = 0.05), is higher than the abundance (n = 2,900) in the 2019 Pacific SAR (Calambokidis & Barlow, 2020).

[4] The relevant areas addressed under the NBVC Point Mugu INRMP are submerged lands and resources 3 NM seaward from Point Mugu and a zone that extends 0.25 NM offshore around San Miguel and Prince Islands. Relevant areas within the footprint of the SNI INRMP are the waters surrounding SNI and Begg Rock within the 300-foot (91 m) depth contour or 1 NM from shore; whichever is greater.

3.7.4.2.5.4 Predator and Prey Interactions

Within the feeding grounds, humpback whales feed on a wide variety of invertebrates and small schooling fishes based on availability and switching in response to changing oceanographic and ecological conditions (Fleming et al., 2016). The most common invertebrate prey are krill (tiny crustaceans); the most common fish prey are herring, mackerel, sand lance, sardines, anchovies, and capelin (Clapham & Mead, 1999). Feeding occurs both at the surface and in deeper waters, wherever prey is abundant. Humpback whales are the only species of baleen whale that shows strong evidence of cooperation when they feed in large groups (D'Vincent et al., 1985).

Humpback whales are known to be attacked by both killer whales and false killer whales, as evidenced by tooth rake scars on their bodies and fins (Jefferson et al., 2015). Photographs of humpback whales with rake mark scarring taken at 16 wintering or feeding areas across the north Pacific were used to determine that a substantial portion of animals had been attacked; the highest rates documented were for whales that migrate between California and Mexico (Steiger et al., 2008).

3.7.4.2.5.5 Species-Specific Threats

Entanglement in pot/trap fisheries has been the most common source of injury to humpback whales along the U.S. Pacific coast (Carretta et al., 2017b; Carretta et al., 2016a; Carretta et al., 2017d; National Marine Fisheries Service, 2018a; National Oceanic and Atmospheric Administration, 2017b; Saez, 2018; Saez et al., 2012). For the five-year period between 2012 and 2016 there were 52 known cases of humpback whale entanglement in Alaska (Helker et al., 2019) and between 2013 and 2017 an additional 117 cases of reported interactions with fishing gear resulting in serious injuries or mortality off the U.S. West Coast (Carretta et al., 2019a; Carretta et al., 2019b). In the two-year period of 2018–2019, there were 51 confirmed entangled humpback whales along the U.S. West Coast (National Oceanic and Atmospheric Administration, 2020b). Humpback whales from Mexico and Central America have been identified feeding in Alaska (Bettridge et al., 2015; Calambokidis et al., 2008), so some proportion of the entanglements in Alaska could be to whales from the Mexico DPS and Central America DPS individuals.

Available data from NMFS indicate that in Alaska in the five-year period between 2012 and 2016, mortalities or serious injuries occurred to a minimum of 21 humpback whales as a result of vessel strike, and along the U.S. Pacific coast between 2013 and 2017, there were an additional 14 known strikes involving humpback whales; none were Navy vessels (Carretta et al., 2019a; Helker et al., 2019).

Humpback whales are also potentially affected by loss of habitat, loss of prey (for a variety of reasons including climate variability), underwater noise, jet skis and similar fast waterborne tourist-related traffic disturbance and vessel strike, and pollutants (Muto et al., 2017). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.2.6 Minke Whale (*Balaenoptera acutorostrata*)

3.7.4.2.6.1 Status and Management

The minke whale is not listed under the ESA. Minke whales in the PMSR Study Area are part of the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.2.6.2 Habitat and Geographic Range

The minke whale's range is known to extend from open ocean and coastal waters to subarctic and arctic waters (Kuker et al., 2005).

Minke whales occur year round off California (Forney & Barlow, 1998; Forney et al., 1995), mainly in nearshore areas (Barlow & Forney, 2007; Hamilton et al., 2009b; Smultea, 2014). During systematic ship surveys conducted in summer and fall off the U.S. West Coast between 1991 and 2018, there have been a total of 49 minke whale sightings (Becker et al., 2020a). During year-round aerial surveys conducted in the Southern California Range Complex from 2008 through 2013 minke whales were sighted 19 times (Jefferson et al., 2014). During shipboard surveys conducted quarterly in the northern portion of the PMSR from 2016 to 2019, minke whales were only sighted in the summer (Trickey et al., 2020).

The migration paths of the minke whale include travel between breeding and feeding grounds and have been shown to follow patterns of prey availability (Jefferson et al., 2015; Towers et al., 2013). Minke whales generally participate in annual migrations between low-latitude breeding grounds in the winter and high-latitude feeding grounds in the summer (Kuker et al., 2005). There is insufficient information to determine if the year-round low numbers of minke whales detected in Southern California suggest there may be resident animals, although acoustic monitoring data indicating only occasional minke "boing" presence in spring and late fall (Debich et al., 2015a; Hildebrand et al., 2012) would be consistent with a general seasonal migration pattern.

3.7.4.2.6.3 Population Trends

There are no data on population trends for minke whales in the California, Oregon, and Washington stock (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c).

3.7.4.2.6.4 Predator and Prey Interactions

Similar to other rorquals, minke whales are lunge feeders, often plunging through patches of shoaling fish or krill (Hoelzel et al., 1989; Jefferson et al., 2008b). In the north Pacific, their major prey include small invertebrates, krill, capelin, herring, pollock, haddock, and other small shoaling fish (Jefferson et al., 2008b; Kuker et al., 2005; Lindstrom & Haug, 2001). Minke whales are prey for killer whales (Ford & Ellis, 1999; Ford et al., 2005; Weller, 2009).

3.7.4.2.6.5 Species-Specific Threats

Serious injury or mortality from interactions with fishing gear poses a threat to minke whales throughout the Study Area. Between 2010 and 2014 there were three mortalities to minke whales reported (Carretta et al., 2019b; Carretta et al., 2016a; Carretta et al., 2013). Additionally, ship strikes also potentially pose a threat to minke whales along the U.S. West Coast (National Marine Fisheries Service, 2019c). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.2.7 Sei Whale (*Balaenoptera borealis*)

3.7.4.2.7.1 Status and Management

The sei whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range, but there is no designated critical habitat for this species. A recovery plan for the sei whale was completed in 2011 and provides a research strategy for obtaining data required to estimate population abundance and trends, and to identify factors that may be limiting the recovery of this species (National Marine Fisheries Service, 2011b). Sei whales along the U.S. West Coast are assigned to the Eastern North Pacific stock within the U.S. EEZ (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c).

3.7.4.2.7.2 Habitat and Geographic Range

Sei whales have a worldwide distribution and are found primarily in cold temperate to subpolar latitudes. During the winter, sei whales are found in warm tropical waters. Sei whales are also

encountered during the summer off California and the North America coast from approximately the latitude of the Mexican border to as far north as Vancouver Island, Canada (Horwood, 2009; Masaki, 1976, 1977; Smultea et al., 2010). Although sei whales have been observed south of 20°N in the winter (Fulling et al., 2011; Horwood, 2009; Horwood, 1987), they are considered absent or at very low densities in most equatorial areas. Whaling data provide some evidence of differential migration patterns by reproductive class, with females arriving at and departing from feeding areas earlier than males (Horwood, 1987; Perry et al., 1999).

Sei whales are distributed in offshore waters in the PMSR Study Area (Carretta et al., 2017c). A total of 10 sei whale sightings were made during systematic ship surveys conducted off the U.S. West Coast in summer and fall between 1991 and 2008 (Barlow, 2010), with an additional 14 groups sighted during a 2014 survey (Barlow, 2016). Sei whales were not seen in the larger Southern California Bight during 15 aerial surveys conducted from 2008 to 2012 (Smultea et al., 2014).

3.7.4.2.7.3 Population Trends

NMFS has determined that an assessment of the sei whale population trend will likely require additional survey data and reanalysis of all datasets using comparable methods (Carretta et al., 2017d). There are no data on Eastern North Pacific sei whale trends in abundance (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c).

3.7.4.2.7.4 Predator and Prey Interactions

Feeding occurs primarily around dawn, which appears to be correlated with vertical migrations of prey species (Horwood, 2009). Unlike other rorquals, the sei whale skims to obtain its food, though, like other rorqual species, it does some lunging and gulping (Horwood, 2009). In the north Pacific, sei whales feed on a diversity of prey, including copepods, krill, fish [specifically sardines and anchovies], and cephalopods [squids, cuttlefish, octopuses] (Horwood, 2009; Nemoto & Kawamura, 1977). The dominant food for sei whales off California during June through August is the northern anchovy, while in September and October they eat mainly krill (Horwood, 2009; Rice, 1977). Sei whales, like other large baleen whales, are likely subject to occasional attacks by killer whales.

3.7.4.2.7.5 Species-Specific Threats

For the U.S. West Coast, based a documented vessel strike mortality and one serious injury to sei whales between 2012 and 2016 and on the statistics for other large whales, it is likely that ship strikes also pose a threat to sei whales (Carretta et al., 2019c). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3 Odontocete Cetaceans Expected in the Study Area

3.7.4.3.1 Baird's Beaked Whale (*Berardius bairdii*)

3.7.4.3.1.1 Status and Management

Baird's beaked whale is not listed under the ESA. Baird's beaked whale stocks are defined for the two separate areas within Pacific U.S. waters where they are found: (1) Alaska; and (2) California, Oregon, and Washington (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c).

3.7.4.3.1.2 Habitat and Geographic Range

Baird's beaked whale occurs mainly in deep waters over the continental slope, near oceanic seamounts, and areas with submarine escarpments, although they may be seen close to shore where deep water

approaches the coast (Jefferson et al., 2008b; Kasuya, 2009). This species is generally found throughout the colder waters of the North Pacific, ranging from off Baja California, Mexico, to the Aleutian Islands of Alaska (Jefferson et al., 2008b; MacLeod & D'Amico, 2006).

The continental shelf margins from the California coast to 125°W longitude have been identified as key areas for beaked whales (MacLeod & D'Amico, 2006). Baird's beaked whale is found mainly north of 28°N in the eastern Pacific (Kasuya & Miyashita, 1997; Reeves et al., 2003). Along the west coast of North America, Baird's beaked whales are seen primarily along the continental slope, from late spring to early fall (Carretta et al., 2010; Green et al., 1992; Hamilton et al., 2009b). Baird's beaked whales are sighted less frequently and are presumed to be farther offshore during the colder water months of November through April (Carretta et al., 2010). Based on habitat models developed using 1991–2008 survey data collected off the west coast of North America during summer and fall, Becker et al. (2012b) found that encounters of Baird's beaked whale increased in waters near the 2,000 m isobath. These patterns are consistent with previous habitat modeling efforts using a subset of the same data (Barlow et al., 2009; Forney et al., 2012). During ship surveys conducted quarterly off Southern California from 2004 to 2008, there was a single sighting of a group of 20 Baird's beaked whales near the shelf break during a summer survey (Douglas et al., 2014). Baird's beaked whales were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 to 2012 (Smultea, 2014).

Although it is unknown if the species migrates, Baird's beaked whales in the western north Pacific are known to move between waters of depths ranging from 1,000 to 3,000 m, where fish that live on or near the bottom of the ocean are abundant (Ohizumi et al., 2003). Data from a satellite tagged Baird's beaked whale off Southern California documented movement north along the shelf-edge for more than 400 NM over a six and one-half day period (Schorr et al., 2019).

3.7.4.3.1.3 Population Trends

A trend-based analysis of data from line transect surveys conducted off the U.S West Coast between 1991 and 2014 yielded an abundance estimate of 2,697 (CV = 0.60) Baird's beaked whales and an indication that the population has remained stable or increased slightly (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2017c; Moore & Barlow, 2017).

3.7.4.3.1.4 Predator and Prey Interactions

Baird's beaked whales feed mainly on bottom-dwelling fishes and cephalopods, but occasionally take open ocean fish, such as mackerel, sardine, and saury (Kasuya, 2009; Ohizumi et al., 2003; Walker et al., 2002). Stomach contents from specimens taken in whaling operations off Vancouver Island and off central California included squid, octopus, various species of fishes, and skate egg cases (MacLeod et al., 2003). Baird's beaked whale is known to forage for prey opportunistically at depths of about 1,000 m or more (Ohizumi et al., 2003). This species has been documented to be prey for killer whales and sharks, as evidenced by wounds and scars observed on their bodies (Jefferson et al., 2008b; Kasuya, 2009).

3.7.4.3.1.5 Species-Specific Threats

Baird's beaked whales have a history of commercial harvesting in small numbers by the Russians, Canadians and Americans. The Japanese fishery has historically been responsible for large numbers of deaths (Jefferson et al., 2008b). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.2 Blainville's Beaked Whale (*Mesoplodon densirostris*)

3.7.4.3.2.1 Status and Management

Blainville's beaked whale is not listed under the ESA. Due to the difficulty in distinguishing different *Mesoplodon* species from one another at sea during visual surveys, the United States management unit is usually defined to include all *Mesoplodon* species that occur in an area. This is the case in the PMSR Study Area, where the six species of *Mesoplodon* beaked whales present along the U.S. West Coast is a single stock for all *Mesoplodon* in the California/Oregon/Washington region waters, including Blainville's beaked whale (Carretta et al., 2019c, 2020c).

3.7.4.3.2.2 Habitat and Geographic Range

Blainville's beaked whales are one of the most widely distributed of the distinctive toothed whales within the *Mesoplodon* genus (Jefferson et al., 2008b; MacLeod & Mitchell, 2006). They are found mostly offshore in deeper waters along the California coast, Hawaii, Fiji, Japan, and Taiwan, as well as throughout the eastern tropical Pacific (Leslie et al., 2005; MacLeod & Mitchell, 2006; Mead, 1989).

There are a handful of known records of Blainville's beaked whale from the coast of California and Baja California, Mexico, but the species does not appear to be common in the PMSR Study Area (Hamilton et al., 2009b; Mead, 1989; Pitman et al., 1988). *Mesoplodon* beaked whales were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 through 2012 (Smultea, 2014).

3.7.4.3.2.3 Population Trends

A Bayesian trend analysis of systematic survey data collected from 1991 to 2008 suggested a decline in the abundance of beaked whales found in waters off California, Oregon, and Washington (Moore & Barlow, 2013). However, a more recent survey in 2014 (Barlow, 2016) and a new analysis incorporating information from all surveys between 1991 and 2014 suggest an increasing abundance for the U.S. West Coast trend over that time, which is a reversal of the previously reported population decline (Carretta et al., 2019c; Carretta et al., 2017d; Moore & Barlow, 2017).

3.7.4.3.2.4 Predator and Prey Interactions

All beaked whales probably feed at or close to the bottom in deep oceanic waters, taking suitable prey opportunistically or as locally abundant, typically by suction feeding (Heyning & Mead, 1996; Jefferson et al., 2015; MacLeod et al., 2003; Werth, 2006a, 2006b). Feeding may also occur at mid-water, rather than only at or near the bottom, as shown from tagging data from Blainville's beaked whales (Baird et al., 2005a; Baird et al., 2006b). Blainville's beaked whales are known to echolocate in groups when they are on foraging dives, which makes them more easily detectable by passive acoustic means (Moretti & Baird, 2015). *Mesoplodon* beaked whales have been observed being actively preyed upon by killer whales (Wellard et al., 2016).

3.7.4.3.2.5 Species-Specific Threats

There were two strandings of Blainville's beaked whales between 2010 and 2014 (National Marine Fisheries Service, 2015d). The individual that stranded in 2011 tested positive for morbillivirus (Jacob et al., 2016).

3.7.4.3.3 Bottlenose Dolphin (*Tursiops truncatus*)

3.7.4.3.3.1 Status and Management

The common bottlenose dolphin is not listed under the ESA. The bottlenose dolphins within the Pacific U.S. EEZ are divided into seven stocks, two of which occur in the PMSR Study Area—the California Coastal stock, and the California, Oregon and Washington Offshore stock (Carretta et al., 2019c, 2020c).

3.7.4.3.3.2 Habitat and Geographic Range

Common bottlenose dolphins typically are found in coastal and continental shelf waters of tropical and temperate regions of the world (Jefferson et al., 2008b; Wells et al., 2009); (Baird, 2013a; Baird et al., 2015; Baird et al., 2003; Barlow, 2006; Barlow et al., 2008; Becker et al., 2012b; Bradford et al., 2013; Forney et al., 2015; Maldini, 2003; Maldini et al., 2005; Martien et al., 2012; Mobley et al., 2000; Richie et al., 2012; Shallenberger, 1981; Shannon et al., 2016).

Common bottlenose dolphins are known to occur year round in both coastal and offshore waters of Monterey Bay, Santa Monica Bay, Anaheim Bay, San Diego Bay, and San Clemente Island, California (Bearzi, 2005a, 2005b; Bearzi et al., 2009; Carretta et al., 2000; Graham & Saunders, 2015; Henkel & Harvey, 2008; Naval Facilities Engineering Command Southwest, 2017). The dolphins in the nearshore waters of Southern California differ somewhat from other coastal populations of this species in distribution, site fidelity, and pod size (Bearzi, 2005a, 2005b; Carretta et al., 2017c; Defran et al., 2015; Defran & Weller, 1999).

During surveys off California, offshore common bottlenose dolphins were generally found at distances greater than 1.9 miles from the coast and throughout the waters of Southern California (Barlow, 2016; Barlow & Forney, 2007; Bearzi et al., 2009; Hamilton et al., 2009b). Sighting records off California and Baja California suggest a continuous distribution of offshore common bottlenose dolphins in these regions (Mangels & Gerrodette, 1994). Analyses of sighting data collected during winter aerial surveys in 1991–1992 and summer shipboard surveys in 1991 indicated no significant seasonal shifts in distribution (Forney & Barlow, 1998). Based on habitat models derived from line-transect survey data collected between 1991 and 2009 off the U.S. West Coast, offshore common bottlenose dolphins exhibit a disjunctive longitudinal distribution, suggesting that there may be two separate populations in this area, although additional genetic data are required for confirmation (Becker et al., 2016).

Off Southern California, animals from the California Coastal stock are found within 500 m of the shoreline 99 percent of the time and within 250 m of the shoreline 90 percent of the time (Hanson & Defran, 1993; Hwang et al., 2014). California Coastal bottlenose dolphins are found generally from Point Conception to as far south as San Quintin, Mexico (Carretta et al., 1998; Defran & Weller, 1999; Hwang et al., 2014), but have also been consistently sighted off central California and as far north as San Francisco since the 1983 El Niño. It has been suggested that as a result of that event, these dolphins traveled further north tracking prey when warmer waters expanded northward and then continued using these more northern waters after that El Niño had ended (Hwang et al., 2014). One photo-identified dolphin that was first sighted in Southern California in 1983, belonging to the Coastal stock of bottlenose dolphins, has been part of a group incrementally expanding the northern range of the stock and has been identified in the waters of Puget Sound (Cascadia Research, 2017c).

Photo identification analyses suggest that there may be two separate stocks of coastal bottlenose dolphins that exhibit limited integration, a California Coastal stock and a Northern Baja California stock (Defran et al., 2015), but they are not yet managed by NMFS as two stocks (Carretta et al., 2019c,

2020c). The results from relatively contemporaneous surveys at Ensenada, San Diego, Santa Monica Bay, and Santa Barbara between 1996 and 2001 provided samples of the speed and distances individual coastal bottlenose dolphins routinely traveled (Hwang et al., 2014). The minimum travel speed was observed as 53 km per day, and the maximum was 95 km per day, with the total distances traveled between points between 104 km and 965 km (Hwang et al., 2014).

3.7.4.3.3.3 Population Trends

The California Coastal stock population size has remained stable over the period for which data are available (Carretta et al., 2017c; Dudzik et al., 2006). For the California, Oregon, and Washington Offshore stock, there has been no trend analysis for the population (Carretta et al., 2019c, 2020c).

3.7.4.3.3.4 Predator and Prey Interactions

Common bottlenose dolphins are opportunistic feeders, taking a wide variety of fishes, cephalopods, and shrimps (Wells & Scott, 1999), and using a variety of feeding strategies (Shane, 1990). As with all odontocetes, bottlenose dolphins use echolocation for locating prey and also likely detect and orient to fish prey by passively listening for the sounds their prey produce (Barros & Myrberg, 1987; Barros & Wells, 1998). Coastal bottlenose dolphins prey predominantly on coastal fish and cephalopods, while offshore individuals prey on open-ocean cephalopods and a large variety of near-surface and mid-water fish species (Mead & Potter, 1995). Pacific coast bottlenose dolphins feed primarily on surf perches and croakers (Wells & Scott, 1999). Throughout its range common bottlenose dolphins are known to be preyed on by killer whales and sharks (Wells & Scott, 2009).

3.7.4.3.3.5 Species-Specific Threats

Common bottlenose dolphins are particularly susceptible to entanglement and other interactions with fishery operations. From 2013 to 2017, there were two known bottlenose dolphin deaths attributed to fishery-related causes along the U.S. West Coast (Carretta et al., 2019a; Carretta et al., 2019b). In U.S. waters south of Point Conception, bottlenose dolphins had the highest levels of halogenated organic compound contamination among six marine mammal species that were studied (Cossaboon et al., 2019). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.4 Cuvier's Beaked Whale (*Ziphius cavirostris*)

3.7.4.3.4.1 Status and Management

The Cuvier's beaked whale is not listed under the ESA. There are two stocks of Cuvier's beaked whales in the Pacific, one of which occurs in the PMSR Study Area—the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.4.2 Habitat and Geographic Range

Cuvier's beaked whales have an extensive range that includes all oceans, from the tropics to the polar waters of both hemispheres. Cuvier's beaked whales have been encountered in almost all areas of the Pacific, including the open mid-ocean, wherever surveys have occurred (Hamilton et al., 2009b). Cuvier's beaked whales are generally sighted in waters with a bottom depth greater than 200 m and are frequently recorded in waters with bottom depths greater than 1,000 m (Bradford et al., 2013; Falcone et al., 2009; Jefferson et al., 2015). Acoustic sampling of bathymetrically featureless areas off Southern California detected many beaked whales over an abyssal plain, which counters a common misperception that beaked whales are primarily found over slope waters, in deep basins, or over seamounts (Griffiths & Barlow, 2016). Cuvier's beaked whales have been regularly detected at the passive acoustic monitoring

site within the PMSR Study Area (Site M) as well as at other similar sites to the south within the Southern California (SOCAL) range complex, with the most detections in spring and fall and the fewest in summer (Baumann-Pickering et al., 2018; Baumann-Pickering et al., 2015b; Rice et al., 2018a; Rice et al., 2018b; Rice et al., 2020).

Adjacent to the southern boundary of the PMSR Study Area, research involving tagged Cuvier's beaked whales in the Southern California Range Complex has documented movements in excess of hundreds of kilometers (Schorr et al., 2018b, 2020). Schorr et al. (2014) reported that five out of eight tagged whales journeyed approximately 250 km from their tag deployment location, and one of these five made an extra-regional excursion over 450 km to the south to Mexico and back (Falcone & Schorr, 2011, 2012, 2013, 2014; Falcone et al., 2009). Acoustic data indicates a regional and seasonal (August and September) dip in Cuvier's echolocation clicks during the fall (DiMarzio et al., 2020; DiMarzio et al., 2018; Moretti, 2017), which may be tied to some as yet unknown population dynamic or oceanographic and prey availability dynamics (Schorr et al., 2018a).

The Cuvier's beaked whale is the most commonly encountered beaked whale off the U.S. West Coast (Carretta et al., 2017c). This species is found from Alaska to Baja California, Mexico, and there are no apparent seasonal changes in distribution (Mead, 1989; Pitman et al., 1988). However, Mitchell (1968) reported that strandings from Alaska to Baja California were the most common between February and September. During ship surveys conducted quarterly off Southern California from 2004 to 2008, there were only six beaked whale sightings, and half of these were Cuvier's beaked whales (Douglas et al., 2014). During 18 aerial surveys conducted in the Southern California Range Complex from 2008 through 2013, Cuvier's beaked whales were sighted on two occasions (Jefferson et al., 2014). Repeated sightings of the same individuals have been reported off San Clemente Island in Southern California, which indicates some level of site fidelity (Curtis et al., 2020; Falcone et al., 2009; Schorr et al., 2018a, 2019; Schorr et al., 2020). This species has also frequently been heard on passive acoustic recording devices in Southern California (Curtis et al., 2020; Griffiths & Barlow, 2016; Širović et al., 2016). In a test of drifting passive acoustic recorders off California in fall 2014, Griffiths and Barlow (2016) reported beaked whale detections over slopes and seamounts, which was not unexpected, and also over deep-ocean abyssal plains, which was a novel finding.

3.7.4.3.4.3 Population Trends

A Bayesian trend analysis of systematic survey data collected from 1991 to 2008 had suggested a decline in the abundance of beaked whales found in waters off California, Oregon, and Washington (Moore & Barlow, 2013). However, a more recent study (Barlow, 2016) included data from an additional survey conducted in 2014 and indicated that the pattern seen for the U.S. West Coast from 1996 to 2014 may indicate a change in that downward trend. More recently, incorporation of information from the entire 1991–2014 time series has suggested an increasing abundance trend and a reversal of the previously indicated declining trend along the U.S. West Coast (Moore & Barlow, 2017). Multiple studies have indicated that in waters surrounding Navy training and testing areas in Southern California, the abundance of beaked whales remains high, including specifically where Navy has been training and testing for decades. Results from passive acoustic monitoring and other research have estimated regional Cuvier's beaked whale densities that were higher than indicated by NMFS's broad-scale visual surveys for the U.S. West Coast (Curtis et al., 2020; Debich et al., 2015a; Debich et al., 2015b; Falcone & Schorr, 2012, 2014; Hildebrand et al., 2009; Moretti, 2016; Širović et al., 2016; Smultea, 2014). In a series of surveys from 2006 to 2008, Falcone et al. (2009) proposed that the ocean basin west of San Clemente Island (adjacent to the PMSR Study Area) may be an important region for Cuvier's beaked

whales. Archived acoustic data gathered over the seven-year interval from 2010 to 2018 found the annual Cuvier's beaked whale abundance for the Navy's range adjacent to San Clemente Islands to have significantly increased over the 10-year period from 2010 to 2019, with the mean number of animals rising from 17.7 for animals to 29.08 animals (DiMarzio et al., 2020; DiMarzio et al., 2018; DiMarzio et al., 2019).

These location-specific results have continuously demonstrated higher abundances observed on the Navy's training and testing areas in Southern California compared to the remainder of the U.S. West Coast. Adjacent to the southern boundary of the PMSR Study Area, research at the Navy's instrumented Southern California Anti-Submarine Warfare Range also indicates a higher-than-expected residency by the species (Curtis et al., 2020; Falcone & Schorr, 2012; Schorr et al., 2018a, 2019; Schorr et al., 2020). Photo identification studies in the Southern California Range Complex have identified approximately 100 individual Cuvier's beaked whale individuals, of which as many as 57 percent having been seen in one or more prior years, with re-sightings up to 12 years apart (Curtis et al., 2020; Falcone & Schorr, 2014; Schorr et al., 2018a, 2019; Schorr et al., 2018b, 2020). The documented residency by many Cuvier's beaked whales over multiple years indicate that a stable population may exist in that small portion of the stock's overall range (Curtis et al., 2020; Falcone & Schorr, 2014; Falcone et al., 2009; Schorr et al., 2017; Schorr et al., 2018a; Schorr et al., 2018b, 2020). Resightings of 45 known reproductive females both with and without calves over time have also provided critically needed calving and weaning rate data that will serve as the basis for future population modeling for the species (Schorr et al., 2018a, 2019; Schorr et al., 2018b, 2020).

3.7.4.3.4.4 Predator and Prey Interactions

Cuvier's beaked whales, similar to other beaked whale species, are apparently deepwater feeders (Gassmann et al., 2015; Griffiths & Barlow, 2016). Stomach contents analyses show that they feed mostly on deep-sea squid, fish, and crustaceans (Hickmott, 2005; Santos et al., 2007; West et al., 2017). Documented prey includes a diverse diet represented by at least 45 prey species (West et al., 2017). Feeding may also occur at mid-water, rather than only at or near the bottom, as shown from tagging data on Cuvier's beaked whales (Baird et al., 2006a; Baird et al., 2005b) and from acoustic tracking of their feeding sounds in Southern California (Gassmann et al., 2015). They apparently use suction to catch and swallow prey (Jefferson et al., 2008b; Werth, 2006a, 2006b). Beaked whales may be preyed upon by killer whales (Heyning & Mead, 2009; Jefferson et al., 2008b; Wellard et al., 2016).

3.7.4.3.4.5 Species-Specific Threats

There are no known species-specific threats. Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.5 Dall's Porpoise (*Phocoenoides dalli*)

3.7.4.3.5.1 Status and Management

This species is not listed under the ESA. Dall's porpoise is managed by NMFS in U.S. Pacific waters as two stocks: (1) a California, Oregon, and Washington stock; and (2) an Alaskan stock (Carretta et al., 2019c, 2020c; Muto et al., 2019). The Alaska stock does not occur in the PMSR Study Area.

3.7.4.3.5.2 Habitat and Geographic Range

The Dall's porpoise is one of the most common odontocete species in north Pacific waters (Calambokidis & Barlow, 2004; Ferrero & Walker, 1999; Houck & Jefferson, 1999; Jefferson, 1991; Jefferson et al.,

2008b; Williams & Thomas, 2007; Zagzebski et al., 2006). Dall's porpoise is found from northern Baja California, Mexico, north to the northern Bering Sea, and south to southern Japan (Jefferson et al., 1993). However, the species is only common between 32°N and 62°N in the eastern North Pacific (Houck & Jefferson, 1999; Morejohn, 1979). It is typically found in waters at temperatures less than 63°F (17°C) with depths of more than 180 m (Houck & Jefferson, 1999; Reeves et al., 2002b).

Dall's porpoise distribution off the U.S. West Coast is highly variable between years, most likely due to changes in oceanographic conditions (Barlow et al., 2009; Becker et al., 2010; Becker et al., 2012b; Boyd et al., 2017; Forney & Barlow, 1998; Forney et al., 2012; Peterson et al., 2006). North-south movements in California, Oregon, and Washington have been observed, with Dall's porpoises shifting their distribution southward during cooler-water periods on both interannual and seasonal time scales (Forney & Barlow, 1998; Peterson et al., 2006). Based on habitat models developed using 1991–2009 survey data collected during summer and fall, Becker et al. (2016) found that encounters of Dall's porpoise increased in shelf and slope waters in the Study Area, and encounters decreased substantially in waters warmer than approximately 63°F (17°C). These patterns are consistent with previous habitat modeling efforts using a subset of the same data (Barlow et al., 2009; Becker et al., 2010; Becker et al., 2012b; Becker et al., 2014; Forney et al., 2012; Henderson et al., 2014).

During ship surveys conducted quarterly off Southern California from 2004 to 2013, Dall's porpoise was encountered year round, with highest encounters during the cold-water months (Campbell et al., 2015; Douglas et al., 2014; Peterson et al., 2006). As a cold-temperate species, Dall's porpoise showed distributional shifts to the north years with elevated water temperatures (Barlow, 2016; Becker et al., 2018; Becker et al., 2017; Fleming et al., 2018). In the PMSR, Dall's porpoise distribution extended from nearshore waters out to approximately 250 km from the coast, with fewer animals encountered the farther south the waters and reflecting the species' preference for cooler water temperatures (Boyd et al., 2017; Campbell et al., 2015). This distribution for Dall's porpoise is also reflective of the biogeographic boundary at approximately Point Conception (Boyd et al., 2017; Campbell et al., 2015; Forney & Barlow, 1998; Hamilton et al., 2009a; Sanford et al., 2019; Santora et al., 2017b) as discussed in greater detail in Section 3.2 (Sediments and Water Quality) of this EIS/OEIS. Distribution patterns based on summer/fall habitat models were substantially different, predicting very low densities in the Southern California Bight and offshore, and highest predicted densities in a more concentrated band closer to shore, starting at approximately Point Mugu and extending north to San Francisco (Becker et al., 2018; Becker et al., 2017).

3.7.4.3.5.3 Population Trends

No data are available regarding population trends for the stock of Dall's porpoises in California, Oregon, and Washington (Carretta et al., 2019c, 2020c). Examination of sighting and stranding data from the 1950s through 2012 suggest that the relative occurrence of this species in the Southern California Bight has not changed substantially over this time period (Smultea, 2014).

3.7.4.3.5.4 Predator and Prey Interactions

The diet of Dall's porpoises, determined from analyses of stomach contents during studies in the north Pacific along the West Coast, included 33 species of near-surface and mid-water fishes, as well as squid (Houck & Jefferson, 1999). Dall's porpoises are known to be preyed on by killer whales and large sharks (Jefferson & Barros, 1997). Attacks by killer whales occur often in Alaskan waters, where they are considered to be a major predator of Dall's porpoise (Jefferson, 2009).

3.7.4.3.5.5 Species-Specific Threats

Dall's porpoises are susceptible to fisheries interactions and entanglement (Carretta et al., 2019a; Carretta et al., 2019b). In the five-year period between 2013 and 2017, there were two serious injuries or mortalities resulting from fishery interactions (Carretta et al., 2019a). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.6 Dwarf Sperm Whale (*Kogia sima*)

There are two species of *Kogia*: the dwarf sperm whale, which is described in the following subsections, and the pygmy sperm whale (discussed in Section 3.7.4.3.17, Pygmy Sperm Whale [*Kogia breviceps*]). Dwarf and pygmy sperm whales are difficult to distinguish from one another at sea, and many misidentifications have been made. Sightings of either species are often categorized as the genus *Kogia* (Jefferson et al., 2015).

3.7.4.3.6.1 Status and Management

The dwarf sperm whale is not listed under the ESA. Dwarf sperm whales within the Pacific U.S. EEZ are divided into two separate stocks, one of which occurs in the Study Area—the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.6.2 Habitat and Geographic Range

Dwarf sperm whales tend to occur over the outer continental shelf, and they may be relatively coastal in some areas with deep waters nearshore (MacLeod et al., 2004). Although the dwarf sperm whale appears to prefer more tropical waters than the pygmy sperm whale, the exact habitat preferences of the species are not well understood. Records of this species from both the western Pacific (Taiwan) and eastern Pacific (California) suggest that its range includes the waters off Southern California (Carretta et al., 2017c; Jefferson et al., 2008b; Wang & Yang, 2006; Wang et al., 2001).

Along the U.S. Pacific coast, no reported sightings of this species during surveys have been confirmed as dwarf sperm whales, and it is likely that most *Kogia* species off California are pygmy sperm whale (*Kogia breviceps*) (Barlow, 2016; Carretta et al., 2015; Nagorsen & Stewart, 1983). There were no *Kogia* detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 through 2012 (Smultea et al., 2014), which is immediately south of the PMSR Study Area. This may be somewhat due to their pelagic distribution, cryptic behavior (i.e., "hidden" because they are not very active at the surface and do not have a conspicuous blow), and physical similarity to the pygmy sperm whale (Jefferson et al., 2008b; McAlpine, 2009). However, the presence of dwarf sperm whales off the coast of California has been demonstrated by at least five dwarf sperm whale strandings in California between 1967 and 2000 (Carretta et al., 2010).

3.7.4.3.6.3 Population Trends

There is no information available to estimate the population size of dwarf sperm whales off the U.S. West Coast (Carretta et al., 2019c). There are no known sighting records of this species despite many vessel surveys along the West Coast, and sightings of unidentified *Kogia* species are likely to be pygmy sperm whales (Carretta et al., 2015).

3.7.4.3.6.4 Predator and Prey Interactions

Dwarf sperm whales feed on cephalopods and, less often, on deep-sea fishes and shrimps (Caldwell & Caldwell, 1989; Sekiguchi et al., 1992). Dwarf sperm whales generally forage near the seafloor (McAlpine 2009). Killer whales are predators of dwarf sperm whales (Dunphy-Daly et al., 2008).

3.7.4.3.6.5 Species-Specific Threats

There were no mortalities observed in the California drift gillnet fishery for the most recent period monitored (Carretta et al., 2019b). In the period from 2013 to 2017 there were no records of human-related injury or mortality to this species on the U.S. West Coast (Carretta et al., 2019a). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.7 Ginkgo-Toothed Beaked Whale (*Mesoplodon ginkgodens*)

3.7.4.3.7.1 Status and Management

The ginkgo-toothed beaked whale is not listed under the ESA. Due to the difficulty in distinguishing the different *Mesoplodon* species from one another at sea during visual surveys, the United States management unit is defined to include all *Mesoplodon* species that occur in the area (Carretta et al., 2015; Jefferson et al., 2008b). The ginkgo-toothed beaked whale has been combined with five other *Mesoplodon* species to make up the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.7.2 Habitat and Geographic Range

Worldwide, beaked whales normally inhabit continental slope and deep ocean waters (greater than 200 m) and are only occasionally reported in waters over the continental shelf (Cañadas et al., 2002; Ferguson et al., 2006; MacLeod & Mitchell, 2006; Pitman, 2009; Waring et al., 2001).

The distribution of the ginkgo-toothed beaked whale likely includes deep waters off the Pacific coast of North America. The handful of known records of the ginkgo-toothed beaked whale are from strandings, one of which occurred in California (Jefferson et al., 2015; MacLeod & D'Amico, 2006). *Mesoplodon* beaked whales were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 through 2012 (Smultea, 2014).

3.7.4.3.7.3 Population Trends

A Bayesian trend analysis of systematic survey data collected from 1991 to 2008 had previously suggested a decline in the abundance of beaked whales found in waters off California, Oregon, and Washington (Moore & Barlow, 2013). However, a more recent survey in 2014 (Barlow, 2016) and a new analysis incorporating information from all surveys between 1991 and 2014 suggest an increasing abundance for the U.S. West Coast trend over that time, which is a reversal of the previously reported population decline (Carretta et al., 2017d; Moore & Barlow, 2017).

3.7.4.3.7.4 Predator and Prey Interactions

All beaked whales probably feed at or close to the bottom in deep oceanic waters, taking suitable prey opportunistically or as locally abundant, typically by suction feeding (Heyning, 1989; Heyning & Mead, 1996; MacLeod et al., 2003). Feeding may also occur at mid-water, rather than only at or near the bottom, as shown from tagging data on Cuvier's and Blainville's beaked whales (Baird et al., 2005b; Baird et al., 2006b). This may also be the case with ginkgo-toothed beaked whales. Although published analyses of stomach contents from ginkgo-toothed beaked whales are not available, this species presumably preys on squid and possibly fish, similar to other *Mesoplodon* species. These species occupy an ecological niche distinct from Cuvier's beaked whales by feeding on smaller squids, allowing the different beaked whale species to coexist (MacLeod, 2005; MacLeod et al., 2003). *Mesoplodon* beaked whales have been observed being actively preyed upon by killer whales (Wellard et al., 2016).

3.7.4.3.7.5 Species-Specific Threats

No information exists regarding species-specific threats to ginkgo-toothed beaked whales in the Study Area.

3.7.4.3.8 Harbor Porpoise (*Phocoena phocoena*)

3.7.4.3.8.1 Status and Management

Harbor porpoise are not considered a threatened or endangered species under the ESA. The Morro Bay stock overlaps the northern extent of the PMSR Study Area (Carretta et al., 2019c, 2020c). This stock is not considered depleted under the MMPA.

3.7.4.3.8.2 Habitat and Geographic Range

The southern extent of the Morro Bay stock is Point Conception, while the northern extent, to the north of and outside the PMSR Study Area, is at Point Sur (approximately 30 km south of Monterey Bay (Carretta et al., 2019a; Carretta et al., 2017c; Forney et al., 2014). The harbor porpoise distribution is reflective of the biogeographic boundary at approximately Point Conception (Forney & Barlow, 1998; Hamilton et al., 2009a; Sanford et al., 2019; Santora et al., 2017b), as discussed in greater detail in Section 3.2 (Sediments and Water Quality) of this EIS/OEIS. Harbor porpoise is a nearshore species, although the outer range of the Morro Bay stock is the 200 m isobath (Carretta et al., 2019a; Carretta et al., 2017c; Forney et al., 2014). Harbor porpoise are expected to be present in these waters year round. Surveys including shallow and deep waters north of Point Conception have encountered very few harbor porpoise in the offshore area (Campbell et al., 2015; Douglas et al., 2014; Forney et al., 2014). In the waters north of Point Conception the 200 m isobath can be up to approximately 10 NM from the coast, but a large portion of the PMSR is beyond 12 NM from the coast in that part of the Study Area.

Aerial surveys that included the Morro Bay harbor porpoise population between 2002 and 2007 indicated a core area of higher density between Point Estero (north of Cayucos), and Point Arguello (north of Point Conception), with density decreasing toward the edges of their range (Calambokidis et al., 2015). It was argued that the small core range of this small and resident Morro Bay harbor porpoise population made it particularly vulnerable to anthropogenic impacts (Calambokidis et al., 2015). As a result, the entire range of the Morro Bay harbor porpoise population was identified by Calambokidis et al. (2015) as a BIA for that small and resident population. A portion of the identified Morro Bay harbor porpoise small and resident population area overlaps with the nearshore boundary of waters within the northern portion of the PMSR Study Area (Figure 3.7-6).

3.7.4.3.8.3 Population Trends

Data had not been available regarding population trends for the stock of harbor porpoises in the Morro Bay stock (Carretta et al., 2019c, 2020c; Forney et al., 2014) because they had not been surveyed often. Data from recent surveys indicates Morro Bay population has increased from a population numbered about 570 animals in 1991 to the current estimate, which has the population at approximately 4,200 porpoises, a roughly seven-fold increase (Forney et al., 2020; National Marine Fisheries Service, 2021). Since 2001, when most coastal set-gillnetting ceased, the current population indicates that the Morro Bay stock trend reflects an increase of approximately 10 percent a year (Forney et al., 2020; National Marine Fisheries Service, 2021).

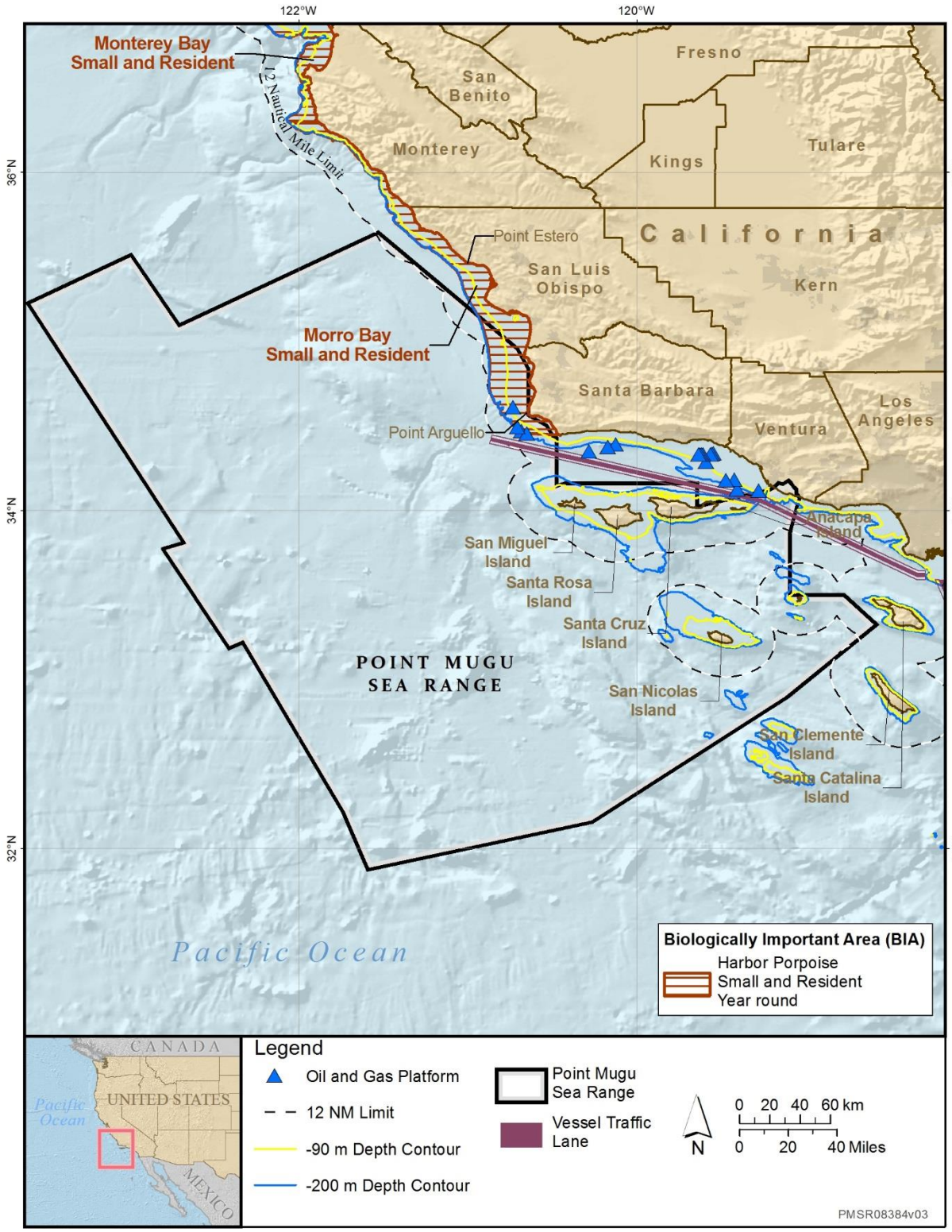


Figure 3.7-6: Morro Bay Harbor Porpoise Biologically Important Small and Resident Population Area Identified in the Vicinity of the PMSR Study Area (per Calambokidis et al. 2015)

3.7.4.3.8.4 Predator and Prey Interactions

The diet of harbor porpoises includes a variety of fish, including herring, sardines, and anchovy, and cephalopods (Berrow & Rogan, 1996; Bjorge & Tolley, 2009; Santos & Pierce, 2003). Passive acoustic monitoring off the Oregon coast in 2014 determined that harbor porpoise habitat use in that area varied with the ebb phase of the tidal forcing in one location while night-time foraging took place at sandy bottom site offshore (Holdman et al., 2019). The harbor porpoise is known to be attacked and killed by killer whales, common bottlenose dolphins, and large sharks (Jefferson et al., 2015).

3.7.4.3.8.5 Species-Specific Threats

National Marine Fisheries Service (2021) indicate that unmonitored fisheries had a dramatic adverse impact on the Morro Bay population before monitoring of harbor porpoise began in 1986. Gillnet fisheries inshore of 60 fathoms between Point Arguello and Point Reyes, California, were banned in 2002, and the large-mesh drift gillnet fishery for swordfish and thresher shark are farther offshore than harbor porpoise's normal range. The small and resident Morro Bay stock increased in number at almost 10 percent a year following the ban on coastal set-gillnetting (Forney et al., 2020; National Marine Fisheries Service, 2021).

In 2013 there was one dead stranded harbor porpoise found entangled in a plastic bag and one found dead with an assumed fishery-related entanglement scar (Carretta et al., 2017b). Chronic vessel noise has also been shown to disrupt the behavior of harbor porpoises in some settings (Graham et al., 2017; Wisniewska et al., 2018). Based on acoustic monitoring within the Monterey Bay National Marine Sanctuary (which is just north of the PMSR), Simonis et al. (2020) have suggested that the noise from seal bomb use associated with purse seine fishing may be a potential threat to harbor porpoise in the region given seal bomb detonations occurring up to 88 times per hour, 335 per day, and 1,188 explosions per month.

3.7.4.3.9 Hubbs' Beaked Whale (*Mesoplodon carlhubbsi*)

3.7.4.3.9.1 Status and Management

Hubbs' beaked whale is not listed under the ESA. Due to the difficulty in distinguishing the different *Mesoplodon* species from one another at sea during visual surveys, the United States management unit is defined to include all *Mesoplodon* species that occur in the area. Hubbs' beaked whale has been combined with five other *Mesoplodon* species to make up the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.9.2 Habitat and Geographic Range

The distribution of Hubbs' beaked whale is generally associated with the deep subarctic current system along the Pacific coast of North America (Mead, 1989; Mead et al., 1982). MacLeod et al. (2006) speculated that the distribution of Hubbs' beaked whale might be continuous across the north Pacific between about 30°N and 45°N, but this remains to be confirmed.(Baumann-Pickering et al., 2014; MacLeod & Mitchell, 2006; Mead, 1989)

Mead (1989) speculated that the range of Hubbs' beaked whale includes the PMSR Study Area off California. During systematic surveys conducted from 1986 to 2005 in the eastern Pacific, there was one confirmed sighting of Hubbs' beaked whale in offshore waters off the State of Washington (Hamilton et al., 2009b). *Mesoplodon* beaked whales were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 through 2012 (Smultea, 2014). The beaked whale-like

frequency modulated pulse type ("BW40") recorded off Southern California may possibly be produced by Hubbs' beaked whale (Baumann-Pickering et al., 2014; Debich et al., 2015b; Rice et al., 2020).

3.7.4.3.9.3 Population Trends

A Bayesian trend analysis of systematic survey data collected from 1991 to 2008 suggested a decline in the abundance of beaked whales found in waters off California, Oregon, and Washington (Moore & Barlow, 2013). However, a more recent NMFS survey in 2014 (Barlow, 2016) and a new analysis incorporating information from all surveys between 1991 and 2014 suggest an increasing abundance for the U.S. West Coast trend over that time, which is a reversal of the previously reported population decline (Carretta et al., 2019c; Carretta et al., 2018b; Carretta et al., 2017d; Moore & Barlow, 2017).

3.7.4.3.9.4 Predator and Prey Interactions

All beaked whales probably feed at or close to the bottom in deep oceanic waters (Heyning, 1989; Heyning & Mead, 1996; MacLeod et al., 2003). Feeding may also occur at mid-water, rather than only at or near the bottom, as shown from tagging data on Cuvier's and Blainville's beaked whales (Baird et al., 2004). This may also be the case with this species. Stomach contents analyses of Hubbs' beaked whales indicated squid beaks, fish ear bones, and other fish bones (MacLeod et al., 2003; Mead et al., 1982). *Mesoplodon* species occupy an ecological niche distinct from that of Cuvier's beaked whales by feeding on smaller squids, allowing the different beaked whale species to coexist (MacLeod, 2005; MacLeod et al., 2003). *Mesoplodon* beaked whales have been observed being actively preyed upon by killer whales (Wellard et al., 2016).

3.7.4.3.9.5 Species-Specific Threats

There are no known threats specific to this species.

3.7.4.3.10 Killer Whale (*Orcinus orca*)

A single species of killer whale is currently recognized, but strong and increasing evidence indicates the possibility of several different species of killer whales worldwide, many of which are called "ecotypes" (Ford, 2008). The different geographic forms of killer whale are distinguished by distinct social and foraging behaviors and other ecological traits. In the north Pacific, these recognizable geographic forms are variously known as "residents, " "transients," and "offshore" ecotypes (Hoelzel et al., 2007). Both the transient and offshore ecotypes are known to occur in the PMSR Study Area (Carretta et al., 2019c, 2020c).

3.7.4.3.10.1 Status and Management

Five killer whale stocks are recognized within the Pacific U.S. EEZs. Both the West Coast Transient stock and the Eastern North Pacific Offshore stock are present in the PMSR Study Area (Carretta et al., 2019c, 2020c). The stocks present in the PMSR Study Area are not species or DPS listed under the ESA.

3.7.4.3.10.2 Habitat and Geographic Range

Killer whales are found in all marine habitats, from the coastal zone (including most bays and inshore channels) to deep oceanic basins, and from equatorial regions to the polar pack ice zones of both hemispheres. Although killer whales are also found in tropical waters and the open ocean, they are most numerous in coastal waters and at higher latitudes (Dahlheim & Heyning, 1999). Forney and Wade (2006) found that killer whale densities increased by one to two orders of magnitude from the tropics to the poles.

In the PMSR Study Area, only the transient and offshore ecotypes may be present (Carretta et al., 2019c). During seven systematic ship surveys of waters off the U.S. West Coast between 1991 and 2014, there were 37 killer whale sightings, only five of which were off Southern California (Henderson et al., 2016). Based on two sightings from 15 aerial surveys conducted in the Southern California Range Complex from 2008 to 2012, killer whales were ranked 12th in occurrence compared to other cetaceans (Jefferson et al., 2014; Smultea et al., 2014).

3.7.4.3.10.3 Population Trends

No data are available on current population trends for the West Coast Transient stock of killer whales (Carretta et al., 2019c, 2020c; Muto et al., 2019, 2020a; Muto et al., 2020b). NMFS considers the population trajectory for Eastern North Pacific Offshore killer whales to be stable (Carretta et al., 2019c).

3.7.4.3.10.4 Predator and Prey Interactions

Killer whales feed on a variety of prey, including bony fishes, elasmobranchs (a class of fish composed of sharks, skates, and rays), cephalopods, seabirds, sea turtles, and other marine mammals (Fertl et al., 1996; Ford et al., 2014; Ford et al., 2013; Jefferson et al., 2008b). Some populations are known to specialize in specific types of prey (Jefferson et al., 2008b; Krahn et al., 2004; Wade et al., 2009). The killer whale has no known natural predators; it is considered to be the top predator of the oceans (Ford, 2008).

3.7.4.3.10.5 Species-Specific Threats

For the killer whale stocks that are present in the PMSR Study Area, no species-specific threats have been identified other than fisheries bycatch. Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.11 Long-Beaked Common Dolphin (*Delphinus capensis*)

Common dolphins are represented by two species for management purposes in the NMFS Pacific Stock Assessment Report (Carretta et al., 2019c; Carretta et al., 2020b), the long-beaked common dolphin (*Delphinus capensis*) and the short-beaked common dolphin (*Delphinus delphis*). There is scientific disagreement regarding the common dolphin taxonomy (Committee on Taxonomy, 2016), but the Navy is following the NMFS naming convention as presented in the most recent stock assessments (Carretta et al., 2019c; Carretta et al., 2020b; Carretta et al., 2020c).

3.7.4.3.11.1 Status and Management

This species is not listed under the ESA. For the NMFS stock assessment reports, there is a single Pacific management stock for long-beaked common dolphins found within the U.S. EEZ off the U.S. West Coast, which is called the California, Oregon, and Washington stock (Carretta et al., 2019c; Carretta et al., 2020b).

3.7.4.3.11.2 Habitat and Geographic Range

The long-beaked common dolphin appears to be restricted to waters relatively close to shore (Jefferson & Van Waerebeek, 2002; Perrin, 2009), apparently preferring shallower and warmer water than the short-beaked common dolphin (Becker et al., 2016; Perrin, 2009; Trickey et al., 2020). Off California and Baja California, Mexico, long-beaked common dolphins are commonly found within 50 NM of the coast (Carretta et al., 2011; Gerrodette & Eguchi, 2011). This species is found off Southern California year round, but it may be more abundant there during the warm-water months (May–October) (Barlow & Forney, 2007; Bearzi, 2005b; Douglas et al., 2014; Henderson et al., 2014; Heyning & Perrin, 1994).

Stranding data and sighting records suggest that this species' abundance fluctuates seasonally and from year to year off California (Carretta et al., 2011; Douglas et al., 2014; Henderson et al., 2014; Trickey et al., 2020). Southern California waters represent the northern limit to this species' range, and the seasonal and inter-annual changes in abundance off California are assumed to reflect the shifts in the movements of animals between U.S. and Mexican waters (Carretta et al., 2019c).

3.7.4.3.11.3 Population Trends

There appears to be an increasing trend in the abundance of long-beaked common dolphin in Southern California waters over the last 30 years (Carretta et al., 2019c; Jefferson et al., 2014).

3.7.4.3.11.4 Predator and Prey Interactions

The genus *Delphinus* is known to feed primarily on organisms in the deep scattering layer, including fish and squid that migrate from depth to surface and back again at different times of day (Evans, 1994). Predation by killer whales on this species has been observed (Leatherwood et al., 1973).

3.7.4.3.11.5 Species-Specific Threats

Long-beaked common dolphins are particularly susceptible to fisheries interactions. From 2013 to 2017, there were 28 known long-beaked common dolphin deaths attributed to human-related causes (primarily gillnet fishery entanglement) (Carretta et al., 2019a; Carretta et al., 2019b). Additionally, along California's coast mortality has been documented due to domoic acid toxicity, which is a neurotoxin associated with algal blooms (Carretta et al., 2015).

The 2015 Pacific Stock Assessment Report notes that four long-beaked common dolphins died in 2011 as the result of blast trauma associated with underwater detonations conducted by the U.S. Navy at the Silver Strand Training Complex off San Diego (Carretta et al., 2017c; Danil & St Leger, 2011). This was the first, and only, incident to date of its kind, in decades of conducting training at that location. Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.12 Northern Right Whale Dolphin (*Lissodelphis borealis*)

3.7.4.3.12.1 Status and Management

This species is not listed under the ESA but is protected by the MMPA. The management stock in U.S. waters consists of a single California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.12.2 Habitat and Geographic Range

The northern right whale dolphin occurs in cool and temperate to subarctic waters of the North Pacific, from the west coast of North America to Japan and Russia. This oceanic species is distributed from approximately 30°N to 50°N, 145°W to 118°E and generally not as far north as the Bering Sea (Jefferson et al., 2015). Occasional movements south of 30°N are associated with unusually cold water temperatures (Jefferson & Lynn, 1994). This species tends to occur along the outer continental shelf and slope, normally in waters colder than 68°F (20°C) (Jefferson & Lynn, 1994). Northern right whale dolphins generally move nearshore only in areas where the continental shelf is narrow or where productivity on the shelf is especially high (Smith et al., 1986).

Off California, the northern right whale dolphin is known to occur year round, but abundance and distribution vary seasonally (Becker et al., 2014; Dohl et al., 1983; Douglas et al., 2014; Forney & Barlow, 1998). Northern right whale dolphins are primarily found off California during the colder water months, with distribution shifting northward into Oregon and Washington as water temperatures increase during

late spring and summer (Barlow, 1995; Forney & Barlow, 1998; Forney et al., 1995; Henderson et al., 2014). In the cool water period, the peak abundance of northern right whale dolphins in Southern California corresponds closely with the peak abundance of squid (Forney & Barlow, 1998; Jefferson & Lynn, 1994). Northern right whale dolphins were sighted year round during 16 ship surveys conducted from 2004 to 2008 off Southern California, but the majority of the sightings were in winter and spring (Douglas et al., 2014). There were 16 sightings of northern right whale dolphins during 18 aerial surveys conducted in the Southern California Bight from 2008 to 2013 (Jefferson et al., 2014).

As noted above, in the warm-water periods, the northern right whale dolphin is not as abundant in Southern California due to shifting distributions north into Oregon and Washington (Barlow, 1995; Forney & Barlow, 1998; Forney et al., 1995). Based on habitat models developed with line-transect survey data collected off the U.S. West Coast during summer and fall from 1991 to 2009, Becker et al. (2016) found that encounters of northern right whale dolphin increased in shelf and slope waters, and encounters decreased substantially in waters warmer than approximately 64°F (18°C). These patterns are consistent with previous habitat modeling efforts using a subset of the same data (Barlow et al., 2009; Becker et al., 2010; Becker et al., 2012b; Becker et al., 2014; Forney et al., 2012). Northern right whale dolphins also tend to occur further offshore of Southern California during the summer months (Douglas et al., 2014; Forney & Barlow, 1998).

3.7.4.3.12.3 Population Trends

Examination of sighting and stranding data from the 1950s through 2012 suggest that the relative occurrence of northern right whale dolphins in the Southern California Bight has not changed over that period (Smultea, 2014), and the Pacific Stock Assessment Report states that there is no evidence of a trend in abundance for this stock (Carretta et al., 2019c, 2020c).

3.7.4.3.12.4 Predator and Prey Interactions

Northern right whale dolphins are known to feed on a wide variety of near-surface and mid-water prey species, including fishes and cephalopods, such as squid. Otolith (earbone) identification has shown that the northern right whale dolphin preys on many different species. Squid and lanternfish appear to be the main prey species in Southern California waters (Jefferson et al., 2015). This species may be preyed on by killer whales and occasionally sharks (Lipsky, 2009).

3.7.4.3.12.5 Species-Specific Threats

Northern right whale dolphins are particularly susceptible to entanglement and other fishery interactions such as purse seines and driftnets (Jefferson et al., 2015). The major threat appears to be bycatch in the California/Oregon thresher shark driftnet fishery, but catches are low, only about five to nine individuals per year (Carretta et al., 2010). From 2013 to 2017 there were seven known northern right whale dolphins deaths attributed to human-related causes along the U.S. West Coast (Carretta et al., 2019a). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.13 Pacific White-Sided Dolphin (*Lagenorhynchus obliquidens*)

3.7.4.3.13.1 Status and Management

This species is not listed under the ESA. NMFS recognizes a single stock for the U.S. West Coast—the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.13.2 Habitat and Geographic Range

Pacific white-sided dolphins are found in cold temperate waters across the northern rim of the Pacific Ocean as far north as the southern Bering Sea and as far south as the Gulf of California off Mexico (Ferguson, 2005; Jefferson et al., 2015; Leatherwood et al., 1984; Reeves et al., 2002b). They are also known to inhabit inshore regions of southeast Alaska, British Columbia, and Washington, and occur seasonally off Southern California (Brownell et al., 1999; Forney & Barlow, 1998). Sighting records and captures in open sea driftnets indicate that this species also occurs in oceanic waters well beyond the shelf and slope (Ferrero & Walker, 1996; Leatherwood et al., 1984).

Off California, Forney and Barlow (1998) found significant north/south shifts in the seasonal distribution of Pacific white-sided dolphin, with animals moving north into Oregon and Washington waters during the summer and showing increased abundance in the Southern California Bight in the winter. During ship surveys conducted off the U.S. West Coast in the summer and fall from 1991 to 2005, the number of Pacific white-sided dolphin sightings showed no clear pattern with respect to geographic region, although they were consistently found in larger groups off central California (Barlow & Forney, 2007; Henderson et al., 2014). Based on habitat models developed with survey data collected during summer and fall from 1991 to 2009, Becker et al. (2016) found that encounters of Pacific white-sided dolphin increased in shelf and slope waters and in relatively cooler waters in the Study Area. These patterns are consistent with previous habitat modeling efforts using a subset of the same data (Barlow et al., 2009; Becker et al., 2010; Becker et al., 2012b; Becker et al., 2014; Forney et al., 2012). Based on ship survey data collected quarterly from 2004 to 2013 and from 2016 to 2019, Pacific white-sided dolphins occurred year round off Southern California, but the majority of the sightings were in winter and spring, when their distribution was more widespread (Campbell et al., 2015; Trickey et al., 2020). There were 21 sightings of Pacific white-sided dolphin during 18 aerial surveys conducted in the Southern California Bight from 2008 to 2013 (Jefferson et al., 2014).

3.7.4.3.13.3 Population Trends

Multiple analyses of sightings and stranding data have indicated a significant decline in abundance over time from the Southern California Bight to the Gulf of California in Mexico (Barlow, 2016; Campbell et al., 2015; Salvadeo et al., 2010; Smultea, 2014).

3.7.4.3.13.4 Predator and Prey Interactions

Pacific white-sided dolphins in the eastern north Pacific feed primarily on near-surface and mid-water fishes, such as lanternfish, anchovies, mackerel, and hake, as well as cephalopods (Black, 1994; Brownell et al., 1999; Heise, 1997; Jefferson et al., 2008b; Morton, 2000). Feeding appears to be mostly on deep scattering layer organisms by use of cooperative feeding methods (Black, 2009; Jefferson et al., 2008b). Large schools have been observed feeding cooperatively on large shoals of schooling fish (Black, 2009; Jefferson et al., 2008b). Pacific white-sided dolphins have been observed being preyed on by killer whales and typically flee when they come in contact with the predator (Black, 2009).

3.7.4.3.13.5 Species-Specific Threats

Pacific white-sided dolphins are particularly susceptible to entanglement and other fishery interactions. Along the U.S. West Coast between 2013 and 2017 there were 6 known deaths or 4 serious injuries to Pacific white-sided dolphins during fishery activities and an additional 22 mortalities during fisheries research (Carretta et al., 2019a). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.14 Perrin's Beaked Whale (*Mesoplodon perrini*)

3.7.4.3.14.1 Status and Management

Perrin's beaked whale was described as a new species of marine mammal in 2002 (Dalebout et al., 2002). Perrin's beaked whale is not listed under the ESA. Due to the difficulty in distinguishing the *Mesoplodon* species at sea during visual surveys, the management unit has been defined by NMFS to include all *Mesoplodon* species that occur in the area. Perrin's beaked whale has been combined with other *Mesoplodon* species to make up the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.14.2 Habitat and Geographic Range

Worldwide, beaked whales normally inhabit continental slope and deep oceanic waters (greater than 200 m) and are only occasionally reported in waters over the continental shelf (Cañadas et al., 2002; Ferguson et al., 2006; MacLeod & Mitchell, 2006; Pitman, 2009; Waring et al., 2001).

Perrin's beaked whale is known only from five strandings along the California coastline from 1975 to 1997 (Dalebout et al., 2002; MacLeod & Mitchell, 2006). These strandings include two at U.S. Marine Corps Base Camp Pendleton (33°15' N, 117°26' W), and one each at Carlsbad, (33°07' N, 117°20' W), Torrey Pines State Reserve (32°55' N, 117°15' W), and Monterey (36°37' N, 121°55' W) (Dalebout et al., 2002; Mead, 1981). These stranded animals were previously identified as Hector's beaked whale but have been reclassified as Perrin's beaked whale (Dalebout et al., 2002; Mead, 1981, 1989; Mead & Baker, 1987). While this stranding pattern suggests an eastern North Pacific Ocean distribution, too few records exist for this to be conclusive (Dalebout et al., 2002). Due to the scarcity of data, the full extent of Perrin's beaked whale distribution is unknown; however, it likely occurs primarily in oceanic waters of the eastern north Pacific with depths exceeding 1,000 m (MacLeod & Mitchell, 2006). *Mesoplodon* beaked whales were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 through 2012 (Smultea, 2014). Acoustic monitoring from devices located at seven sites in the Southern California Bight (across a broad area stretching from Santa Cruz Island to an open ocean area south of San Clemente Island) documented the presence of a beaked whale-like frequency modulated pulse type that may possibly be produced by Perrin's beaked whale since it is otherwise unidentified (Baumann-Pickering et al., 2014; Baumann-Pickering et al., 2015b; Debich et al., 2015b; Rice et al., 2020).

3.7.4.3.14.3 Population Trends

A Bayesian trend analysis of systematic survey data collected from 1991 to 2008 suggested a decline in the abundance of beaked whales found in waters off California, Oregon, and Washington (Moore & Barlow, 2013). However, a more recent survey in 2014 (Barlow, 2016) and a new analysis incorporating information from all surveys between 1991 and 2014 suggest an increasing abundance for the U.S. West Coast trend over that time, which is a reversal of the previously reported population decline (Carretta et al., 2017d; Moore & Barlow, 2017).

3.7.4.3.14.4 Predator and Prey Interactions

All beaked whales probably feed at or close to the bottom in deep oceanic waters, taking suitable prey opportunistically or as locally abundant (Heyning, 1989; Heyning & Mead, 1996; MacLeod et al., 2003). Feeding may also occur at mid-water rather than only at or near the bottom, as shown from recent tagging data on Cuvier's and Blainville's beaked whales (Baird et al., 2004). This may also be the case with this species. Stomach contents analyses of captured and stranded individuals suggest beaked

whales are deep divers that feed by suction on mid-water fishes, squids, and deepwater bottom-feeding invertebrates (Heyning, 1989; Heyning & Mead, 1996; MacLeod et al., 2003; Santos et al., 2007; Santos et al., 2001). Dalebout et al. (2002) reported finding deep-sea squid species within stomach contents of stranded Perrin's beaked whales. *Mesoplodon* species occupy an ecological niche distinct from Cuvier's beaked whales by feeding on smaller squids, allowing the different beaked whale species to coexist (MacLeod, 2005; MacLeod et al., 2003). *Mesoplodon* beaked whales have been observed being actively preyed upon by killer whales (Wellard et al., 2016).

3.7.4.3.14.5 Species-Specific Threats

No information exists regarding species-specific threats to Perrin's beaked whales in the Study Area.

3.7.4.3.15 Pygmy Beaked Whale (*Mesoplodon peruvianus*)

Literature published before the pygmy beaked whale was identified referred to it by the common name "*Mesoplodon* species A" (Pitman & Lynn, 2001). It is also commonly referred to as "Lesser beaked whale" (Carretta et al., 2015). The pygmy beaked whale was first described as a new species in 1991 (Jefferson et al., 2008b).

3.7.4.3.15.1 Status and Management

The pygmy beaked whale is not listed under the ESA. Due to the difficulty in distinguishing the *Mesoplodon* species at sea during visual surveys, the United States management unit is defined to include all *Mesoplodon* species that occur in the area. The pygmy beaked whale has been combined with five other *Mesoplodon* species to make up the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.15.2 Habitat and Geographic Range

Worldwide, beaked whales normally inhabit continental slope and deep oceanic waters (greater than 200 m) and are only occasionally reported in waters over the continental shelf (Cañadas et al., 2002; Ferguson et al., 2006; MacLeod & Mitchell, 2006; Pitman, 2009; Waring et al., 2001). Based on stranding data from the Pacific coast of Bahia de La Paz, Mexico, this species' range is thought to include deep waters off the Pacific coast of North America (Aurioles-Gamboa & Urban-Ramirez, 1993; Jefferson et al., 2008b; Urban-Ramirez & Aurioles-Gamboa, 1992). This species was first described in 1991 from stranded specimens from Peru. Since then, strandings have been recorded along the coasts of Mexico, Peru, and Chile (Pitman & Lynn, 2001; Reyes et al., 1991; Sanino et al., 2007). Based on sightings and strandings, the pygmy beaked whale is presumed to be found only in the eastern tropical Pacific. MacLeod et al. (2006) suggested that the pygmy beaked whale occurs in the eastern Pacific from about 30° N to about 30° South (S) (MacLeod & Mitchell, 2006; Mead, 1989).

Pygmy beaked whales are assumed to be present in the PMSR Study Area. *Mesoplodon* beaked whales were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 through 2012 (Smultea, 2014). Acoustic monitoring has documented the presence of a beaked whale-like frequency modulated pulse type ("BW70") in Southern California that may possibly be produced by pygmy beaked whales (Baumann-Pickering et al., 2014).

3.7.4.3.15.3 Population Trends

A Bayesian trend analysis of systematic survey data collected from 1991 to 2008 suggested a decline in the abundance of beaked whales found in waters off California, Oregon, and Washington (Moore & Barlow, 2013). However, a more recent survey in 2014 (Barlow, 2016) and a new analysis incorporating

information from all surveys between 1991 and 2014 suggest an increasing abundance for the U.S. West Coast trend over that time, which is a reversal of the previously reported population decline (Carretta et al., 2019c; Carretta et al., 2018b; Carretta et al., 2017d; Moore & Barlow, 2017).

3.7.4.3.15.4 Predator and Prey Interactions

All beaked whales probably feed at or close to the bottom in deep oceanic waters, taking suitable prey opportunistically or as locally abundant (Heyning, 1989; Heyning & Mead, 1996; MacLeod et al., 2003). Feeding may also occur at mid-water, rather than only at or near the bottom, as shown from recent tagging data on Cuvier's and Blainville's beaked whales (Baird et al., 2004). This may also be the case with this species. Stomach contents analyses are available for only two pygmy beaked whales; the contents included no squid beaks but did include ear bones of perches and ray-finned fish (Reyes et al., 1991). *Mesoplodon* species occupy an ecological niche distinct from Cuvier's beaked whales by feeding on smaller squids, allowing the different beaked whale species to coexist. The stomach contents of this species suggests even less overlap with the Cuvier's beaked whale (MacLeod, 2005; MacLeod et al., 2003). *Mesoplodon* beaked whales have been observed being actively preyed upon by killer whales (Wellard et al., 2016).

3.7.4.3.15.5 Species-Specific Threats

There are no known species-specific threats to pygmy beaked whales in the Study Area.

3.7.4.3.16 Pygmy Killer Whale (*Feresa attenuata*)

3.7.4.3.16.1 Status and Management

The pygmy killer whale is not listed under the ESA. The only stock for the species in the Pacific is for animals found within the U.S. EEZ around the Hawaiian Islands. The species has only been sighted in U.S. West Coast waters once, which occurred in 2014 (Barlow, 2016). The Pacific Stock Assessment report does not include pygmy killer whales as a managed stock in U.S. West Coast waters (Carretta et al., 2019c, 2020c).

3.7.4.3.16.2 Habitat and Geographic Range

This tropical species' range in the open ocean generally extends to the southern regions of the North Pacific Gyre and the southern portions of the North Pacific Transition Zone in deep water areas (Davis et al., 2000; McSweeney et al., 2009; Oleson et al., 2013; Würsig et al., 2000). Many sightings have occurred from cetacean surveys of the eastern tropical Pacific (Au & Perryman, 1985; Barlow & Gisiner, 2006; Wade & Gerrodette, 1993).

During a NMFS 2014 systematic ship survey off the U.S. West Coast in unusually warm water conditions, a group of 27 pygmy killer whales was sighted in deep offshore waters near the southern U.S. EEZ bordering Mexico (Barlow, 2016). This was the first sighting of that tropical species in U.S. West Coast waters. Even with this 2014 sighting, it remains unlikely for this species to routinely be present off the U.S. West Coast.

3.7.4.3.16.3 Population Trends

The 2014 sighting was the first sighting of this tropical species in U.S. West Coast waters (Barlow, 2016). There are no data available for an analysis of the population trend for pygmy killer whales in U.S. West Coast waters. Lacking any other data for context, surveys in the Eastern Tropical Pacific indicated that population had an abundance of approximately 39,000 (Wade & Gerrodette, 1993).

3.7.4.3.16.4 Predator and Prey Interactions

Pygmy killer whales feed predominantly on fish and squid. They have been known to attack other dolphin species, apparently as prey, although this is not common (Jefferson et al., 2008b; Perryman & Foster, 1980; Ross & Leatherwood, 1994). The pygmy killer whale has no documented predators (Weller, 2009), although it may be subject to predation by killer whales.

3.7.4.3.16.5 Species-Specific Threats

There are no known specific threats for pygmy killer whales off the U.S. West Coast. Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.17 Pygmy Sperm Whale (*Kogia breviceps*)

There are two species of *Kogia*: the pygmy sperm whale (*Kogia breviceps*) and the dwarf sperm whale (*Kogia sima*; discussed in Section 3.7.4.3.6, Dwarf Sperm Whale [*Kogia sima*]). Dwarf and pygmy sperm whales are difficult to detect and distinguish from one another at sea, and many misidentifications have been made. Sightings of either species are often categorized as the genus *Kogia* (Jefferson et al., 2015).

3.7.4.3.17.1 Status and Management

The pygmy sperm whale is not listed under the ESA. Pygmy sperm whales in the Study Area have been designated the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.17.2 Habitat and Geographic Range

The pygmy sperm whale frequents more temperate habitats than the dwarf sperm whale, which is more of a tropical species (Baird, 2013a; Baird, 2005; Baird et al., 2003; Barlow et al., 2004; Maldini et al., 2005; Oleson et al., 2013). Pygmy sperm whales have only rarely been sighted along the U.S. West Coast during surveys, and the limited sightings cannot be used to produce a reliable population estimate (Carretta et al., 2017c). Several studies have suggested that this species generally occurs beyond the continental shelf edge (Bloodworth & Odell, 2008; MacLeod et al., 2004), and all confirmed pygmy sperm whale sightings off the U.S. West Coast have been well offshore (Barlow, 2016; Hamilton et al., 2009b). For California, a total of six pygmy sperm whale sightings have been made in offshore waters along the U.S. West Coast during systematic surveys conducted between 1991 and 2014 (Barlow, 2016; Hamilton et al., 2009b). There were no *Kogia* detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 to 2012 (Smultea, 2014).

Movement patterns for this species are poorly understood. No specific information regarding routes, seasons, or resighting rates in specific areas is available for the PMSR Study Area.

3.7.4.3.17.3 Population Trends

There are no data available for an analysis of the population trend for pygmy sperm whales in the Pacific (Carretta et al., 2019c, 2020c).

3.7.4.3.17.4 Predator and Prey Interactions

Pygmy sperm whales feed on cephalopods and, less often, on deep-sea fishes and shrimps (Beatson, 2007; Caldwell & Caldwell, 1989). A recent study in Hawaiian waters confirmed cephalopods were the primary prey of pygmy sperm whales, making up 78.7 percent of prey abundance and 93.4 percent contribution by mass (West et al., 2009). Stomach samples revealed an extreme diversity of cephalopod prey, with 38 species from 17 different families (West et al., 2009). Pygmy sperm whales have not been

documented to be prey to any other species, though they are likely subject to occasional killer whale predation like other whale species.

3.7.4.3.17.5 Species-Specific Threats

Pygmy sperm whales are susceptible to fisheries interactions. In 1992 and 1993 two pygmy sperm whale mortalities were observed in the California drift gillnet fishery, but none were observed in the most recent period monitored (2004–2008) (Carretta et al., 2017c). There have been no records of human related injury or mortality to this species on the U.S. West Coast in the last decade (Carretta et al., 2019a; Carretta et al., 2020c; Carretta et al., 2016a). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.18 Risso's Dolphins (*Grampus griseus*)

3.7.4.3.18.1 Status and Management

Risso's dolphin is not listed under the ESA. For the NMFS stock assessment reports, Risso's dolphins within the Pacific U.S. EEZ are divided into two separate stocks, one of which occurs in the PMSR Study Area—the California, Oregon and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.18.2 Habitat and Geographic Range

Risso's dolphins are found in the waters off the U.S. West Coast (Barlow, 2016). Studies have documented that Risso's dolphins are found along the continental slope, over the outer continental shelf (Baumgartner, 1997; Cañadas et al., 2002; Cetacean and Turtle Assessment Program, 1982; Davis et al., 1998; Green et al., 1992; Kruse et al., 1999; Mignucci-Giannoni, 1998), and over submarine canyons (Mussi et al., 2004). This species is frequently observed in the waters surrounding San Clemente Island, located just south of the PMSR Study Area (Bacon et al., 2017; Carretta et al., 2000; Schorr et al., 2020; Smultea et al., 2018).

Risso's dolphins exhibit an apparent seasonal shift in distribution off the U.S. West Coast, with movements from California waters north into Oregon and Washington waters in summer (Carretta et al., 2000; Forney & Barlow, 1998; Green et al., 1992; Schorr et al., 2020; Soldevilla et al., 2008). During ship surveys conducted quarterly off Southern California from 2004 to 2008, Risso's dolphins were encountered year round, with the highest number of encounters during the cold-water months (Douglas et al., 2014), consistent with previously observed seasonal shifts in distribution (Carretta et al., 2000; Forney & Barlow, 1998; Henderson et al., 2014; Soldevilla, 2008). During ship surveys conducted quarterly off Southern California from 2016 to 2019, Risso's dolphins were never encountered during the spring cruises (Trickey et al., 2020).

Habitat models derived from line-transect survey data collected between 1991 and 2009 off the U.S. West Coast show that Risso's dolphins exhibit a disjunctive longitudinal distribution, suggesting that there may be two separate populations in this area, although additional genetic data are required for confirmation (Becker et al., 2016). Aerial surveys over a six-year period between 2008 and 2013 found Risso's dolphins to be the most common species among mixed-species associations with other marine mammals in the Southern California Bight (Bacon et al., 2017).

3.7.4.3.18.3 Population Trends

For Risso's dolphins in California, Oregon, and Washington waters, differences in estimated abundance are present at both seasonal and interannual time scales and no long-term population trends have been identified (Barlow, 2016; Becker et al., 2012b; Carretta et al., 2019c, 2020c). However, based on density

estimates derived from aerial survey data collected from 2008 to 2013, the abundance of Risso's dolphin in Southern California waters appears to have increased (Jefferson et al., 2014). Further, examination of sighting and stranding data from the 1950s through 2012 also indicated an increase in the relative occurrence of this species in the Southern California Bight (Smultea, 2014).

3.7.4.3.18.4 Predator and Prey Interactions

Cephalopods and crustaceans are the primary prey for Risso's dolphins (Clarke, 1996), which feed mainly at night (Baird et al., 2008; Jefferson et al., 2008b). Research involving 493 stranded and necropsied cetaceans in the Canary Islands found two Risso's dolphins with gas bubble embolisms, which have often been attributed to anthropogenic causes, but with evidence indicating that struggling with a squid during hunting was the most likely cause of those embolisms (Fernandez et al., 2017).

3.7.4.3.18.5 Species-Specific Threats

Risso's dolphins are particularly susceptible to entanglement and fisheries interactions (Bradford & Forney, 2017). From 2007 to 2011, there were four known Risso's dolphin deaths attributed to human-related causes along the U.S. West Coast (primarily gillnet fishery entanglement) (Carretta et al., 2013). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.19 Short-Beaked Common Dolphin (*Delphinus delphis*)

Common dolphins are represented by two species for management purposes in NMFS Pacific Stock Assessment Report (Carretta et al., 2019c), the short-beaked common dolphin (*Delphinus delphis*) and long-beaked common dolphin (*Delphinus capensis*). There is scientific disagreement regarding the common dolphin taxonomy (Committee on Taxonomy, 2016), but the Navy is following NMFS naming convention as presented in the most recent stock assessment (Carretta et al., 2019c, 2020c).

3.7.4.3.19.1 Status and Management

This species is not listed under the ESA. There is a single Pacific management stock for those animals found within the U.S. EEZ off the U.S. West Coast—the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.19.2 Habitat and Geographic Range

Historically along the U.S. West Coast, short-beaked common dolphins were sighted primarily south of Point Conception (Dohl et al., 1983), but now they are commonly encountered as far north as 42°N (Hamilton et al., 2009b), and occasionally as far north as 48°N (Forney, 2007). Seasonal distribution shifts are pronounced, with a significant southerly shift south of Point Arguello, California, in the winter (Becker et al., 2014; Campbell et al., 2015; Forney & Barlow, 1998; Henderson et al., 2014). Short-beaked common dolphins are a warm temperate to tropical species; based on habitat models developed using line-transect survey data collected off the U.S. West Coast, densities are greatest when waters are warmest (Barlow, 2016; Barlow et al., 2009; Becker et al., 2010; Becker et al., 2016; Becker et al., 2014; Becker et al., 2018; Forney & Barlow, 1998; Forney et al., 2012; Trickey et al., 2020). The abundance of short-beaked common dolphins off the U.S. West Coast varies, with seasonal and year-to-year changes in oceanographic conditions; movements may be north-south or inshore-offshore (Barlow et al., 2009; Becker et al., 2016; Becker et al., 2014; Forney & Barlow, 1998; Forney et al., 2012; Henderson et al., 2014). Short-beaked common dolphin abundance off California has increased dramatically since the late 1970s, along with a smaller decrease in abundance in the eastern tropical

Pacific, suggesting a large-scale northward shift in the distribution of this species in the eastern North Pacific (Barlow, 2016; Forney & Barlow, 1998; Forney et al., 1995).

Short-beaked common dolphins are found in Southern California throughout the year, distributed between the coast and approximately 345 miles from shore (Barlow, 2016; Barlow & Forney, 2007; Forney & Barlow, 1998). Based on multiple line-transect studies conducted by NMFS, the short-beaked common dolphin is the most abundant cetacean species, with a widespread distribution off Southern California (Barlow, 2016; Barlow & Forney, 2007; Campbell et al., 2015; Carretta et al., 2011; Douglas et al., 2014; Forney et al., 1995; Trickey et al., 2020). From 2004 to 2008 during ship surveys conducted quarterly by the State of California off Southern California, short-beaked common dolphins were encountered year round, with the highest encounters during the summer (Douglas et al., 2014). From 2008 to 2013 during 18 aerial surveys conducted in the Southern California Bight, short-beaked common dolphins were the most frequently observed cetacean species (Jefferson et al., 2014).

3.7.4.3.19.3 Population Trends

Based on an analysis of sighting data collected during quarterly surveys off Southern California from 2004 to 2013, short-beaked common dolphins showed annual variations in density, but there was no significant trend evident during the period of this study (Campbell et al., 2015) or as a result of any other data (Carretta et al., 2019c). However, Barlow (2016) noted a nearly monotonic increase in the abundance of short-beaked common dolphins from 1991 to 2014 off the U.S. West Coast and suggested that a future trend analysis is appropriate.

3.7.4.3.19.4 Predator and Prey Interactions

Delphinus species fluctuate in vocal activity, with more vocal activity during late evening and early morning, apparently linked to feeding on the deep scattering layer, which rises in this same timeframe (Henderson et al., 2012). Predation by killer whales on this species has been observed (Leatherwood et al., 1973).

3.7.4.3.19.5 Species-Specific Threats

Short-beaked common dolphins are particularly susceptible to fisheries interactions and entanglement. From 2013 to 2017, there were 32 known short-beaked common dolphin deaths attributed to gillnet fishery interactions along the U.S. West Coast (Carretta et al., 2019a; Carretta et al., 2019b; Carretta et al., 2020c) and additional two serious injuries to the stock outside the EEZ (Bradford & Forney, 2017). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.20 Short-Finned Pilot Whale (*Globicephala macrorhynchus*)

3.7.4.3.20.1 Status and Management

Short-finned pilot whales are not listed under the ESA. For MMPA stock assessment reports, short-finned pilot whales within the Pacific U.S. EEZ are divided into two discrete stocks, one of which occurs in the PMSR Study Area—the California, Oregon and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.20.2 Habitat and Geographic Range

The short-finned pilot whale is widely distributed throughout most tropical and warm temperate waters of the world and occurs in waters over the continental shelf break, in slope waters, and in areas of high topographic relief (Baird, 2013a; Olson, 2009). While pilot whales are typically distributed along the continental shelf break, movements over the continental shelf are commonly observed in the northeastern United States (Payne & Heinemann, 1993) and close to shore at oceanic islands, where the

shelf is narrow and deeper waters are found nearby (Baird, 2013b; Gannier, 2000; Mignucci-Giannoni, 1998). Short-finned pilot whales are not considered a migratory species, although seasonal shifts in abundance have been noted in some portions of the species' range. A number of studies in different regions suggest that the distribution and seasonal inshore/offshore movements of pilot whales coincide closely with the abundance of squid, their preferred prey (Bernard & Reilly, 1999; Hui, 1985; Payne & Heinemann, 1993).

Short-finned pilot whale distribution off Southern California changed dramatically after El Niño in 1982–1983, when squid did not spawn as usual in the area, and pilot whales virtually disappeared from the area for nine years (Jefferson & Schulman-Janiger, 2018; Shane, 1995). There were nine short-finned pilot whale sightings during seven systematic ship surveys conducted by NMFS off California, Oregon, and Washington between 1991 and 2014, with three of these off Southern California (Barlow, 2016; Barlow & Forney, 2007). There were two additional short-finned pilot whale sightings during 16 ship surveys conducted by the State of California in the Southern California Bight between 2004 and 2008 (Douglas et al., 2014). Short-finned pilot whales were not sighted during 18 aerial surveys conducted in the Southern California Bight between 2008 and 2013 (Jefferson et al., 2014). A group of approximately 50 individuals was encountered off San Diego in May 2015 and included an individual photo-identified previously off Ensenada, Mexico (Kendall-Bar et al., 2016).

3.7.4.3.20.3 Population Trends

Pilot whales appear to have returned to California waters, as evidenced by an increase in sighting records as well as by incidental fishery bycatches (Barlow, 2016; Barlow & Forney, 2007; Douglas et al., 2014; Jefferson & Schulman-Janiger, 2018; Kendall-Bar et al., 2016). Because these changes likely reflect a change in distribution based on a changing environment rather than a change in the population, there can be no assessment of the current population trend for short-finned pilot whales in California (Carretta et al., 2019c, 2020c).

3.7.4.3.20.4 Predator and Prey Interactions

Pilot whales feed primarily on squid but also take fish (Bernard & Reilly, 1999). They are generally well adapted to feeding on squid (Abecassis et al., 2015; Jefferson et al., 2008b; Werth, 2006a, 2006b).

Pilot whales are not generally known to prey on other marine mammals, but records from the eastern tropical Pacific suggest that the short-finned pilot whale does occasionally chase and attack dolphins during fishery operations and may eat them (Olson, 2009; Perryman & Foster, 1980). They have also been observed harassing sperm whales in the Gulf of Mexico (Weller et al., 1996).

This species is not known to have any predators (Weller, 2009), although it may be subject to predation by killer whales.

3.7.4.3.20.5 Species-Specific Threats

There are no species-specific threats to short-finned pilot whales in the PMSR Study Area. Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.21 Sperm Whale (*Physeter macrocephalus*)

3.7.4.3.21.1 Status and Management

The sperm whale has been listed as endangered since 1970 under the precursor to the ESA (National Marine Fisheries Service, 2009), and is depleted under the MMPA throughout its range, but there is no designated critical habitat for this species in the North Pacific. Sperm whales are divided into three

stocks in the Pacific; one (California/Oregon/Washington) occurs within the Study Area (Carretta et al., 2019c, 2020c). Based on genetic analyses, Mesnick et al. (2011) found that sperm whales in the California Current are demographically independent from animals in the rest of the tropical Pacific.

3.7.4.3.21.2 Habitat and Geographic Range

Primarily, this species is found in the temperate and tropical waters of the Pacific (Merkens et al., 2019; Rice, 1989). Their secondary range includes areas of higher latitudes in the PMSR Study Area (Jefferson et al., 2015; Whitehead et al., 2008; Whitehead & Weilgart, 2000; Whitehead et al., 2009). This species appears to have a preference for deep waters and the continental shelf break and slope (Baird, 2013a; Jefferson et al., 2015; Rice, 1989; Whitehead, 2003; Whitehead et al., 2008). Typically, sperm whale concentrations also correlate with areas of high productivity generally near drop offs and areas with strong currents and steep topography (Gannier & Praca, 2007; Jefferson et al., 2015).

Sperm whales are found year round in California waters, but their abundance is temporally variable, most likely due to variation in the availability of prey species (Barlow, 1995; Barlow & Forney, 2007; Forney & Barlow, 1993; Smultea, 2014). Based on habitat models derived from line-transect survey data collected between 1991 and 2008 off the U.S. West Coast, sperm whales show an apparent preference for deep waters (Barlow et al., 2009; Becker et al., 2012a; Becker et al., 2010; Forney et al., 2012). During quarterly ship surveys conducted off Southern California between 2004 and 2008, there were a total of 20 sperm whale sightings, the majority (12) occurring in summer in waters greater than 2,000 m deep (Douglas et al., 2014). Only one sperm whale group was observed during 18 aerial surveys conducted in the Southern California Bight from 2008 through 2012 (Smultea et al., 2014).

Sperm whales are somewhat migratory. General shifts occur during summer months for feeding and breeding, while in some tropical areas, sperm whales appear to be largely resident (Rice, 1989; Whitehead, 2003; Whitehead et al., 2008; Whitehead et al., 2009). Pods of females with calves remain on breeding grounds throughout the year, between 40°N and 45°N (Rice, 1989; Whitehead, 2003), while males migrate between low-latitude breeding areas and higher-latitude feeding grounds (Pierce et al., 2007). In the northern hemisphere, “bachelor” groups (males typically 15–21 years old and bulls [males] not taking part in reproduction) generally leave warm waters at the beginning of summer and migrate to feeding grounds that may extend as far north as the perimeter of the arctic zone. In fall and winter, most return south, although some may remain in the colder northern waters during most of the year (Pierce et al., 2007).

3.7.4.3.21.3 Population Trends

Sperm whale population abundance and trends based on line-transect surveys conducted off the U.S. West Coast from 1991 to 2014 include a high level of uncertainty but indicate that sperm whale abundance has appeared stable with some evidence for an increasing number of sperm whales (Carretta et al., 2019c; Moore & Barlow, 2017; Moore & Barlow, 2014).

3.7.4.3.21.4 Predator and Prey Interactions

Sperm whales are known to occur in groups for both predator defense and foraging purposes. Sperm whales feed on squid, other cephalopods, and bottom-dwelling fish and invertebrates (Davis et al., 2007; Marcoux et al., 2007; Rice, 1989). The sperm whale is the largest whale that uses sound echolocation to find prey. Killer whales have been documented harassing and on occasion attacking sperm whales (Baird, 2009).

3.7.4.3.21.5 Species-Specific Threats

Sperm whales are susceptible to entanglement in fishing gear and ship strikes. Based on reports from 2010 to 2014, a total of five sperm whales were entangled in fishing gear off the U.S. West Coast (Carretta et al., 2016a). The mean annual serious injury and mortality for fisheries on the U.S. West Coast, based on the 2011–2015 data, indicate a total take of 0.7 per year (Carretta et al., 2017a; Carretta et al., 2017d). Available data from NMFS indicate that in waters off the U.S. West Coast between 2011 and 2015, there was one reported ship strike involving a sperm whale in 2012 (Carretta et al., 2017d). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.22 Striped Dolphin (*Stenella coeruleoalba*)

3.7.4.3.22.1 Status and Management

This species is not listed under the ESA. In the eastern north Pacific, NMFS identifies two striped dolphin management stocks within the U.S. EEZ, one of which occurs in the PMSR Study Area—the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.22.2 Habitat and Geographic Range

Although primarily a warm-water species, the range of the striped dolphin extends higher into temperate regions than that of any other species in the genus *Stenella*. Striped dolphins are generally restricted to oceanic regions and are seen close to shore only where deep water approaches the coast. In some areas (e.g., the eastern tropical Pacific), they are mostly associated with convergence zones and regions of upwelling (Au & Perryman, 1985; Reilly, 1990). The northern limits are the Sea of Japan, Hokkaido, Washington State, and along roughly 40°N across the western and central Pacific (Reeves et al., 2002b). In the eastern tropical Pacific, striped dolphins inhabit areas with large seasonal changes in surface temperature and thermocline depth, as well as seasonal upwelling (Au & Perryman, 1985; Reilly, 1990). In some areas, this species appears to avoid waters with sea temperatures less than 68°F (20°C) (Van Waerebeek et al., 1998).

Based on sighting records, striped dolphins appear to have a continuous distribution in offshore waters from California to Mexico (Mangels & Gerrodette, 1994). The striped dolphin also occurs far offshore, in waters affected by the warm Davidson Current as it flows northward (Archer, 2009; Jefferson et al., 2008b). During ship surveys conducted off the U.S. West Coast in the summer and fall from 1991 to 2005, striped dolphins were sighted primarily from 100 to 300 NM offshore of the California coast (Barlow & Forney, 2007). Striped dolphin encounters increase in deep, relatively warmer waters off the U.S. West Coast (Becker et al., 2012a; Becker et al., 2016; Henderson et al., 2014), and their abudance decreases north of about 42°N (Barlow et al., 2009; Becker et al., 2012a; Becker et al., 2016; Forney et al., 2012). There were only three striped dolphin encounters during 16 ship surveys off Southern California from 2004 to 2008 (Douglas et al., 2014), and they were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 to 2012 (Smultea, 2014).

3.7.4.3.22.3 Population Trends

No long-term trends in abundance have been identified for the California, Oregon, and Washington stock of striped dolphins (Carretta et al., 2019c, 2020c).

3.7.4.3.22.4 Predator and Prey Interactions

Striped dolphins often feed in open sea or sea bottom zones along the continental slope or just beyond it in oceanic waters. Most of their prey possess light-emitting organs, suggesting that striped dolphins

may be feeding at great depths, possibly diving to 200–700 m (Archer & Perrin, 1999). Striped dolphins may feed at night in order to take advantage of the deep scattering layer's diurnal vertical movements. Small mid-water fishes (in particular lanternfishes) and squids are the predominant prey (Perrin et al., 1994). This species has been documented to be preyed upon by sharks (Ross & Bass, 1971). It may also be subject to predation by killer whales.

3.7.4.3.22.5 Species-Specific Threats

From 2013 to 2017, there were four serious injuries or mortalities for striped dolphin resulting from fishery interactions along the U.S. West Coast (Carretta et al., 2019a; Carretta et al., 2019b). The prevalence of morbillivirus and Brucella in the general striped dolphin population is not known at the present time (Carretta et al., 2017d; Jacob et al., 2016). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.3.23 Stejneger's Beaked Whale (*Mesoplodon stejnegeri*)

Stejneger's beaked whale was initially described in 1885 from a skull, and nothing more of the species was known for nearly a century. The late 1970s saw several strandings, but it was not until 1994 that the external appearance was well described from fresh (stranded) specimens.

3.7.4.3.23.1 Status and Management

Stejneger's beaked whale is not listed under the ESA. Due to the difficulty in distinguishing the *Mesoplodon* species at sea during visual surveys, the United States management unit is defined to include all *Mesoplodon* species that occur in the area. Stejneger's beaked whale has been combined with five other *Mesoplodon* species to make up the California, Oregon, and Washington stock (Carretta et al., 2019c, 2020c).

3.7.4.3.23.2 Habitat and Geographic Range

Worldwide, beaked whales normally inhabit continental slope and deep oceanic waters (greater than 200 m) (Cañadas et al., 2002; Ferguson et al., 2006; MacLeod & Mitchell, 2006; Pitman, 2009; Waring et al., 2001). They are occasionally reported in waters over the continental shelf (Pitman & Stinchcomb, 2002).

Stejneger's beaked whale appears to prefer cold to temperate and subpolar waters (MacLeod & Mitchell, 2006). This species has been observed in waters ranging from 730 to 1,560 m deep on the steep slope of the continental shelf (Loughlin & Perez, 1985). The southern limit in the central Pacific is unknown but is likely to range between 60°N and 30°N (Baumann-Pickering et al., 2014; Loughlin & Perez, 1985; MacLeod & Mitchell, 2006). Specific movement patterns of this species are not known, but high stranding rates in the winter and spring along the Pacific coast suggest that Stejneger's beaked whales migrate north during summer (Jefferson et al., 2008b; Pitman, 2009). Stejneger's beaked whales are not considered to regularly occur in Southern California coastal waters (Jefferson et al., 2008b; MacLeod & Mitchell, 2006). The farthest south this species has been observed in the eastern Pacific is Cardiff, California (33°N), but this is considered an extralimital occurrence (Loughlin & Perez, 1985; MacLeod & Mitchell, 2006; Mead, 1989). *Mesoplodon* beaked whales were not detected during 15 aerial surveys conducted in the Southern California Range Complex from 2008 through 2012 (Smultea, 2014). Beaked whales produce species-specific frequency modulated echolocation pulses. Acoustic monitoring at a site (Site "M") located south of the PMSR Study Area recorded the presence of sounds from Stejneger's beaked whales once in July 2009 and again in July 2010 (Baumann-Pickering et al., 2014).

3.7.4.3.23.3 Population Trends

A Bayesian trend analysis of systematic survey data collected from 1991 to 2008 suggested a decline in the abundance of beaked whales found in waters off California, Oregon, and Washington (Moore & Barlow, 2013). However, a more recent survey in 2014 (Barlow, 2016) and a new analysis incorporating information from all surveys between 1991 and 2014 suggest an increasing abundance for the U.S. West Coast trend over that time, which is a reversal of the previously reported population decline (Carretta et al., 2019c; Carretta et al., 2018b; Carretta et al., 2017c; Carretta et al., 2017d; Moore & Barlow, 2017).

3.7.4.3.23.4 Predator and Prey Interactions

Stejneger's beaked whales are known to feed primarily on squids of the families Gonatidae and Cranchiidae, typically in mid-water to near-bottom depths. Analyses of stomach contents of this species found they also feed on deep-sea fish (Jefferson et al., 2008b; Walker & Hanson, 1999; Yamada, 1998). This species has not been documented to be prey to any other species, though other *Mesoplodon* beaked whales have been observed being actively preyed upon by killer whales (Wellard et al., 2016).

3.7.4.3.23.5 Species-Specific Threats

There are no known specific threats to Stejneger's beaked whales in the Study Area.

3.7.4.4 Otariid Pinnipeds Expected in the Study Area

3.7.4.4.1 California Sea Lion (*Zalophus californianus*)

3.7.4.4.1.1 Status and Management

The California sea lion is not listed under the ESA. The California sea lion is managed by NMFS as the U.S. stock in all areas where they occur along the U.S. west coast and in Alaska (Carretta et al., 2019c, 2020c).

3.7.4.4.1.2 Habitat and Geographic Range

The California sea lion occurs in the eastern north Pacific from Puerto Vallarta, Mexico, through the Gulf of California and north along the west coast of North America to the Gulf of Alaska (Barlow et al., 2008; DeLong et al., 2017b; Jefferson et al., 2008b; Maniscalco et al., 2004). Typically, during the summer, California sea lions congregate near rookery islands and specific open-water areas. The primary rookeries off the coast of the United States are on San Nicolas, San Miguel, Santa Barbara, and San Clemente Islands (Carretta et al., 2000; Le Boeuf & Bonnell, 1980; Lowry et al., 1992; Lowry & Forney, 2005; Lowry et al., 2017). Haulout sites are also found on Anacapa Island, Richardson Rock, Santa Catalina Island, Santa Cruz Island, and Santa Rosa Island in the Southern California Bight (Le Boeuf, 2002; Lowry et al., 2017). This species is prone to invade human-modified coastal sites that provide good haulout substrate, such as marinas, buoys, bait barges, and rip-rap tidal control structures.

In the nonbreeding season, beginning in late summer, adult and subadult males migrate northward along the coast of California to Washington and return south the following spring (Laake, 2017; Lowry & Forney, 2005). Females and juveniles also disperse somewhat but tend to stay in the Southern California area, although north and west of the Channel Islands (Lowry & Forney, 2005; Melin & DeLong, 2000; Thomas et al., 2010). California sea lions from the west coast of the Baja California peninsula also migrate to Southern California during the fall and winter (Lowry & Forney, 2005), and sea lions from San Clemente Island tend to remain in Southern California (Melin, 2015). There is a general distribution shift northwest in fall and southeast during winter and spring, probably in response to changes in prey availability (DeLong et al., 2017a; DeLong et al., 2017b; Lowry et al., 2017).

California sea lions can be found in California open ocean and coastal waters (Barlow et al., 2008; Jefferson et al., 2008b; Lander et al., 2010). California sea lions are usually found in waters over the continental shelf and slope; however, they are also known to occupy locations far offshore in deep, oceanic waters, such as Guadalupe Island and Alijos Rocks off Baja California (Jefferson et al., 2008b; Melin et al., 2008; Urrutia & Dziendzielewski, 2012; Zavala-Gonzalez & Mellink, 2000). California sea lions are the most frequently sighted pinnipeds offshore of Southern California during the spring, and peak abundance is during the May through August breeding season (Green et al., 1992; Keiper et al., 2005; Lowry et al., 2017).

Tagged California sea lions from Monterey Bay and SNI, California, demonstrated that adult males can travel more than 450 km from shore during longer foraging bouts (Weise et al., 2006; Weise et al., 2010); however, rehabilitated females and subadults normally stay within 65 km of the coast (Thomas et al., 2010). Most individuals stay within 50 km of the rookery islands during the breeding season (Melin & DeLong, 2000). In the PMSR Study Area, females breeding and pupping on the Channel Islands typically feed over the continental shelf and generally remain within 150 km north and west of the islands (Kuhn & Costa, 2014; Melin & DeLong, 2000; Melin et al., 2008; Melin et al., 2012). Tagging results showed that lactating females foraging along the coast would travel as far north as Monterey Bay and offshore to the 1,000 m isobath (Henkel & Harvey, 2008; Kuhn & Costa, 2014; McHuron et al., 2017; Melin & DeLong, 2000; Melin et al., 2008). Data from satellite tags and time-depth recorders on nine females at SNI indicated they primarily foraged around the northern Channel Islands, while six tagged females at San Miguel Island foraged north of the Channel Islands along or just off the mainland coast (McHuron et al., 2017). During the nonbreeding season, they occur most often over the slope or offshore; during the breeding season, they occur most often over the continental shelf (Melin & DeLong, 2000; Melin et al., 2008). Lowry and Forney (2005) estimated that 47 percent of sea lions would potentially be at-sea during the cold seasons.

Dive durations range from 1.4 to 5.0 minutes, with longer dives during El Niño events; surface intervals range from 0.7 to 17.0 minutes, with sea lions diving about 32–47 percent of the time at sea (Feldkamp et al., 1989; Kuhn & Costa, 2014; Melin et al., 2008; Melin et al., 2012). Adult females alternate between nursing their pup on shore and foraging at sea, spending approximately 67–77 percent of time at sea (Kuhn & Costa, 2014; Melin & DeLong, 2000). Data from satellite tags and time-depth recorders on 15 California sea lions at (nine at SNI and six at San Miguel Island) indicated different foraging strategies, with some individuals spending energy at almost twice the rate of other individuals (McHuron et al., 2017).

3.7.4.4.1.3 Population Trends

The California sea lion is the most abundant pinniped along the California coast. Overall, the California sea lion population is abundant and has been generally increasing (Carretta et al., 2010; Jefferson et al., 2008b; Lowry et al., 2017). In spite of the robustness of the overall species population, in Mexican waters in the Gulf of California, the abundance of California sea lions has declined over the last decade (Urrutia & Dziendzielewski, 2012). A time-series data analysis supported the hypothesis that the Gulf of California has four subpopulations of California sea lions, three of which exhibit lower-than-expected growth rates; two subpopulations have high probabilities of extinction within the next 50 years (Ward et al., 2010).

Using count and resighting data gathered between 1975 and 2015, NMFS researchers showed that California sea lion population growth was above the maximum net productivity level and within the

range of the optimal sustainable population (Laake et al., 2018). This research also noted that the species abundance can be dramatically decreased by increasing sea surface temperature associated with El Niño events or similar regional ocean temperature anomalies (Laake et al., 2018).

3.7.4.4.1.4 Predator and Prey Interactions

California sea lions are known to feed in both benthic and open-water habitats, which allows for a broader feeding spectrum than other pinnipeds that have overlapping foraging areas (e.g., Guadalupe fur seal). The California sea lion is adapted to cope with changes in prey availability (Aurioles-Gamboa & Camacho-Rios, 2007). California sea lions feed on a variety of fish and cephalopod species, including salmon, Pacific sardines, northern anchovy, Pacific mackerel, Pacific whiting, rockfish, market squid, bass, cutlassfish, cusk eels, greenlings, dogfish, perch, various flatfish, and various species of midshipmen and lanternfish (Lowry & Forney, 2005; Orr et al., 2012; Orr et al., 2011). California sea lions have been documented to be preyed on by killer whales, sharks, coyotes, and feral dogs. In the California Channel Islands, California sea lion pups were at one time observed being preyed on by bald eagles (Heath & Perrin, 2009).

3.7.4.4.1.5 Species-Specific Threats

California sea lions are susceptible to entanglement and other interactions with fishery operations (Allyn & Scordino, 2020; Carretta et al., 2020a). Along the U.S. West Coast between 2013 and 2017, there were 1,096 serious injuries or mortalities to California sea lions due to human-related causes (primarily 284 hook and line fishery interactions) (Carretta et al., 2019a). From a total of 7,673 California sea lions reported as stranded along the central California coast between 2003 and 2015, 277 were determined to be caused by entanglement in marine debris, 35 by gunshots, and 158 by fishing tackle injuries (Barcenas De La Cruz et al., 2017). Entanglement of California sea lions documented along the north coast of Washington from 2010 to 2018 were mostly from packing bands, followed by salmon flashers during the local ocean salmon troll season (June-September) (Allyn & Scordino, 2020).

Along California's coast mortality has been documented due to domoic acid toxicity, which is a neurotoxin associated with algal blooms that may be exacerbated by the recent increase in water temperature in the northeastern Pacific (Bond et al., 2015). The toxoplasmosis parasite (often attributed to feral cat feces in urban area storm run-off) also impacts sea lions (Simeone et al., 2015).

Starting in January 2013, an elevated number of strandings of California sea lion pups were observed in five Southern California counties. These strandings were declared an UME by NMFS. This is the sixth UME involving California sea lions that has occurred in California since 1991. The 2013 UME had been confined to California sea lion pups born in the summer of 2012, but as of 2016 had affected other pinniped species in the area (National Marine Fisheries Service, 2015a; National Oceanic and Atmospheric Administration, 2017a, 2018a). The stranded pups were found to be emaciated, dehydrated, and underweight for their age. Although the exact causes of this UME are unknown, the working hypotheses are a shift in the sea lion prey resulting in these young animals being abandoned by their mothers, nutritional stress of pups resulting from a lack of forage fish available to lactating mothers, and unknown disease agents (Carretta et al., 2017c; National Oceanic and Atmospheric Administration, 2017a). Surveys in 2016 at SNI and San Miguel Island found better growth and body condition for sea lions at both locations than had been present in recent years (Laake, 2017). The average January–June stranding rate in 2017 was below the average stranding rate for the years 2003–2012 (National Oceanic and Atmospheric Administration, 2017a), which may also suggest this mortality event has ended.

Since 2010, the Oregon Department of Fish & Wildlife and Washington Department of Fish & Wildlife have conducted a removal program for California sea lions that prey on ESA-listed Chinook salmon and steelhead stocks at Bonneville Dam. Although non-lethal pyrotechnic and rubber buckshot are used as short-term deterrents, in 2016 (for example), they lethally removed 59 California sea lions (Madson et al., 2017).

3.7.4.4.2 Northern Fur Seal (*Callorhinus ursinus*)

3.7.4.4.2.1 Status and Management

Two stocks of northern fur seals are recognized in United States waters: an Eastern Pacific stock that breeds in southern Bering Sea, and a California stock (Carretta et al., 2019c; Muto et al., 2019). The California stock is present in the PMSR Study Area, is not considered depleted under the MMPA, and is not listed under the ESA (Carretta et al., 2019c, 2020c).

3.7.4.4.2.2 Habitat and Geographic Range

Northern fur seals range throughout the north Pacific along the west coast of North America, from California (32°N) to the Bering Sea, and west to the Sea of Okhotsk and Honshu Island, Japan (36°N) (Baird & Hanson, 1997; Carretta et al., 2010; Gentry, 2009; Jefferson et al., 2008b; Ream et al., 2005). Olesiuk (2012) characterized northern fur seals as ubiquitous in the North Pacific between 60°N and 40°N latitude, with their distribution at sea driven by prey concentrations associated with oceanographic features such as the boundary of the sub-arctic–sub-tropical transition zone near 42°N latitude (Polovina et al., 2001). Migrating seals and those along the U.S. West Coast are typically found over the edge of the continental shelf and slope (Adams et al., 2014; Gentry, 2009; Kenyon & Wilke, 1953; Sterling & Ream, 2004), although two fur seals were tracked over 2,000 km offshore into the central North Pacific Ocean (Ream et al., 2005). Their offshore distribution has been correlated with oceanographic features (e.g., eddies and fronts) where prey may be concentrated (Ream et al., 2005; Sterling et al., 2014). Northern fur seals are found throughout their Pacific offshore range throughout the year, although seasonal peaks are known to occur. The small breeding population from San Miguel Island migrates north into the north Pacific after the breeding season, arriving in the region in November and December. Females and subadult males are often observed off Canada's west coast during winter (Adams et al., 2014; Baird & Hanson, 1997; Lee et al., 2018; Orr et al., 2018).

Northern fur seal colonies are present at Adams Cove on San Miguel Island and on Castle Rock, an offshore island 1.1 km northwest of San Miguel Island (Baird & Hanson, 1997; Carretta et al., 2017c; Melin et al., 2012; Pyle et al., 2001; Stewart & Huber, 1993). Northern fur seal can also occasionally be present on SNI during summer (Baird & Hanson, 1997; Carretta et al., 2017c; Melin et al., 2012; Pyle et al., 2001). In aerial surveys of the Channel Islands between 2011 and 2015, the species was only observed at San Miguel Island (Lowry et al., 2017). Current information indicates that the presence of a northern fur sea on SNI would be an extremely rare occurrence and is therefore not expected (Lowry et al., 2017; National Marine Fisheries Service, 2014a, 2019e).

Animals from the California stock may remain in or near the area throughout the year but generally move to the North Pacific in waters off Washington, Oregon, and Northern California to forage (Carretta et al., 2017c; Koski et al., 1998; Melin et al., 2012; Sterling et al., 2014). In 2005–2006, during a period of cooler ocean temperatures, northern fur seals shifted their distribution from their common occurrence at least 50 km from coast, to being unusually abundant within 10 km of the central California coast (Carretta et al., 2017c; Peterson et al., 2006).

Most northern fur seals, excluding those of the California stock, migrate along continental margins from low-latitude winter foraging areas to northern breeding islands (Gentry, 2009; Ragen et al., 1995). They leave the breeding islands in November and concentrate around the continental margins of the north Pacific Ocean in January and February, where they have access to vast, predictable food supplies and where the Eastern Pacific and the California stocks overlap (Gentry, 2009; Loughlin et al., 1994; Newsome et al., 2007; Ream et al., 2005). Juveniles have been known to conduct trips between 8 and 29 days in duration, ranging from 171 to 680 km (Sterling & Ream, 2004). Adult female fur seals equipped with radio transmitters have been recorded conducting roundtrip foraging trips of up to 740 km (National Marine Fisheries Service, 2007a; Robson et al., 2004).

3.7.4.4.2.3 Population Trends

The abundance of northern fur seals at San Miguel Island, the primary rookery for the California stock, has increased steadily over the past four decades, except for two severe declines associated with El Niño-southern Oscillation events in 1993 and 1998 (Carretta et al., 2019c; Carretta et al., 2015; Carretta et al., 2017c; DeLong & Stewart, 1991; Lee et al., 2018; Melin et al., 2008; Melin et al., 2006; Orr et al., 2018; Orr et al., 2012). The San Miguel Island population makes up 96 percent of the California stock of northern fur seals (Carretta et al., 2015; Carretta et al., 2017c). (Lee et al., 2018) reported an annual growth rate of 45 percent for the population at San Miguel Island over a study period from 1996 to 2016.

3.7.4.4.2.4 Predator and Prey Interactions

Northern fur seals are opportunistic feeders. The principal prey off California includes northern anchovy, hake, Pacific saury, Pacific whiting, squid, rockfishes, and salmon (Antonelis et al., 1990; Gentry, 2009; Jefferson et al., 2008b; Kajimura, 1984). This species is known to feed along the continental slope and off the shelf; females forage in areas of 100–200 m in depth, while males forage in areas greater than 400 m in depth (Calambokidis et al., 2004; Gentry, 2009). Lactating female northern fur seals primarily forage north of San Miguel Island in areas of 200–3,000 m, with a mean depth of 933 m in depth (Antonelis et al., 1990).

This species may be preyed on by killer whales and sharks (Gentry, 2009; Jefferson et al., 2008b).

3.7.4.4.2.5 Species-Specific Threats

Along the U.S. West Coast from 2007 to 2014, there were 19 deaths and 7 serious injuries to northern fur seals due to human-related causes reported, primarily due to fishing interactions and marine debris entanglement (Carretta et al., 2016a; Carretta et al., 2013). From a total of 165 northern fur seals reported as stranded along the central California coast between 2003 and 2015, five were determined to be caused by entanglement in marine debris, two by fishing tackle injuries, and one by gunshot (Barcenas De La Cruz et al., 2017).

Counts of northern fur seal from 1972 to 2012 at San Miguel and Castle Rock appear to show that the population is greatly affected and the abundance reduced by El Niño events, which result in animals being in poor physical condition, having reduced reproductive success, and experiencing high mortality during those warmer ocean temperature events (Carretta et al., 2017c).

3.7.4.4.3 Guadalupe Fur Seal (*Arctocephalus townsendi*)

3.7.4.4.3.1 Status and Management

The Guadalupe fur seal is listed as threatened under the ESA and depleted under the MMPA throughout its range. Critical habitat for the Guadalupe fur seal has not been designated given that the only areas that meet the definition for critical habitat are outside of U.S. jurisdiction (National Oceanic and Atmospheric Administration, 1985). Guadalupe fur seals were hunted nearly to extinction during the 1800s. The last NMFS status review of the Guadalupe fur seals was conducted in 1984, but with the recent population growth and increase in distribution NMFS has initiated a new status review (Fahy, 2015). All individuals alive today are recent descendants from one breeding colony at Isla Guadalupe and Isla San Benito off Mexico and are considered a single stock (Carretta et al., 2019c, 2020c; Carretta et al., 2017c; Norris & Elorriaga-Verplancken, 2020; Pablo-Rodríguez et al., 2016).

3.7.4.4.3.2 Habitat and Geographic Range

The Guadalupe fur seal is typically found on shores with abundant large rocks, often at the base of large cliffs on shorelines in Mexico (Norris & Elorriaga-Verplancken, 2020). They are also known to inhabit caves, which provide protection and cooler temperatures, especially during the warm breeding season (Belcher & Lee, 2002). Adult males, juveniles, and nonbreeding females may live at sea during some seasons or for part of a season (Reeves et al., 1992). Several observations suggest that this species travels alone or in small groups of fewer than five (Belcher & Lee, 2002; Seagars, 1984).

Before intensive hunting decreased their numbers, Guadalupe fur seals ranged from Monterey Bay, California, to the Revillagigedo Islands, Mexico (Aurioles-Gamboa et al., 2010). Guadalupe fur seals are most common at their primary breeding ground of Guadalupe Island, Mexico (Melin & DeLong, 1999). A second rookery was found in 1997 at the San Benito Islands off Baja California (Aurioles-Gamboa et al., 2010; Esperon-Rodriguez & Gallo-Reynoso, 2012; Maravilla-Chavez & Lowry, 1999), they have been found in La Paz Bay in the southern Gulf of California (Elorriaga-Verplancken et al., 2016a), and at least one individual juvenile male has been found as far south as the Galapagos Islands off Ecuador (Páez-Rosas et al., 2020). Adult and juvenile males have occasionally been observed at San Miguel Island, California since the mid-1960s, and in the late 1990s, a pup was born on the island. Rare sightings of individuals have also occurred at Santa Barbara, San Nicolas, and San Clemente Islands (Stewart, 1981; Stewart & Yochem, 1984; Stewart & Yochem, 2011; Stewart et al., 1993). In the most recent known occurrence, between 2006 and 2009 and again in 2012, a lone male established a territory on the south side of SNI (National Marine Fisheries Service, 2014a; National Oceanic and Atmospheric Administration, 2014). In NMFS aerial surveys between 2011 and 2015, Guadalupe fur seals were not observed on any of the Channel Islands and other than at San Miguel Island (Lowry et al., 2017). There have been no Guadalupe fur seals observed in Navy surveys on SNI since the one individual last seen in 2012 (Burke, 2017; National Marine Fisheries Service, 2019e; Ugoretz, 2014, 2015, 2016). As a result, Guadalupe fur seals are not expected to be hauled out on SNI in the future.

Documentation of apparently healthy Guadalupe fur seals in offshore waters of Washington and British Columbia, the increased number of strandings in the Pacific Northwest, the increase in ocean temperature of the Northeastern Pacific, and their increasing population suggest that Guadalupe fur seals may be reinhabiting the northern extent of their previous range (Aurioles-Gamboa et al., 2010; D'Agnese et al., 2020; Etnier, 2002; Lambourn et al., 2012; National Marine Fisheries Service, 2017b; Norris & Elorriaga-Verplancken, 2020). Satellite tracking data from Guadalupe fur seals tagged at Guadalupe Island demonstrating movements into the offshore waters of the Pacific Northwest also

support this suggestion (Norris, 2017a, 2017b; Norris et al., 2015). Guadalupe fur seals can be expected to occur in both deeper waters of the open ocean and coastal waters within the PMSR Study Area (Hanni et al., 1997; Jefferson et al., 2015; Norris, 2017a, 2019). Up to 2017, animals from Guadalupe Island affixed with data recording tags (n=39) included adult females, juvenile/sub-adult males and females, and weaned pups/yearlings, and along with satellite tags (n=26) placed on rehabilitated pups/yearlings that had stranded in California that were released from central California (Gallo-Reynoso et al., 2008; Norris, 2017a, 2017b; Norris et al., 2015). In 2018, an additional 35 satellite tags were deployed on adult females, juvenile females, and juvenile males. Data from animals leaving Guadalupe Island indicate that Guadalupe fur seals primarily use habitats offshore of the continental shelf between 50 and 300 km from the U.S. West Coast, with approximately one-quarter of the population foraging farther out and up to 700 km offshore (Norris, 2017b, 2019). Females with pups are generally restricted to rookery areas because they must return to nurse their pups (Gallo-Reynoso et al., 2008). Satellite tags have documented the movement of females without pups at least as far as 1,300 km north of Guadalupe Island (approximately Point Cabrillo in Mendocino County, California) (Norris, 2019). Adult males have not been tagged but typically undertake some form of seasonal movement either after the breeding season or during the winter, when prey availability is reduced (Arnould, 2009). Satellite-tagged juvenile males appear to have more variable movement patterns than females. Although most remained within 600 km of Guadalupe Island, only one of ten satellite tagged males traveled north of Point Cabrillo, California (Norris, 2017b).

3.7.4.4.3.3 Population Trends

The most recent stock assessment reports (Carretta et al., 2019b; Carretta et al., 2020c) reflect the population of Guadalupe fur seals from a survey in 2010, which indicated a total estimated population size of approximately 20,000 animals and an average annual growth rate of 10.3 percent (Carretta et al., 2019a). The ongoing UME involving Guadalupe fur seals (National Marine Fisheries Service, 2019a, 2020a; National Oceanic and Atmospheric Administration, 2018a) is likely to have impacted the recent population trend (Elorriaga-Verplancken et al., 2016a; Elorriaga-Verplancken et al., 2016b; Ortega-Ortiz et al., 2019). However, based on counts off Mexico in 2018 at Guadalupe Island and the San Benito Archipelago, the minimum population estimate was 29,747 Guadalupe fur seals at those locations (Norris, 2019; Norris & Elorriaga-Verplancken, 2020). Valdivia et al. (2019) has noted that since being ESA-listed in 1985, the population of the Guadalupe fur seal increased about nine-fold at a rate of approximately 15 percent per year. The dispersion of Guadalupe fur seal from rookeries off Mexico may be an indicator of potential species recovery (D'Agnese et al., 2020; Norris & Elorriaga-Verplancken, 2020; Ortega-Ortiz et al., 2019).

3.7.4.4.3.4 Predator and Prey Interactions

Guadalupe fur seals feed on a variety of cephalopods, fish, and crustaceans (Aurioles-Gamboa & Camacho-Rios, 2007). In the San Benito Islands, and possibly at Guadalupe Island and the offshore waters of California, Guadalupe fur seals primarily feed on cephalopods (Aurioles-Gamboa & Camacho-Rios, 2007). Guadalupe fur seals predominantly forage at night to take advantage of prey migrating vertically through the water column (Arnould, 2009; Gallo-Reynoso et al., 2008; Ronald & Gots, 2003). Females have been observed feeding in the California Current south of Guadalupe Island and making an average round trip of 2,375 km (Arnould, 2009; Gallo-Reynoso et al., 2008; Ronald & Gots, 2003).

Guadalupe fur seals are known to be preyed on by sharks and killer whales (Belcher & Lee, 2002; Jefferson et al., 2015).

3.7.4.4.3.5 Species-Specific Threats

Out of a total of 76 reported Guadalupe fur seals stranded along the central California coast between 2003 and 2015, 10 were caused by entanglement in marine debris (Barcenas De La Cruz et al., 2017). In the five-year period between 2013 and 2017, there were a known minimum of 25 serious injuries or mortalities caused by entanglement of Guadalupe fur seals in fishing gear or marine debris (Carretta et al., 2019a).

In 2015 an UME was declared for Guadalupe fur seal (National Oceanic and Atmospheric Administration, 2018a). The 80 strandings in 2015 were approximately eight times higher than the historical average, occurred along the entire coast of California, consisted of mostly weaned pups and juveniles in the one-to-two-year age range, and included animals in distress but alive as well as dead individuals. Findings from the majority of these stranded Guadalupe fur seals were that they were malnourished and had secondary bacterial and parasitic infections (National Oceanic and Atmospheric Administration, 2018a). It is likely that a shift in the prey may have resulting in these young animals being unable to obtain adequate food due to anomalously persistent warm ocean conditions (Bond et al., 2015). This UME was ongoing in 2018; there were approximately 60 Guadalupe fur seal strandings recorded in 2017 (National Oceanic and Atmospheric Administration, 2018a). Section 3.7.4.1.6 (General Threats) discusses general threats to marine mammals.

3.7.4.5 Phocid Pinnipeds Expected in the Study Area

3.7.4.5.1 Harbor Seal (*Phoca vitulina*)

3.7.4.5.1.1 Status and Management

The harbor seal is not listed under the ESA. The Society of Marine Mammalogy's Committee on Taxonomy (2016) has determined that all harbor seals in the north Pacific should be recognized as a single subspecies (*Phoca vitulina richardii*) until the subspecies limits of various populations are better known. There are 17 stocks of harbor seal along the U.S. West Coast; the California stock of harbor seals is the only stock present within the PMSR Study Area (Carretta et al., 2019c, 2020c; Muto et al., 2019).

3.7.4.5.1.2 Habitat and Geographic Range

The harbor seal is one of the most widely distributed seals, found in nearly all temperate coastal waters of the northern hemisphere (Jefferson et al., 2008b). Harbor seals are generally not present in the deep waters of the open ocean. Harbor seals, while primarily aquatic, also use the coastal terrestrial environment, where they haul out of the water periodically. Harbor seals are a coastal species, rarely found more than 20 km from shore, and frequently occupying bays, estuaries, and inlets (Baird, 2001; Harvey & Goley, 2011; Jefferson et al., 2014). Individual seals have been observed several kilometers upstream in coastal rivers (Baird, 2001). Harbor seals are not considered migratory (Burns, 2009; Harvey & Goley, 2011; Jefferson et al., 2008b), and data from 180 radio-tagged harbor seals in California indicated most remained within 10 km of the location where they were captured and tagged (Harvey & Goley, 2011).

Ideal harbor seal habitat includes suitable haulout sites, shelter from high surf during the breeding periods, and sufficient food near haulout sites to sustain the population throughout the year (Bjorge, 2002). Haulout sites vary but include intertidal and subtidal rock outcrops, sandbars, sandy beaches, estuaries, and even peat banks in salt marshes (Burns, 2009; Gilbert & Guldager, 1998; Prescott, 1982; Schneider & Payne, 1983; Wilson, 1978).

Small numbers of harbor seals are found hauled out on coastal and island sites and forage in the nearshore waters off Southern California (Jefferson et al., 2014; Lowry et al., 2008; Lowry et al., 2017). Haulout counts for harbor seals in Southern California are scheduled to occur during the late May to early June to correspond with the peak molt season when the maximum number of harbor seals are onshore (Lowry et al., 2017). In California, approximately 400–600 harbor seal haulout sites are widely distributed along the mainland and on offshore (Lowry et al., 2008; Lowry et al., 2017). The harbor seal haulout sites include mainland beaches and all of the Channel Islands (Lowry et al., 2008; Lowry et al., 2017). There were 1,367 harbor seals counted in the Channel Islands during aerial surveys in July 2015 (Lowry et al., 2017). A total of 15 harbor seals were sighted at sea in waters south of Santa Catalina and to the west and south of San Clemente Island during 18 aerial surveys conducted between 2008 and 2013 in Southern California (Jefferson et al., 2014).

3.7.4.5.1.3 Population Trends

The most recent (2012) statewide survey of California harbor seal rookeries has indicated that in the Channel Islands the count has been stable or trending as a slight increase since 1995 (Carretta et al., 2020c). As noted above, a survey of the Channel Islands in July 2015 counted 1,367 harbor seals in that subset of the California population (Lowry et al., 2017), but there was not comparative information from 2012 to 2015 to allow for examination of the trend over that period.

3.7.4.5.1.4 Predator and Prey Interactions

The main prey species of the harbor seal are cod, some rockfish species, sand eels, herring, and capelin. Harbor seals are also known to feed on cephalopods. Pups feed on bottom-dwelling crustaceans during their first few weeks of foraging. Sand eels are the main prey for individuals foraging in the south of their range, while cod is the main prey for other geographic areas included in the harbor seal range. Harbor seals are known to be preyed on by killer whales, sharks, eagles, ravens, gulls, and coyotes (Burns, 2009; Weller, 2009).

3.7.4.5.1.5 Species-Specific Threats

There were a reported 270 serious injuries or mortalities to harbor seals along the U.S. West Coast from 2013 to 2017 due to human-related causes, primarily from shore-based electrical power plant intake entrainment and direct harassment by members of the public (Carretta et al., 2019a). Out of a total of 1,071 harbor seals reported as stranded along the central California coast between 2003 and 2015, four were determined to be caused by entanglement in marine debris, four by fishing tackle injuries, four by boat collisions, and two by gunshots (Barcenas De La Cruz et al., 2017).

3.7.4.5.2 Northern Elephant Seal (*Mirounga angustirostris*)

3.7.4.5.2.1 Status and Management

The northern elephant seal is not listed under the ESA. The northern elephant seal population has recovered dramatically after being reduced to perhaps no more than 10–100 animals surviving in Mexico in the 1890s (Carretta et al., 2010; Hoelzel, 1999; Stewart et al., 1994). Movement and some genetic interchange occur between rookeries, but most elephant seals return to the rookeries where they were born to breed and thus may have limited genetic differentiation (Carretta et al., 2010). There are two distinct populations of northern elephant seals: one that breeds in Baja, Mexico; and a population that breeds on the Channel Islands off California (Garcia-Aguilar et al., 2018). NMFS considers northern elephant seals in the Study Area to be from the California Breeding Stock, although

elephant seals from Baja Mexico frequently migrate north through the PMSR Study Area (Aurioles-Gamboa & Camacho-Rios, 2007; Carretta et al., 2019c, 2020c; Carretta et al., 2017c).

3.7.4.5.2.2 Habitat and Geographic Range

Northern elephant seals are found in both coastal and deep waters of the eastern and central north Pacific. Elephant seals spend more than 80 percent of their annual cycle at sea, making long migrations to offshore foraging areas and feeding intensively to build up the blubber stores required to support them during breeding and molting haulouts (Hindell & Perrin, 2009; Le Boeuf & Laws, 1994; Worthy et al., 1992). Breeding and pupping take place on offshore islands and mainland rookeries (Carretta et al., 2010; Le Boeuf & Laws, 1994; Lowry et al., 2014; Lowry et al., 2017). Small colonies of northern elephant seals breed and haul out on Santa Barbara Island and San Clemente Island, while large colonies are found on San Nicolas, Santa, Rosa, and San Miguel Islands (Lowry et al., 2014; Lowry et al., 2017; Stewart et al., 1993; Stewart et al., 1994); peak abundance in California is during the January–February breeding season (Lowry et al., 2020; Lowry et al., 2017). An aerial survey that included all the Channel Islands in July 2015 found the majority (approximately 61 percent) of elephant seals at San Miguel Island, approximately 21 percent at SNI, and 18 percent at Santa Rosa Island (Lowry et al., 2017). Elephant seals use these islands as rookeries from late December to February, and to molt from April to July. Northern elephant seals spend little time nearshore and migrate through offshore waters four times a year as they travel to and from breeding/pupping and molting areas on various islands and mainland sites along the Mexico and California coasts.

With most of their prey found in open oceans, northern elephant seal juveniles and females are often found in deepwater zones, while males also engage in benthic foraging and travel as far north as seamounts in the Gulf of Alaska (Le Boeuf et al., 2000; Le Boeuf et al., 1996; Robinson et al., 2012; Simmons et al., 2010; Simmons et al., 2007; Stewart & DeLong, 1995). Northern elephant seals are found in both coastal areas and deeper waters off Southern California (Carretta et al., 2010; Jefferson et al., 2008b; Robinson et al., 2012). The foraging range of northern elephant seals extends thousands of kilometers offshore from the breeding range into the central North Pacific Transition Zone well to the north of Hawaii; however, their range is not considered to be continuous across the Pacific (Simmons et al., 2010; Stewart & Huber, 1993). Adult males and females segregate while foraging and migrating (Simmons et al., 2010; Stewart, 1997; Stewart & DeLong, 1995). Adult females mostly range west to about 173°W, between the latitudes of 40°N and 45°N, whereas adult males range farther north into the Gulf of Alaska and along the Aleutian Islands to between 47°N and 58°N (Le Boeuf et al., 2000; Robinson et al., 2012; Stewart & DeLong, 1995; Stewart et al., 1993). Adults stay offshore during migration, while juveniles are often seen along the coasts of Oregon, Washington, and British Columbia (Le Boeuf et al., 1996; Stewart & Huber, 1993). The most far-ranging individual appeared on Nijima Island off the Pacific coast of Japan in 1989 (Kiyota et al., 1992). This demonstrates the great distances that these animals are capable of covering.

3.7.4.5.2.3 Population Trends

The population in California continues to increase, but the Mexican stock appears to be stable or slowly decreasing (Carretta et al., 2015; Lowry et al., 2014; Lowry et al., 2017; Stewart & DeLong, 1994). The two most productive elephant seal rookeries as of 2010 have been on San Miguel Island and SNI (Lowry et al., 2014; Lowry et al., 2017). An analysis of pup survey data from San Miguel, San Nicolas, and Santa Rosa islands (accounting for over 99 percent of elephant seal births) shows that pup mortality rates decreased from 7.1 percent in 2010 to between 2.7 and 3.6 percent in 2013. Based on the pup data, the

population of elephant seals in the Channel Islands was estimated to have increased by 3.1 percent annually between 1989 and 2013 (Lowry et al., 2020). Elephant seals have expanded their pupping range northward in response to continued population growth, and this trend is expected to continue (Hodder et al., 1998; Lowry et al., 2014); there are rookeries as far north as Northern California at the Farallon Islands, Point Reyes, and Castle Rock off Crescent City. Other rookeries within or in the vicinity of the PMSR Study Area are at Cape Martin/Gorda, Piedras Blancas, Point Conception, Santa Rosa Island, Santa Barbara, and San Clemente Island (Lowry et al., 2014; Lowry et al., 2020; Lowry et al., 2017; Stewart et al., 1994).

3.7.4.5.2.4 Predator and Prey Interactions

The diet of the northern elephant seal is known to include 53 different prey species (Antonelis et al., 1994; Jefferson et al., 2008b). They primarily feed on cephalopods, hake, and other near-surface and mid-water fishes and crustaceans, such as pelagic red crabs, as well as open ocean prey and bottom-dwelling prey (Stewart & Huber, 1993). Elephant seals from the Mexico breeding stock probably feed farther south and over a broader longitudinal scale than those from the California breeding stock (Aurioles-Gamboa & Camacho-Rios, 2007). Male and female northern elephant seals are known to conduct different foraging strategies. Males feed near the eastern Aleutian Islands and in the Gulf of Alaska, and females feed farther south, south of 45°N (Carretta et al., 2010; Stewart & Huber, 1993). Females range widely over deep water, apparently foraging on patchily distributed, vertically migrating, open ocean prey (Le Boeuf et al., 2000). Males forage along the continental margin at the end of their migration and may feed on bottom-dwelling prey (Le Boeuf et al., 2000). Given concerns over the impact of climate change on prey availability, a study of Northern elephant seals has suggested that the tendency to revisit sites for foraging, breeding, or shelter may be of less evolutionary benefit in anomalous climate conditions and increasing environmental variability (Abrahms et al., 2017).

3.7.4.5.2.5 Species-Specific Threats

Along the U.S. West Coast reported oil-related injuries, fishery interactions, marine debris interactions, and shootings were identified as leading causes of observed human-caused injury and mortality to elephant seals between 2013 through 2017 (Carretta et al., 2019a). From a total of 1,831 elephant seals reported as stranded along the central California coast between 2003 and 2015, 35 were determined to be caused by entanglement in marine debris, 4 by fishing tackle injuries, and 2 by boat collisions (Barcenas De La Cruz et al., 2017).

Northern elephant seals are preyed on by killer whales and great white sharks, which have been known to group around the haulout and rookery sites of this species (Hindell & Perrin, 2009; Jefferson et al., 2008b; Klimley et al., 2001; Kuhn & Costa, 2014).

3.7.4.6 Mustelids (Sea Otter) Expected in the Study Area

3.7.4.6.1 Southern Sea Otter (*Enhydra lutris neris*)

3.7.4.6.1.1 Status and Management

Unlike all other marine mammals in the Study Area, the southern sea otter is a species under the federal jurisdiction of the USFWS within the Department of the Interior. The southern sea otter is listed as threatened under the ESA and, by definition, is considered a depleted stock under the MMPA (Carretta et al., 2017c; U.S. Fish and Wildlife Service, 2017).

Shortly after their discovery by 18th century European explorers, fur traders hunted sea otters across the north Pacific. By the turn of the 20th century, sea otters were nearly extinct. Southern sea otters are descendants of a small remnant colony that survived along the central California coast. In 1986, the USFWS sought to enhance recovery of the species through translocation of southern sea otters from the central coast of California to SNI. Inconsistencies between the ESA and MMPA led the USFWS to seek congressional authorization for the Southern Sea Otter Translocation Program, and President Reagan signed Public Law 99-625 into law on November 7, 1986. The law authorized the USFWS to establish an experimental population of sea otters and provided provisions for a sea otter management zone and specific exemptions from the ESA for Department of Defense activities. Between 1987 and 1990, the USFWS moved 140 sea otters to SNI. By 1993, fewer than 15 sea otters remained at the island. Many animals swam back to the central coast; some were captured and returned to the central coast after swimming into the designated sea otter management zone, and some died as a result of being moved (U.S. Fish and Wildlife Service, 2012b). The USFWS eventually declared the translocation program a failure and removed regulations governing the program (77 FR 75266, December 19, 2012).

Since declaring the translocation a failure, the sea otter colony has increased significantly with more than 100 animals routinely observed at SNI. At the start of the translocation program, the USFWS had committed to removing sea otters from SNI if the translocation program was ever declared a failure. They instead determined that it would be in the best interest of southern sea otter recovery to leave them at the island. The USFWS acknowledged that the Navy was given an exemption from ESA for sea otters on SNI but stated in their final rule (77 FR 75266) that there was no exemption from the MMPA for Navy activities. Clarification of Department of Defense ESA and MMPA responsibilities for sea otters in Southern California was provided by Congress in the National Defense Authorization Act for Fiscal Year 2016. The National Defense Authorization Act (NDAA) for Fiscal Year 2016 included provisions directing the Secretary of the Navy to establish Southern Sea Otter Military Readiness Areas at SNI and San Clemente Island (Figure 3.7-7). Within these Military Readiness Areas, the 2016 NDAA established that the ESA sections 4 and 9 and MMPA sections 101 and 102 do not apply to the incidental taking of any southern sea otter during Navy testing and training activities. Any sea otter within the Areas is to be treated for the purposes of section 7 of the ESA as a member of a species that is proposed to be listed as endangered or threatened under the ESA.

As an additional component of the management of the species, the 2016 NDAA requires that the Navy conduct monitoring and research within the Southern Sea Otter Military Readiness Areas to determine the effects of military readiness activities on the growth or decline of the southern sea otter population and on the nearshore ecosystem. The monitoring and research is designed in consultation with the USFWS, and reports to Congress are required periodically. The first of these reports was completed in 2017 (U.S. Department of the Navy, 2017a; U.S. Department of the Navy et al., 2016). Subsequent follow-on reports will be provided every three years thereafter, and findings from these reports will continue to be reviewed by the Navy and USFWS to ensure the plan continues to adequately monitor interactions between military readiness activities and the sea otter population.

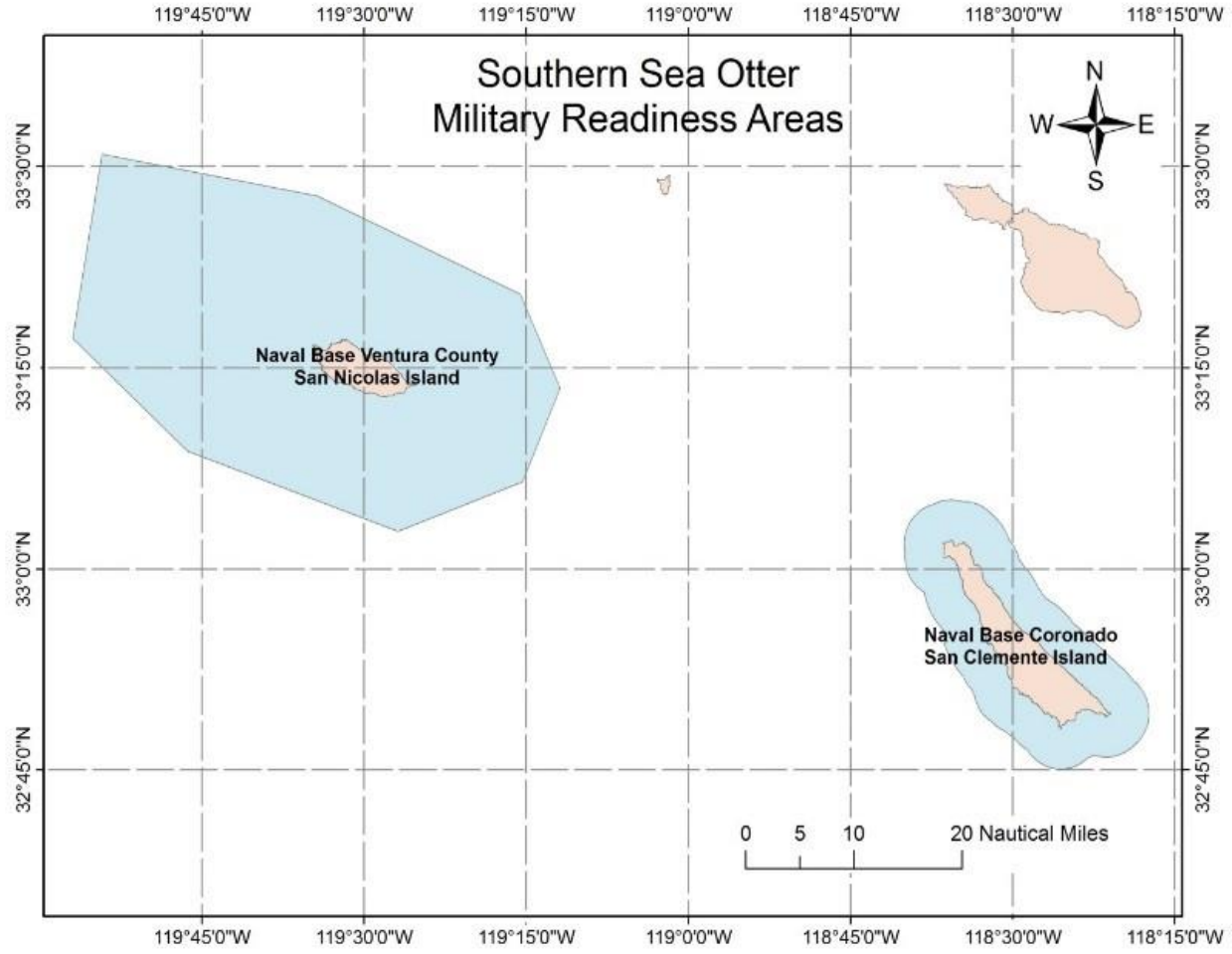


Figure 3.7-7: Southern Sea Otter Military Readiness Areas As Established by the 2016 NDAA

3.7.4.6.1.2 Habitat and Geographic Range

The current occupied range of the Southern sea otter's range represents just a fraction of its historical distribution, which once included portions of coastal Oregon, all the coastal waters of California, and Baja, Mexico (Tinker et al., 2021; U.S. Fish and Wildlife Service, 2015, 2019). The Southern sea otter (*Enhydra lutris nereis*) currently occurs nearshore off the coast of central California, ranging from Half Moon Bay in the north to Point Conception and at SNI (Tinker et al., 2006; Tinker & Hatfield, 2016; Tinker et al., 2021; U.S. Geological Survey, 2014). The highest densities of sea otters along the coast occur in the center part of the range from the Monterey peninsula to Estero Bay (Carretta et al., 2017c), which is north of the PMSR Study Area. Southern sea otters rarely come ashore and spend most of their life in the nearshore waters, where they regularly swim, feed, reproduce, and rest. Sea otters may occasionally be present in deeper waters when moving between areas or in attempts to establish new habitat (Burn & Doroff, 2005). At this point in time, there is little evidence to suggest that otters residing at San Nicolas are leaving the island.

Stranded (dead) sea otters and sightings of vagrant individual sea otters occasionally occur along the Southern California coast south of Point Conception and the species currently recognized range (Connelly, 2016; Fletcher, 2013; Hunt, 2012). Adult and sub-adult males throughout the range tend to

move to the southern range periphery (Santa Barbara County) during the late winter and early spring (Riedman & Estes, 1990; Tinker et al., 2006). The southern sea otters at SNI are present at that location as a result of a translocation program conducted by the USFWS between 1987 and 1990 (U.S. Fish and Wildlife Service, 2012a), specifically to establish the colony on that island.

As presented in the Pacific Stock Assessment Report and field research findings, the currently recognized range of the southern sea otter population is approximately from Half Moon Bay to Point Conception California (Carretta et al., 2016b; Hatfield et al., 2019b; Tinker & Hatfield, 2016). These nearshore waters along the California mainland are outside the boundary of the PMSR, which does not extend to the coast in those areas.

3.7.4.6.1.3 Population Trends

USFWS surveys from 2017 to 2020 showed a 22 percent per year increase in the Southern sea otter population, with a total of 114 individuals as of February 2020 (Yee et al., 2020). The positive population trend at SNI has been higher than the trend for the remainder of the population along the California coast (Hatfield et al., 2018; Hatfield et al., 2019b). Navy activities on SNI will not significantly change as a result of the Proposed Action. It is reasonable to expect that the sea otter population at San Nicolas will not decline as a result of continued military readiness activities.

3.7.4.6.1.4 Species-Specific Threats

The toxoplasmosis parasite (often attributed to feral cat feces in urban area storm run-off) impacts sea otters along the U.S. West Coast (Simeone et al., 2015). The emergence of a nematode parasite in Southern sea otters-associated hepatitis has also been reported (Miller et al., 2020a). Examination of Southern sea otter tissue samples have detected polyomavirus, parvovirus, and adenovirus infections in 80 percent of tested animals, suggesting endemic infection is present in the population (Siqueira et al., 2017). Miller et al. (2020b) found that in Southern sea otters that were subjected to necropsy between 1998 and 2012 (n=560), the most prominent cause of death was infectious disease. Heart disease in southern sea ottters is linked to their inadvertent consumption of domoic acid that accumulates in their prey (Moriarty et al., 2021). Elevated levels of domoic acid in the marine environment are known to result from harmful algal blooms of the diatom *Pseudo-nitzschia* (McCabe et al., 2016). Once the algae die, their remains sink to the seafloor and are ingested and accumulate in benthic species (e.g., crabs) that are preyed upon by sea otters. Moriarty et al. (2021) revealed that sea otters consuming a high proportion of crabs and clams had a 2.5 and 1.2 times higher likelihood of death due to cardiomyopathy, respectively, than otters that consumed lower proportions of those prey. The risk of heart disease was shown to be greater for younger adults in their prime compared with older otters, which showed a lower risk for developing the disease at similar exposures levels. Having greater detrimental effects on adults in their prime reproductive years has long-term consequences for the recovery of the species, particularly with warmer ocean temperatures giving rise to more frequent and longer-lasting harmful algal blooms (Moriarty et al., 2021; Wells et al., 2015).

Sea otters are also considered likely prey for killer whales (Hatfield et al., 1998) and sharks (Moxley et al., 2019; Tinker et al., 2016; Tinker et al., 2021).

3.7.5 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 mammals in the Study Area. The stressors[5] analyzed for impacts on marine mammals in the Study Area include the following:

- Acoustic (explosives; weapons firing, launch, and impact noise; vessel noise; aircraft noise)
- Physical disturbance and strike (vessels; military expended materials [MEM])
- Entanglement (decelerator/parachutes)
- Ingestion (non-explosive practice munitions; fragments from high explosive munitions; MEM other than munitions)
- Indirect Effects (Secondary Stressor)

The assessment of which stressors are likely to have meaningful impact on marine mammals presented in the following sections has been based on five main categories of information: (1) multiple previous analyses undertaken and conclusions reached by the Navy since 2001 for the same type of testing and training activities as are presented in the Proposed Action, (2) the best available latest science (see "References" at the end of this section), (3) analysis of strike stressor probabilities for in-water devices and MEM used in the PMSR, (4) regulations and authorizations pursuant to the MMPA reached by NMFS for all other Navy areas analyzed in the Pacific and Atlantic, and (5) Biological Opinions from NMFS and findings from the USFWS analyzing the effects of the Navy's activities on ESA-listed marine mammals for all other Navy areas analyzed in the Pacific and Atlantic. Each of the stressors has been further evaluated to determine if that stressor should be carried forward for additional analysis of possible impacts on marine mammals resulting from Navy's testing and training activities in the PMSR Study Area; see the summary provided in in Section 3.7.5.2.5 (Summary of Stressor Assessment). In addition to the analysis of direct and indirect impacts on individual marine mammals, an assessment of the long-term impact on populations and species was considered as described in the next section.

3.7.5.1 Long-Term Consequences

Long-term consequences to a population are determined by examining changes in the population growth rate. For additional information on the determination of long-term consequences, see documents (U.S. Department of the Navy, 2018b, 2018c), regulations, and a Letter of Authorization from NMFS (83 FR 66849; December 27, 2018), and recent Biological Opinions (National Marine Fisheries Service, 2018b, 2020b) involving the same types of Navy activities and the same populations of protected marine mammals occurring in the PMSR Study Area. Physical effects from explosive sources that could lead to a reduction in the population growth rate include mortality or injury; however, no such mortality or injury is expected to occur based on the standard modeling. Modeling for the PMSR

[5] In prior Navy analyses (for example, U.S. Department of the Navy (2018c)), high-energy lasers aimed at surface targets were assessed for their potential to strike a marine mammals by assuming the laser beam would miss the target and the beam then strike a surfaced marine mammal's body. Navy has reconsidered this extremely conservative approach given the following: (1) precision targeted high-energy lasers firing over relatively short ranges, (2) marine mammals spend up to 90 percent of their time under the water, (3) marine mammals are unlikely to remain stationary and may avoid the target area during set-up activity prior to and during the testing activity, (4) the very small diameter of the laser beam, and (5) the laser should not miss a target given the system's tracking ability and automated shut-down if target-lock is lost. The same approach to the analysis applies to similar directed energy systems, including high-power microwave systems.

activities does predict both permanent and temporary hearing impairment may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface). These effects on marine mammal hearing could range from impairing an animal's navigation, foraging, predator avoidance, or communication to having no meaningful consequences to an individual animal's routine. Most of the impacts on marine mammals from the analysis of Navy testing and training are predicted to be behavioral reactions to an activity. The long-term consequences due to individual behavioral reactions, masking and short-term instances of physiological stress are especially difficult to predict because individual experience over time can create complex contingencies, especially for long-lived animals like marine mammals. For example, a lost reproductive opportunity could be a measurable cost to the individual; however, short-term costs may be recouped during the life of an otherwise healthy individual. These factors are taken into consideration when assessing risk of long-term consequences under the various alternatives.

Consideration of Mitigation in the Analysis

The analysis in this document has taken into consideration the qualitative potential for implemented mitigation measures to reduce or avoid impacts on marine mammals. However, the predicted numbers of acoustic exposures presented in Appendix C (Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or near the Ocean's Surface) did not take into account implemented mitigation measures and did not quantitatively reduce any of the predicted effects resulting from the acoustic impact modeling. Chapter 5 (Standard Operating Procedures and Mitigation) details how the Navy considered and analyzed the need for mitigation measures designed to reduce or avoid impacts on marine mammals and the marine environment. The Navy considered geographic mitigation measures in addition to those already in place for the Channel Islands National Marine Sanctuary, SNI, and the nearshore of Point Mugu. For example, the Navy has long had numerous measures in place with regards to habitat at SNI involving pinniped haulout sites along the shoreline and activities that include the launches of vehicles from the island. There is also existing geographic mitigation for the Channel Islands National Marine Sanctuary in that there is no Navy testing and training involving the use of explosives within boundaries of the sanctuary. Given the overlap between the blue whale, humpback whale, and gray whale BIAs and the newly designated humpback whale critical habitat, that existing geographic mitigation for the sanctuary potentially reduces or avoids impacts within those overlapping areas of those BIAs and the critical habitat. Furthermore, designating mitigation areas where impactful activities would not occur provides no additional benefit to resources occurring within such a designated area. Mitigation areas are intended to avoid or reduce harmful effects to resources within a static boundary, but if effects are not occurring within those boundaries, then designating mitigation areas would not contribute any further avoidance or reduction in a non-existent harmful effect on the resource (e.g., within the Channel Islands National Marine Sanctuary that overlaps two feeding area BIAs). For other areas considered, see specifically Section 5.3.6.2 (Geographic Mitigation) for a detailed discussion of time-area management considerations for the BIAs designated for blue whale and humpback whale feeding, gray whale migration, and the Morro Bay harbor porpoise small and resident population.

Restricting Navy access to large portions of the PMSR, including avoidance of the BIAs and or critical habitat, that have been used intermittently by Navy for decades would have significantly detrimental impacts on the ability of the Navy to complete its mission in the PMSR Study Area. As stated above, time and area restrictions are only effective at reducing or avoiding impacts if there are marine mammals present when and where an impactful activity would have otherwise occurred.

As Hyrenbach et al. (2000) noted, while areas designated on maps are effective when habitats are static (like in many terrestrial settings), many important pelagic habitats are neither fixed nor predictable, and thus mitigation associated with those habitats require dynamic boundaries to be effective (see also Abrahms et al. (2019b); Becker et al. (2016); Becker et al. (2018); D'Aloia et al. (2019); Dunn et al. (2016); Dwyer et al. (2020); Hazen et al. (2016); Hazen et al. (2018); Lewison et al. (2015); Maxwell et al. (2020); Maxwell et al. (2015); Oestereich et al. (2020); Perez-Jorge et al. (2015); Redfern et al. (2017b); Rockwood et al. (2020); Scales et al. (2017a); Sequeira et al. (2019); Szesciorka et al. (2020); Blondin et al. (2020)). The statically bounded blue whale and humpback whale feeding BIAs overlapping the PMSR, as provided in Calambokidis et al. (2015), were largely based on a smoothed and averaged best estimate of the species abundance and distribution over an approximately 20-year period between 1991and 2008 and by encompassing sighting data at locations judged to be the most likely to have the species of interest present (see for example, Calambokidis et al. (2009b)). The feeding BIAs represent bounded regions where probability of marine mammal occurrence is as an average more likely over multiple year time frames than in surrounding waters. For humpback whales and blue whale, the krill aggregations they feed upon tend to be spatially (tens of meters to kilometers) and temporally (hours to days) ephemeral and result in changes to the distribution these mysticetes when feeding (Benson et al., 2002; Blondin et al., 2020; Brinton & Townsend, 2003; Cimino et al., 2020; Fiechter et al., 2020; Horton et al., 2020; Rockwood et al., 2020; Santora et al., 2017a; Szesciorka et al., 2020). With marine mammals being highly mobile and due to the ephemeral nature of their prey, avoiding areas bounded by static lines on a map defined by a multi-year average higher marine mammal density may not be effective at avoiding or reducing potential effects to marine mammals, given the short-term time scales and relatively small area of square kilometers that may be exposed to Navy stressors. For example, multiple satellite tag data sets (for blue whales see Section 3.7.4.2.1.2, Habitat and Geographic Range; for fin whales see Section 3.7.4.2.3.2, Habitat and Geographic Range; and for humpback whales see Section 3.7.4.2.5.2, Habitat and Geographic Range) indicate variability in core area use between years and in some instances, little or no documented presence in a BIA despite tagged individuals using nearby areas or transiting past a BIA,\; this suggests prey distributions in that sample period resulted in there being more of that species outside a BIA's mapped boundaries than within it. A northward shift in distribution of blue whales has also been documented by the most recent (2018) NMFS survey of the U.S. West Coast (Becker et al., 2020a). In short, given the variability in marine mammal distributions over short-term time scales and small areas, statically defined geographic mitigation areas are not an effective means to reduce or avoid potential impacts to marine mammals driven by the spatiotemporal impermanence of prey species (Blondin et al., 2020; D'Aloia et al., 2019; Dwyer et al., 2020; Hazen et al., 2018; Hyrenbach et al., 2000; Lewison et al., 2015; Maxwell et al., 2020; Oestereich et al., 2020; Perez-Jorge et al., 2015), although they will remain a useful management tool when considering fixed anthropogenic activities such as commercial vessel traffic lanes (Cimino et al., 2020; Lewison et al., 2015; Redfern et al., 2020; Redfern et al., 2019; Rockwood et al., 2020); see additional background citations and discussion presented in Section 3.7.4.1.6.2 (Commercial Industries, subsection Vessel Strike).

3.7.5.2 Stressor Assessment

3.7.5.2.1 Acoustic (weapons firing, launch, and impact noise; vessel noise; aircraft noise; explosives)

Over approximately the last decade and for multiple Navy range complexes including the SOCAL Range Complex that borders the PMSR Study Area, analyses have been undertaken for the same general Navy testing and training activities that are included in the Proposed Action (U.S. Department of the Navy, 2002, 2008, 2010c, 2013d, 2015a, 2017b, 2018a, 2018c). In these prior analyses and based on the best

available science and consultations with NMFS, the Navy determined that acoustic stressors used during testing and training at-sea that include weapons firing, launch, and impact noise; vessel noise; and aircraft noise, have had *de minimis*, discountable, or negligible impacts; or no impacts. In the analyses for each of these stressors, it was the underlying nature of the stressor that resulted in the determination, not number of stressor exposures as having been below a threshold quantity above which impacts might otherwise occur. In short, there is no reasonably foreseeable level of Navy activity where weapons firing, launch, and impact noise; vessel noise; and aircraft noise would result in significant impacts on marine mammals. Since fewer activities are proposed at the PMSR than were proposed in the SOCAL Range Complex (as well as other previously analyzed Navy range complexes), activities at the PMSR should result in fewer stressor exposures to marine mammals than similar activities with similar stressors at the SOCAL Range Complex. As listed above, impacts from acoustic stressors other than sonar and explosives during testing and training activities at all other range complexes, including the SOCAL Range Complex, have been found to be discountable, negligible, or insignificant by the Navy and NMFS (U.S. Department of the Navy, 2015a, 2018b, 2018d). For details consistent with the most up-to-date analysis of acoustic stressors, see U.S. Department of the Navy (2018c). NMFS reviewed the Navy's analyses and conclusions regarding these stressors as they pertain to the MMPA and found them "complete and supportable," including the recent analysis for the adjacent SOCAL Range Complex (83 FR 66849; December 27, 2018). Navy has determined that acoustic stressors may affect ESA-listed marine mammals. With regard to the ESA and training and testing for the adjacent SOCAL Range Complex and as pertaining to marine mammal stressors at PMSR, NMFS has recently, and again consistent with determinations for all other Navy range complexes, determined that weapons firing, launch, and impact noise; vessel noise; and aircraft noise are discountable or insignificant and not likely to adversely affect ESA-listed species (National Marine Fisheries Service, 2018b). The rationale for why these stressors have been determined to have *de minimis*, discountable, or negligible impacts; or no impacts are summarized in the following paragraphs. Details can be found in U.S. Department of the Navy (2018c).

Weapons Firing, Launch, and Impact Noise – Marine mammals at sea may be exposed to sounds caused by the firing of weapons, objects in flight, and inert impact of non-explosive munitions on the water's surface. In general, these are impulsive sounds are generated in close vicinity to, or at, the water surface next to a vessel. The firing or launch of a weapon may have several components of associated noise. Firing of guns could include sound generated in air by firing a gun (its muzzle blast) and a crack sound due to a low amplitude shock wave generated by a supersonic projectile flying through the air. The majority of in-air sound energy is reflected by the water's surface except for a narrow cone-shaped area that is perpendicular to initial the path of the projectile (Bolghasi et al., 2017; Chapman & Godin, 2004; Cheng & Edwards, 2003; Moody, 2006; Richardson et al., 1995; Sawyers, 1968; Sohn et al., 2000; Swisdak, 1975; Waters & Glass, 1970; Woods et al., 2015). As a result, noise from weapons firing in-air and transmitted into the water would mainly occur in instances when a large-caliber gun is fired at a low vertical angle aimed to the side of the vessel. Other gunfire arrangements, such as with smaller-caliber weapons or greater angles of fire, would result with lower noise levels until the angle of incidence is reached where no sound enters the water.

The launch of missiles from vessels may also result in noise near the water's surface. Any in-air sound that enters the water only does so within a narrow cone below the path of the missile. Underwater sounds would be strongest just below the surface and directly under the launch point next to a vessel. Vibration from the blast propagating through a surface ship's hull, the sound generated by the impact of an object with the water's surface, and the sound generated by launching an object underwater from a

submarine are other sources of impulsive sound in the water. Sound in-air due to missile and target launches is typically at a maximum at initiation of the booster rocket and rapidly fades as the missile or target travels downrange.

Subsurface launches of cruise missiles or ballistic missiles are considered a component of subsurface-to-surface testing or training events. As described in the Trident EA (U.S. Department of the Navy, 2003) and because of the manner by which a missile is launched from inside the submarine, a subsurface launch of a missile would not be a significant source of underwater noise. A missile begins its launch from inside the submarine when a gas generator at the bottom of the missile tube flash boils the water in the tube, creating expanding steam that ejects the missile from the submarine. With that momentum, the missile rises through the water in the steam bubble and continues into the air. Then, when it reaches approximately 50 ft. above the water's surface, the jet or the first stage of the missile ignites and pushes the missile along its flight path. Given that the ignition occurs well above the ocean's surface (10 m or 33 ft.), as well as the height of potential in-air noise sources considered for underwater acoustic impacts, the acoustic energy from that in-air ignition and flight should be mostly reflected by the ocean surface and then rapidly diminish as the missile gains altitude. As a result, there is no significant underwater noise generated by the mechanics of the subsurface missile launch or the in-air ignition of the missile associated with these events, and subsurface missile launches are not considered further as a stressor.

The Navy will implement mitigation measures to avoid or reduce potential impacts from weapon noise during large-caliber gunnery activities, as discussed in Section 5.3.2.1 (Weapons Firing Noise). Given that the sound from weapons firing, launch, and impact noise is small in extent, generally occurring next to a vessel, and mainly reflected by the water's surface, these stressors would not result in the incidental taking of marine mammals and may affect but is not likely to adversely affect ESA-listed marine mammals.

Vessel Noise – Marine mammals may be exposed to noise from Navy vessels within PMSR. Navy vessels represent a small amount of overall vessel traffic and an even smaller amount of overall vessel traffic noise within the PMSR because many Navy ships incorporate quieting technology that other vessels do not have. Navy vessel noise exposures should generally be of short duration, transient, and at low source levels. Any behavioral, physiological stress, if they occur, are likely to be insignificant. Masking marine mammal vocalizations and communication is unlikely to occur as a result of Navy activities given the vast numbers of commercial and recreational vessels in the area that would drown out the relatively quiet Navy combatant vessels. In addition, Navy mitigation measures to avoid potential interactions with marine mammals (see Section 5.3.4.1, Vessel Movement) include maneuvering to maintain a specified distance from an observed marine mammal, which will also help the Navy reduce potential impacts from vessel noise on marine mammals. As a result of these factors, Navy vessel noise would not result in the incidental taking of marine mammals and may affect but is not likely to adversely affect ESA-listed marine mammals.

Aircraft Noise – Marine mammals may be exposed to aircraft-noise throughout the Study Area as a result of Navy testing and training activities. In general, marine mammals have demonstrated no responses or insignificant responses to aircraft, except at very low altitudes when directly over the animals—lower than approximately 300 m or 1,000 ft. in altitude (Acevedo-Whitehouse et al., 2010; Christiansen et al., 2016; Durban et al., 2015; Fettermann et al., 2019; Holst et al., 2011; Koski et al., 1998; Moreland et al., 2015; Pomeroy et al., 2015; Richardson et al., 1985; Richardson et al., 1995; Smith et al., 2016a; Smith et al., 2016b; Smultea et al., 2008; Smultea & Lomac-MacNair, 2016; Sweeney et al.,

2015; Würsig et al., 1998). Fixed- and rotary-wing aircraft are used for a variety of training and testing activities throughout the Study Area. Rotary-wing aircraft produce low-frequency sound and vibration (Pepper et al., 2003). Tilt-rotor impacts would be similar to fixed-wing or helicopter impacts depending which mode the tilt-rotor aircraft is in. Aircraft produce extensive airborne noise from either turbofan or turbojet engines but within PMSR this will generally be at a high enough altitude to be negligible. An infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Given the sound from Navy aircraft noise underwater is small in extent and the majority of sound energy is largely reflected by the water's surface, aircraft noise would not result in the incidental taking of marine mammals and may affect but is not likely to adversely affect ESA-listed marine mammals.

3.7.5.2.1.1 Land-Based Launch Noise

Launches of missiles and aerial targets (vehicle launches) from land are unlike many other forms of disturbance because of their sudden sound onsets, high peak levels in some cases, and short durations (Cummings, 1993). Noises with sudden onset or high amplitude relative to the ambient noise level may elicit a behavioral response from pinnipeds resting on shore; however, strong launch sounds are typically detectable by pinnipeds on beaches at the west end of SNI for no more than a few seconds per launch (Holst & Greene Jr., 2005; Holst & Greene Jr., 2008).

Pinniped reactions to launches from SNI are well documented (Burke, 2017; Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010; Ugoretz, 2014, 2015, 2016; Ugoretz & Greene Jr., 2012). California sea lions, northern elephant seals, and Pacific harbor seals generally tolerate high sound levels without reacting strongly, whereas some may react strongly when sound levels are low. Observations of behavioral responses of these species to vehicle launches from SNI are correspondingly variable. Responses range from momentary startle reactions to animals fleeing into the water or otherwise away from their resting sites. Northern elephant seals are very tolerant of acoustic disturbances (Holst & Greene Jr., 2008) and were removed from the list of target species for monitoring on SNI in 2010 (75 FR 71672). In contrast, harbor seals are more easily disturbed. Most pinnipeds exhibit no more than short-term alert or startle responses (Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008). Localized displacement is typically short in duration (5–15 minutes), although some harbor seals may leave their haulout site until the following low tide when the haulout site is again accessible.

A more detailed analysis of the environmental effects of vehicle launches from SNI was prepared by NMFS in 2014 (National Marine Fisheries Service, 2014a). The resulting environmental assessment and Finding of No Significant Impact concluded that the effect of launches from SNI is related to the sound produced by the launch vehicles and this sound would not result in substantial impacts on marine mammals or to their role in the ecosystem. Launch vehicle sound might result in short-term behavioral effects, but no long-term displacement or temporary/permanent threshold shift in the hearing sensitivities of pinnipeds and no serious injury or mortality is expected.

3.7.5.2.1.2 Explosives as an Acoustic Stressor

Long recognized by the scientific community (Payne & Webb, 1971), and summarized by the National Academies of Science, human-generated sound could possibly harm marine mammals or significantly interfere with their normal activities (National Research Council of the National Academies, 2005). Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present in the vicinity of the sound, and the effects that sound may have on the physiology and behavior of those marine mammals.

For an overview and discussion of acoustic measures and terminology and the two basic sound types (non-impulsive and impulsive), see Southall et al. (2007). Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council of the National Academies, 2003, 2005), there are many unknowns in assessing impacts such as the potential interaction of different effects and the significance of responses by marine mammals to sound exposures (Nowacek et al., 2007; Southall et al., 2007; Southall et al., 2009a). Furthermore, many other factors besides just the received level of sound may affect an animal's reaction such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound (Ellison et al., 2011). Assessing whether an explosive detonation may disturb or injure a marine mammal involves understanding the characteristics of the explosive sources, where the detonation occurs, the marine mammals that may be present near the detonation, the physiological effects of a close explosive exposure, and the effects of impulsive sound on marine mammal hearing and behavior. Many other factors besides just the received level or pressure wave of an explosion, such as the animal's physical condition and size, prior experience with the explosive sound, and proximity to the explosion may influence physiological effects and behavioral reactions.

All the ways in which an exposure resulting from the use of explosives could result in immediate effects or lead to long-term consequences for an marine mammal are explained in detail in previous Navy documents (U.S. Department of the Navy, 2018b, 2018c), regulations and a Letter of Authorization from NMFS (83 FR 66849; December 27, 2018), and a recent Biological Opinion (National Marine Fisheries Service, 2018b) involving the same types of Navy activities and the same populations of protected marine mammals occurring in the PMSR Study Area. A further detailed explanation of this analysis is provided in the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing* (U.S. Department of the Navy, 2018d).

In these previous determinations, injury refers to the direct effects on the tissues or organs of an animal due to exposure to pressure waves resulting from underwater explosions; these injuries are considered Level A harassment as defined under the MMPA. Injury in marine mammals can be caused directly by exposure to explosions. Explosive injury to marine mammals would consist of primary blast injury, which refers to those injuries that result from the compression of a body exposed to a blast wave and is usually observed as barotrauma of gas-containing structures (e.g., lung and gut) and structural damage to the auditory system (Greaves et al., 1943; Office of the Surgeon General, 1991; Richmond et al., 1973).

There are no fully underwater explosives proposed for use in the PMSR under any of the alternatives. All explosives used during testing and training activities at the PMSR would detonate at or above the water's surface. There is currently no modeling methodology to accurately predict how in-air explosive energy may transmit through the air-water interface and potentially effect marine species. Therefore, to estimate possible marine mammal exposure, the Navy's modeling conservatively considers all detonations occurring within 10 m above the water's surface, as if the detonation occurred as a point source located 10 cm underwater (U.S. Department of the Navy, 2019, 2020b). The Navy modeling considers all acoustic energy from the detonation remains underwater with no sound transmitted into the air and that none of the detonation energy would be released as a plume of water from the surface. As a result of these conservative modeling assumptions, the modeling will tend to overestimate potential effects to marine mammals.

The underwater acoustic effects on marine mammals from the use of explosives were modeled consistent with recent Navy analyses (U.S. Department of the Navy, 2017c, 2018c) and with recent

regulations promulgated by NMFS (83 FR 66846, December 27, 2018). The modeling results indicate that non-auditory injury (i.e., lung or digestive tract injuries) or mortality should not be expected to result from the proposed testing and training activities under any of the alternatives.[6] The only injury effects expected are Permanent Threshold Shifts (PTS) (i.e., permanent damage to cells in the ear associated with hearing), resulting in Level A harassment as defined under the MMPA. Other predicted effects are Temporary Threshold Shifts (TTS) (i.e., temporarily impaired hearing affecting behavior) and other behavioral reactions, both of which result in Level B harassment as defined under the MMPA and are consistent with recent regulations promulgated by NMFS (83 FR 66846, December 27, 2018). Background information on these affects and their impacts on marine mammal hearing and behavior are summarized in the following section and are available in detail in 83 FR 66846 as well as U.S. Department of the Navy (2017c, 2018c) for reference. Given the reference to regulations covering the SOCAL Range Complex were being considered in this analysis, the Navy took an additional step to investigate whether or not the determinations made most recently for the SOCAL Range Complex (see U.S. Department of the Navy (2018c)) were directly applicable to the PMSR Study Area based on the underwater acoustic environment. The Navy's acoustic effects model was used to conduct an ad hoc acoustic propagation analysis comparing how the different bathymetric and oceanographic properties of the PMSR and the SOCAL Range Complex would affect sound propagation. The results showed that the underwater range-to-effects distances (e.g., the range to an effect on a marine mammal; see Appendix E, Underwater Range to Effects for Explosives at or Near the Surface in the Point Mugu Sea Range) that were calculated for the PMSR Study Area were the same as the distances calculated for the SOCAL Range Complex, indicating the two locations are acoustically equivalent for purposes of acoustic effects analysis.

3.7.5.2.1.3 Loss of Hearing Sensitivity

Exposure to acute and intense noise or exposure to sufficiently loud noise over a long duration may result in noise-induced loss of hearing sensitivity that persists after cessation of the exposure. This reduction in hearing sensitivity, resulting in subsequent sounds needing to be louder to be heard, is also referred to as a threshold shift (Ketten, 2012). A loss of hearing sensitivity may be temporary or permanent, depending on factors such as the exposure frequency, received sound pressure level, temporal pattern, and duration intensity, and whether the noise profile is impulsive (such as result from underwater explosives) or continuous, and the subject's sensitivity at that frequency (Ketten, 2012). The frequencies affected by hearing loss may vary depending on the exposure frequency, with frequencies at and above the exposure frequency most strongly affected. The amount of hearing loss may range from slight (from the point where the loss is unnoticed by the individual effected) to profound where it interferes with or prevents communication. It is normal for adult mammals (humans and cetaceans) to have some level of PTS as a result of age-related nonsyndromic hearing loss, (Education.com, 2013; Green et al., 1987; Houser et al., 2008; Ketten, 2012; Mann et al., 2010; McGowen et al., 2020; National

[6] Under Alternative 1, the modeling predicts a recoverable gastrointestinal injury to one short-beaked common dolphin per year. This model-predicted probability of one injury does not result from any one event, but results from the summation of all fractional probabilities of exposure from multiple occurrences of all 23 activities at PMSR involving explosives at or near the water surface, over the period of a year. By standard rounding that summation is rounded up, resulting in it being counted as one exposure to the species. This one exposure does not take into consideration any implemented mitigation and is based on the modeling that assumes all sound energy from an explosion at or near the surface would be contained underwater, which is a known overestimate of the resulting sound/energy that would occur underwater. For this reason, the predicted fractional gastrointestinal injury exposures to short-beaked common dolphin have been discounted since they are not likely to occur.

Institute on Deafness and Other Communication Disorders, 2017), which in humans is called presbycusis. For example, by the age of 75 approximately 50 percent of humans have impaired hearing (Ketten, 2012).

Hearing loss has only been studied in a few species of marine mammals, although hearing studies with terrestrial mammals and humans are also informative. There are no direct measurements of hearing loss in marine mammals due to exposure to explosive sources. The sound resulting from an explosive detonation is considered an impulsive sound and shares important qualities (i.e., short duration and fast rise time) with other impulsive sounds such as those produced by air guns which have been the subject of some limited research (see for example, Finneran et al. (2015); Kastelein et al. (2019); Kastelein et al. (2018); Kastelein et al. (2017); Reichmuth et al. (2016)).

3.7.5.2.1.4 Physiological Stress

Marine mammals naturally experience stress within their environment and as part of their life histories. The stress response is a suite of physiological changes that are meant to help an organism mitigate the impact of a stressor. However, if the magnitude and duration of the stress response is too great or too long, then it can have negative consequences to the organism (e.g., decreased immune function, decreased reproduction). There are no direct measurements of physiological stress in marine mammals due to exposure to explosive sources. Because there are many unknowns regarding the occurrence of acoustically induced stress responses in marine mammals, it is assumed that any physiological response such as hearing loss or significant behavioral response is also associated with a stress response. Passive acoustic monitoring between 2012 and 2016 involving bottlenose dolphins exposed to 74 underwater detonations (net explosive weights of 5–20 pounds [lb.]) at a training site in the Atlantic does provide data in regard to potential stress responses to explosives (Lammers et al., 2017). Researchers found that within 6 km of the detonation, the number of dolphin whistles increased significantly in the 30 seconds after explosions compared to the 30 seconds before and that dolphin acoustic activity then decreased in the area until the second day after the event when the dolphin acoustic activity was significantly higher than it had been the day before an event (Lammers et al., 2017). Given that even for the largest of the explosions monitored, the effects were only present within 6 km and that the noted reactions were of short duration, it is unlikely the documented behavioral reactions were a significant source of stress as otherwise documented in response to chronic noise stressors (Aarts et al., 2016; Booth, 2019; Cholewiak et al., 2018; National Academies of Sciences Engineering and Medicine, 2017; Putland et al., 2018; Rolland et al., 2012; Sullivan & Torres, 2018; Tyne et al., 2018; Wisniewska et al., 2018).

3.7.5.2.1.5 Masking

Masking occurs when one sound, distinguished as the “noise,” interferes with the detection, discrimination, or recognition of another sound. The quantitative definition of masking is the amount in decibels (dB) an auditory detection, discrimination, or recognition threshold is raised in the presence of a masker (Erbe et al., 2016). Masking can effectively limit the distance over which a marine mammal can communicate, detect biologically relevant sounds, and echolocate (odontocetes). Masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise. Masking can lead to vocal changes (e.g., Lombard effect, increasing amplitude, or changing frequency) and behavior changes (e.g., cessation of foraging, leaving an area) to both signalers and receivers, in an attempt to compensate for noise levels (Erbe et al., 2016). There are no direct observations of masking in marine mammals due to exposure to explosive sources, but the activities at the PMSR involve either a single explosive detonation, or a series of detonations in a discrete impact area (i.e., a target) over a short duration, so any masking, if occurring at all, would also be of short duration and likely insignificant.

3.7.5.2.1.6 Behavioral Reactions to Impulse Noise

Analysis and quantification of estimated behavioral reactions from the use of explosives is consistent with the previous Navy documents (U.S. Department of the Navy, 2018b, 2018c), regulations and a Letter of Authorization from NMFS (83 FR 66849; December 27, 2018), and a recent Biological Opinion (National Marine Fisheries Service, 2018b) involving the same types of Navy activities and the same populations of protected marine mammals occurring in the PMSR Study Area. There are few direct observations of behavioral reactions from marine mammals due to exposure to explosive sounds upon which to base an any analysis of impacts, but the following subsections provide a review of the best available science in that regard for the species likely to be affected by Navy activities resulting in impulsive noise in the PMSR Study Area.

Prior Experience with In-Water Explosions within the PMSR Study Area

As detailed in Chapter 2 (Description of Proposed Action and Alternatives), various ongoing and proposed Navy activities at the PMSR involve explosions occurring at or near the surface and are herein considered for the potential to result in noise impacts on marine mammals underwater. The resulting impulse noise from occasional Navy explosions at or near the surface would be occurring in an environment that is subjected to intensive commercial and recreational vessel traffic and routine civilian use of in-water explosives. As noted in Section 3.0.5.5.2 (Explosives and Noise Resulting from Fishing Activities), passive acoustic monitoring off Southern California since 2009 has documented the routine use of non-military explosives at-sea, commonly known as "seal bombs" (Baumann-Pickering et al., 2013; Bland, 2017; Debich et al., 2015a; Debich et al., 2015b; Rice et al., 2018a; Rice et al., 2017; Rice et al., 2018b; Širović et al., 2016; Wiggins et al., 2019; Wiggins et al., 2018). These non-Navy explosive devices are directed at marine mammals to deter those animals from interfering with fishing activities, are only one of a number of deterrent devices that may be used for similar purposes (National Marine Fisheries Service, 2015b; Schakner & Blumstein, 2013), and have been in widespread and routine use as the acoustic monitoring data demonstrates. For example, at a monitoring site to the northeast of SNI, in seven months from May to November 2013, there were over 24,000 explosions identified as seal bombs (Debich et al., 2015a). In the time-period between June 2012 and June 2017, at a site to the south of SNI, there was average of 9,514 explosions detected per year (Wiggins et al., 2018), although this average varies within the year based on start and end of the fishing season and between locations based on shifts in fishing effort to the north and south. It is therefore critical to consider this baseline environmental context when analyzing the potential impacts on marine mammals from the Navy's use of explosives in the PMSR given the science indicating the importance an animal's prior experience with and proximity to a sound (Demarchi et al., 2012; Ellison et al., 2011; Finneran & Branstetter, 2013; Nowacek et al., 2007; Richardson et al., 1995; Southall et al., 2007; Southall et al., 2019b; St. Aubin & Dierauf, 2001). Based on that science and the routine civilian use of explosives directed at marine mammals, exposure to sound from Navy activities involving explosions at or near the surface should not be a novel experience for most marine mammals in habiting the waters off Southern California and therefore should be less likely to result in a significant behavioral reaction.

Mysticetes

Baleen whales have shown a variety of responses to impulsive sound sources, including avoidance, attraction to the source, reduced surface intervals, altered swimming behavior, and changes in vocalization rates (Gordon et al., 2003; McCauley et al., 2000; Richardson et al., 1985; Southall et al., 2019a). Studies have been conducted on many baleen whale species, including gray, humpback, blue, fin

and bowhead whales; it is assumed that these responses are representative of all baleen whale species. The behavioral state of the whale seems to be an integral part of whether or not the animal responds and how they respond, as does the location and movement of the sound source, more than the received level of the sound.

In a behavioral response study, some migrating gray whales showed avoidance responses to sound sources placed in their path (Malme et al., 1986, 1988; Richardson et al., 1995). Similarly, migrating humpback whales showed avoidance behavior at ranges of 5–8 km from a seismic array during observational studies and controlled exposure experiments in one Australian study (McCauley et al., 1998), and in another Australian study decreased their dive times and reduced their swimming speeds (Dunlop et al., 2015). However, when comparing received levels and behavioral responses when using ramp-up versus a constant noise level of air guns, humpback whales did not change their dive behavior but did deviate from their predicted heading and decreased their swim speeds (Dunlop et al., 2016). In addition, the whales demonstrated more course deviation during the constant source trials but reduced travel speeds more in the ramp-up trials; in either case there was no dose-response relationship with the received level of the air gun noise, and similar responses were observed in control trials with vessel movement but no air guns so some of the response was likely due to the presence of the vessel and not the received level of the air guns. When looking at the relationships between proximity, received level, and behavioral response, Dunlop et al. (2017) used responses to two different air guns and found responses occurred more towards the smaller, closer source than to the larger source at the same received level, demonstrating the importance of proximity. Responses were found to be more likely when the source was within 3 km or above 140 dB re 1 µPa, although responses were variable and some animals did not respond at those values while others responded below them. In addition, responses were generally small, with course deviations of only around 500 m, and short term (Dunlop et al., 2017). McDonald et al. (1995) tracked a blue whale with seafloor seismometers and reported that it stopped vocalizing and changed its travel direction at a range of 10 km from the seismic vessel (estimated received level 143 dB re 1 µPa peak-to-peak). Bowhead whales seem to be the most sensitive species, perhaps due to a higher overlap between bowhead whale distribution and seismic surveys in Arctic and sub-Arctic waters, as well as a recent history of being hunted. While most bowhead whales did not show active avoidance until within 8 km of seismic vessels (Richardson et al., 1995), some whales avoided vessels by more than 20 km at received levels as low as 120 dB re 1 µPa. Additionally, Malme et al. (1988) observed clear changes in diving and breathing patterns in bowheads at ranges up to 73 km from seismic vessels, with received levels as low as 125 dB re 1 µPa. Bowhead whales may also avoid the area around seismic surveys, from 6–8 km (Koski and Johnson 1987, as cited in Gordon et al., 2003) out to 20 or 30 km (Richardson et al., 1999). However, work by Robertson (2014) supports the idea that behavioral responses are contextually dependent, and that during seismic operations bowhead whales may be less “available” for counting due to alterations in dive behavior but that they may not have left the area after all.

In contrast, noise from seismic surveys was not found to impact feeding behavior or exhalation rates in western gray whales while resting or diving off the coast of Russia (Gailey et al., 2007; Yazvenko et al., 2007); however, the increase in vessel traffic associated with the surveys and the proximity of the vessels to the whales did affect the orientation of the whales relative to the vessels and shortened their dive-surface intervals (Gailey et al., 2016). Todd et al. (1996) found no clear short-term behavioral responses by foraging humpback whales to explosions associated with construction operations in Newfoundland but did see a trend of increased rates of net entanglement closer to the noise source, possibly indicating a reduction in net detection associated with the noise through masking or TTS.

Distributions of fin and minke whales were modeled with a suite of environmental variables along with the occurrence or absence of seismic surveys, and no evidence of a decrease in sighting rates relative to seismic activity was found for either species (Vilela et al., 2016). Their distributions were driven entirely by environmental variables, particularly those linked to prey including warmer sea surface temperatures, higher chlorophyll-a values, and higher photosynthetically available radiation (a measure of primary productivity).

Vocal responses to seismic surveys have been observed in a number of baleen whale species, including a cessation of calling, a shift in frequency, increases in amplitude or call rate, or a combination of these strategies. Blue whale feeding/social calls were found to increase when seismic exploration was underway, with seismic pulses at average received Sound Exposure Levels (SELs) of 131 decibels referenced to 1 micropascal squared seconds (dB re 1 μPa^2s) (Di Lorio & Clark, 2010), a potentially compensatory response to increased noise level. Responses by fin whales to a 10-day seismic survey in the Mediterranean Sea included possible decreased 20-Hz call production and movement of animals from the area based on lower received levels and changes in bearings (Castellote et al., 2012). However, similarly distant seismic surveys elicited no apparent vocal response from fin whales in the mid-Atlantic Ocean; instead, Nieukirk et al. (2012) hypothesized that 20-Hz calls may have been masked from the receiver by distant seismic noise. Models of humpback whale song off Angola showed significant seasonal and diel variation, but also showed a decrease in the number of singers with increasing received levels of air gun pulses (Cerchio et al., 2014). Bowhead whale calling rates decreased significantly at sites near seismic surveys (41–45 km) where median received levels were between 116–129 dB re 1 µPa, and did not decrease at sites further from the seismic surveys (greater than 104 km) where median received levels were 99–108 dB re 1 µPa (Blackwell et al., 2013). In fact, bowhead whale calling rates increased at the lower received levels, began decreasing at around 127 dB re 1 μPa^2s cumulative SEL, and ceased altogether at received levels over 170 dB re 1 μPa^2s cumulative SEL (Blackwell et al., 2015). Similar patterns were observed for bowhead vocalizations in the presence of tonal sounds associated with drilling activities, and were amplified when the presence of both the tonal sounds and air gun pulses (Blackwell et al., 2017).

Mysticetes seem to be the most sensitive taxonomic group of marine mammals to impulsive sound sources, with possible avoidance responses occurring out to 30 km and vocal changes occurring in response to sounds over 100 km away. However, responses appear to be behaviorally mediated, with most avoidance responses occurring during migration behavior and little observed response during feeding behavior. These response patterns are likely to hold true for Navy impulsive sources; however, Navy impulsive sources would largely be stationary (e.g., pile driving), short term (on the order of hours rather than days or weeks), and lower source level (e.g., swimmer defense air guns) than were found in these studies and so responses would likely occur in closer proximity or not at all.

Odontocetes

In general, odontocetes appear to be less sensitive to impulsive sound than mysticetes, with responses requiring animals be at much closer to the source. This may be due to the predominance of low-frequency sound associated with these sources that propagates long distances and overlaps with the range of best hearing for mysticetes, but is below the range of best hearing in odontocetes. The exception to this is the harbor porpoise, which has been shown to be highly sensitive to most sound sources, avoiding both stationary (e.g., pile driving) and moving (e.g., air gun survey vessels) impulsive sound sources out to approximately 20 km (e.g., Haelters et al., 2014; Pirotta et al., 2014). However,

even this response is short term, with porpoises returning to the area within hours after the cessation of the noise.

A study was conducted on the response of harbor porpoises to a seismic survey using aerial surveys and C-PODs (an autonomous recording device that counts odontocete clicks); the animals appeared to have left the area of the survey, and decreased their foraging activity within 5–10 km, as evidenced by both a decrease in vocalizations near the survey and an increase in vocalizations at a distance (Pirotta et al., 2014; Thompson et al., 2013). However, the animals returned within a day after the air gun operation ceased, and the decrease in occurrence over the survey period was small relative to the observed natural seasonal decrease compared to the previous year. A number of studies (Brandt et al., 2011; Dähne et al., 2014; Haelters et al., 2014; Thompson et al., 2010; Tougaard et al., 2005; Tougaard et al., 2009) also found strong avoidance responses by harbor porpoises out to 20 km during pile driving; however, all studies found that the animals returned to the area after the cessation of pile driving. When bubble curtains were deployed around pile driving, the avoidance distance appeared to be reduced to half that distance (12 km), and the response only lasted about 5 hours rather than a day before the animals returned to the area (Dähne et al., 2017). Kastelein et al. (2013) exposed a captive harbor porpoise to impact pile driving sounds, and found that above 136 dB re 1 µPa (zero-to-peak) the animal's respiration rates increased, and at higher levels it jumped more frequently. Bergstrom et al. (2014) found that although there was a high likelihood of acoustic disturbance during wind farm construction (including pile driving), the impact was short term. Graham et al. (2017) assessed the occurrence of bottlenose dolphins and harbor porpoises over different area and time scales with and without impact and vibratory pile driving. While there were fewer hours with bottlenose dolphin detections and reduced detection durations within the pile driving area and increased detection durations outside the area, the effects sizes were small, and the reduced harbor porpoise encounter duration was attributed to seasonal changes outside the influence of the pile driving. However, received levels in this area were lower due to propagation effects than in the other areas described above, which may have led to the lack of or reduced response.

Captive bottlenose dolphins sometimes vocalized or were reluctant to return to the test station after exposure to single impulses from a seismic water gun (Finneran et al., 2002). When exposed to multiple impulses from a seismic air gun, some dolphins turned their heads away from the sound source just before the impulse, showing that they could anticipate the timing of the impulses and perhaps reduce the received level (Finneran et al., 2015). During construction (including the blasting of old bastions) of a bridge over a waterway commonly used by the Tampa Bay, FL stock of bottlenose dolphins, the use of the area by females decreased while males displayed high site fidelity and continued using the area, perhaps indicating differential habitat uses between the sexes (Weaver, 2015).

As noted previously in Section 3.7.5.2.1.4 (Physiological Stress), Lammers et al. (2017) recorded bottlenose dolphin vocalizations near naval mine neutralization events over a four-year period off the Atlantic coast and found that within 6 km of the detonation site, there was an increase in whistles after the detonation, and a reduction in daytime acoustic activity during the rest of the day and the day after the event. However, the nighttime activity did not seem to be affected and two days after the event there appeared to be an increase in daytime acoustic activity, indicating a rapid return to the area by the dolphins (Lammers et al., 2017).

Madsen et al. (2006) and Miller et al. (2009) tagged and monitored eight sperm whales in the Gulf of Mexico exposed to seismic air gun surveys. Sound sources were from approximately 2 to 7 NM away from the whales, and received levels were as high as 162 dB sound pressure level re 1 µPa (Madsen et

al., 2006). The whales showed no horizontal avoidance, however one whale rested at the water's surface for an extended period of time until air guns ceased firing (Miller et al., 2009). While the remaining whales continued to execute foraging dives throughout exposure, tag data suggested there may have been subtle effects of noise on foraging behavior (Miller et al., 2009). Similarly, Weir (2008) observed that seismic air gun surveys along the Angolan coast did not significantly reduce the encounter rate of sperm whales during the 10-month survey period, nor were avoidance behaviors to air gun impulsive sounds observed. In contrast, Atlantic spotted dolphins did show a significant, short-term avoidance response to air gun impulses within approximately 1 km of the source (Weir, 2008). The dolphins were observed at greater distances from the vessel when the air gun was in use, and when the air gun was not in use they readily approached the vessel to bow ride.

Odontocete behavioral responses to impulsive sound sources are likely species- and context-dependent, with most species demonstrating little to no apparent response. Responses might be expected within close proximity to a noise source, under specific behavioral conditions such as females with offspring, or for sensitive species such as harbor porpoises.

Pinnipeds

A review of behavioral reactions by pinnipeds to impulsive noise can be found in Richardson et al. (1995) and Southall et al. (2007). Blackwell et al. (2004) observed that ringed seals exhibited little or no reaction to pipe-driving noise with mean underwater levels of 157 dB re 1 µPa and in air levels of 112 dB re 20 µPa, suggesting that the seals had habituated to the noise. In contrast, captive California sea lions avoided sounds from an underwater impulsive source at levels of 165–170 dB re 1 µPa (Finneran et al., 2003). Harbor and grey seals were also observed to avoid a seismic air gun by rapidly swimming away, and ceased foraging during exposure, but returned to normal behavior afterwards (Thompson et al. 1998, cited in Gordon et al., 2003). In another study, few responses were observed by New Zealand fur seals to a towed air gun array operating at full power; rather, when responses were observed it seemed to be to the physical presence of the vessel and tow apparatus, and these only occurred when the vessel was within 200 m and sometimes as close as 5 m (Lalas & McConnell, 2016). Captive Steller sea lions were exposed to a variety of tonal, sweep, impulsive and broadband sounds to determine what might work as a deterrent from fishing nets. The impulsive sound had a source level of 120 dB re 1 µPa at 1 m, and caused the animals to haul out and refuse to eat fish presented in a net (Akamatsu et al., 1996). Steller sea lions exposed to in-air explosive blasts increased their activity levels and often re-entered the water when hauled out (Demarchi et al., 2012). However, these responses were short-lived and within minutes, the animals had hauled out again, and there were no lasting behavioral impacts in the days following the blasts.

Experimentally, Götz & Janik (2011) tested underwater startle responses to a startling sound (sound with a rapid rise time and a 93 dB sensation level [the level above the animal's hearing threshold at that frequency]) and a nonstartling sound (sound with the same level, but with a slower rise time) in wild-captured gray seals. The animals exposed to the startling treatment avoided a known food source, whereas animals exposed to the nonstartling treatment did not react or habituated during the exposure period. The results of this study highlight the importance of the characteristics of the acoustic signal in an animal's response of habituation.

Pinnipeds may be the least sensitive to most noise sources of any marine mammals based on observations monitoring Navy activities and through other research (Burke, 2017; Holst et al., 2011; Mikkelsen et al., 2019; Southall et al., 2007; Ugoretz, 2016; Wilson et al., 2012). Some pinniped species (e.g., harbor seals) are more sensitive than others (e.g., elephant seals), but even these more reactive

species are likely to only respond to loud sound sources at close ranges by startling, jumping into the water when hauled out, or may even cease foraging, but only for brief periods before returning to their previous behavior. Pinnipeds may even be exposed to sound levels high enough to result in TTS before exhibiting a behavioral response (Southall et al., 2007).

3.7.5.2.1.7 Mitigation of Effects from Explosive Stressors

The Navy will implement mitigation measures to avoid or reduce potential impacts from explosives on marine mammals, as described in Chapter 5 (Standard Operating Procedures and Mitigation). The Navy's mitigation measures are identical for all alternatives. Procedural mitigation measures include delaying or ceasing applicable detonations when a marine mammal is observed in a mitigation zone. The ability of Navy Lookouts to detect marine mammals within a mitigation zone is dependent on the animal's presence at the surface and the characteristics of the animal that influence its sightability (such as group size or surface active behavior). The behaviors and characteristics of some species may make them easier to detect. Certain behaviors, such as leaping and breaching, are visible from a great distance and likely increase sighting distances and detections of those species. The mitigation zones for explosives were designed to extend beyond the respective average ranges to mortality. In practice, implemented mitigation also protects unobserved (below the surface) animals in the vicinity, including other species, in addition to the observed animal. The analysis of effects for the PMSR Study Area does not include the potential for implemented mitigation to reduce the number of model predicted PTS, TTS, or behavioral effects, even though mitigation would reduce the likelihood of occurrence for some of the predicted effects. The analysis, therefore, does not capture the protection afforded to all marine species that may be near or within the mitigation zone.

3.7.5.2.1.8 Impact Ranges for Explosives

The following section and Appendix E (Underwater Range to Effects for Explosives at or Near the Surface in the Point Mugu Sea Range) provide the range (distance) over which specific physiological or behavioral effects are expected to occur based on the explosive criteria and the explosive propagation calculations from the Navy Acoustic Effects Model (U.S. Department of the Navy, 2019, 2020b). The range to effects are shown for a range of explosive bins, from Bin E1 (up to 0.25 lb. net explosive weight) to E10 (up to 500 lb. net explosive weight). Ranges are determined by modeling the distance that noise from an explosion will need to propagate to reach exposure level thresholds specific to a hearing group that will cause behavioral response, TTS, PTS, and non-auditory injury. Range to effects is important information in not only predicting effects from explosives, but also in verifying the accuracy of model results against real-world situations and assessing the level of affect that will likely be mitigated within applicable mitigation zones.

Appendix E (Underwater Range to Effects for Explosives at or Near the Surface in the Point Mugu Sea Range), Table E-1 shows the minimum, average, and maximum ranges due to varying propagation conditions to non-auditory injury based on the larger of the range to slight lung injury or gastrointestinal tract injury for representative animal masses ranging from 10 to 72,000 kilograms and different explosive bins ranging from 0.25 to 500 lb. net explosive weight. Animals within these water volumes would be expected to receive minor injuries at the outer ranges, increasing to more substantial injuries, and finally mortality as an animal approaches the detonation point. Ranges to mortality, based on animal mass, are shown in Table E-2.

Appendix E (Underwater Range to Effects for Explosives at or Near the Surface in the Point Mugu Sea Range), Table E-3 through Table E-12 show the minimum, average, and maximum ranges to onset of

auditory and behavioral effects based on the thresholds described in previous Navy documents (U.S. Department of the Navy, 2017c, 2018b, 2018c), regulations and a Letter of Authorization from NMFS (83 FR 66849; December 27, 2018), and a recent Biological Opinion (National Marine Fisheries Service, 2018b) for the adjacent SOCAL Range Complex. Ranges are provided for a representative source depth and cluster size (the number of rounds fired within a very short duration) for each bin. For events with multiple explosions, sound from successive explosions can be expected to accumulate and increase the range to the onset of an impact based on SEL thresholds. For additional information on how ranges to impacts from explosions were estimated, see the technical report *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing Ranges* (U.S. Department of the Navy, 2018d).

3.7.5.2.1.9 Land-Based Launch Noise Near Pinniped Haulout Sites

Since 2001, the Naval Air Warfare Center Weapons Division has requested and received Incidental Harassment Authorizations (IHAs) or Letters of Authorization from NMFS for incidental harassment (Level B) of pinnipeds[7] resulting from target and missile launches at SNI (66 FR 41834, 67 FR 56271, 68 FR 52132, 74 FR 26580, 79 FR 32678, 84 FR 28462, 85 FR 38862, 85 FR 55257). Specifically, incidental take authorizations were issued for California sea lions, Pacific harbor seals, and northern elephant seals. Under the MMPA, the current IHA is valid through June 11, 2021. For the purpose of these authorizations, pinnipeds were considered to be "taken" if they were hauled out on a beach and either moved into the water or moved along the beach more than ten meters immediately after a launch. Three additional pinniped species (northern fur seal, Guadalupe fur seal, and Steller sea lion), which are present within the waters of the Point Mugu Sea Range, have occasionally been observed hauled-out on SNI as lone individuals (Stewart & Yochem, 2011); J. Laake, NOAA pers. comm., and M. Lowry, NOAA, pers. comm., in National Marine Fisheries Service (2014a)). Because of the extremely rare occurrence of individual northern fur seal, Guadalupe fur seal, and Steller sea lion on SNI, it is very unlikely that these pinniped species would overlap in time and location with the proposed launches. Exposure to noise from those activities on hauled-out northern fur seal, Guadalupe fur seal, and Steller sea lion is discountable.

Visual and acoustic monitoring of pinniped response to every launch from SNI was required under these authorizations. The results from this monitoring effort (2001–2017) are included in the analysis below.

The most common type of reaction to airborne noise from missile launches at SNI is a momentary "alert" response. When the animals hear or otherwise detect the launch, they are likely to become alert and interrupt prior activities to pay attention to the launch. Observations from monitoring indicate that elephant seals, in particular, will rarely if ever show more than a momentary alert reaction (Holst et al., 2011; Holst & Greene Jr., 2005, 2006; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010; Stewart et al., 1994), even when exposed to noise levels or types that caused nearby harbor seals and California sea lions to react more. Most elephant seals merely raise their heads briefly upon hearing the launch sounds and then quickly return to their previous activity pattern (usually sleeping). During some launches, a small proportion of northern elephant seals moved a short distance on the beach, away from their resting site, but settled within minutes. Because of this, elephant seals were not specifically targeted for launch monitoring after 2010 (75 FR 71672), but in subsequent years they were often in the field of view when monitoring other species.

[7] California Sea Lions (*Zalophus californianus*), Northern Elephant Seals (*Mirounga angustirostris*), and Pacific Harbor Seals (*Phoca vitulina*).

Video recordings of pinnipeds around the periphery of western SNI during launches on SNI from 2001-2017 have shown that some pinnipeds react to a nearby launch by moving into the water or along the shoreline (Burke, 2017; Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010; Ugoretz, 2014, 2015, 2016; Ugoretz & Greene Jr., 2012). Pinniped behavioral responses to launch sounds are typically brief and of low magnitude, especially for northern elephant seals. California sea lions (especially the young animals) exhibited more reaction than elephant seals, and harbor seals were the most responsive of the three species.

Responses of California sea lions to the launches vary by individual and age group (Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010). Some exhibit brief startle responses and increased vigilance for a short period after each launch. Others, particularly pups that are playing in groups along the margin of the haulouts, appear to react more vigorously. A greater proportion of hauled-out sea lions typically respond and/or enter the water when launch sounds are louder (Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010).

During the majority of launches at SNI, most harbor seals leave their haulout sites on rocky ledges to enter the water. In some cases harbor seals return to their haulout in a short period of time, while in other cases other harbor seals do not return during the duration of the video-recording period (which sometimes extends up to several hours after a launch) (Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010; Ugoretz & Greene Jr., 2012). During the day following a launch, harbor seals usually haul out again at these sites (Holst & Lawson, 2002). The height of the tide following a launch event may play a significant role in when harbor seals can return to a haulout site.

Since the launches are relatively infrequent, and of such brief duration, it is unlikely that pinnipeds near the launch sites are habituated to launch sounds. Additionally, the infrequent launch events (up to 40 per year, of which some will use small vehicles) are unlikely to cause any significant masking since they occur for a very small fraction of the time during any single day (i.e., usually less than two seconds and rarely more than five seconds during a single launch). These occasional brief episodes of masking have minimal effects on the abilities of pinnipeds to hear one another or to detect natural environmental sounds that may be relevant to the animals.

Starting with the first MMPA harassment authorizations and analyses of noise impacts related to space shuttle landings and missile launches in the 1980s, there has been an expressed concern over the suggested possibility that a sonic boom or launch-related noise response could cause "stampede-related" injury or mortality 79 FR 32678 (National Marine Fisheries Service, 2014a). There has been no observations of any such occurrence and, specifically for the monitored launches at SNI from 2001 to present (December 2019), there have been no observed launch-related injuries or deaths (Burke, 2017; Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010; National Marine Fisheries Service, 2019e; Naval Air Warfare Center Weapons Division, 2018; Ugoretz, 2014, 2015, 2016; Ugoretz & Greene Jr., 2012). On several occasions, harbor seals and California sea lion adults moved over pups (which can also happen without the presence of an anthropogenic noise) as the animals moved in response to the launches, but the pups did not appear to be injured (Holst et al., 2011; Holst & Greene Jr., 2005; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010; Ugoretz & Greene Jr., 2012).

Indirect evidence that launches have not caused significant, if any, mortality comes from the fact that populations of northern elephant seals, and especially California sea lions, on SNI are growing rapidly despite similar launches for many years. Harbor seal numbers have remained stable, but new harbor

seal haulout sites have been established at locations directly under and near the launch tracks of vehicles.

Thorson et al. (1999) used measurements of auditory brainstem response to demonstrate that harbor seals did not exhibit loss in hearing sensitivity following launches of large vehicles at Vandenberg Air Force Base, California. Available evidence from launch monitoring at SNI in 2001–2017 suggests that only a small minority (if any) of the pinnipeds at SNI are exposed to launch sound levels that are the within the threshold for a TTS exposure (Burke, 2017; Holst et al., 2011; Holst & Greene Jr., 2008; Ugoretz, 2014, 2015, 2016; Ugoretz & Greene Jr., 2012).

Individual pinniped resting behavior (hauling out at SNI) may be abandoned if an animal leaves its haulout and then does not return shortly afterwards. NMFS has concluded that the impacts from sounds produced by launch vehicles launched from SNI are temporary in nature, affect pinnipeds hauled out on land and do not result in substantial effects to marine mammals or to their role in the ecosystem (National Oceanic and Atmospheric Administration, 2014). Monitoring of launches (2001–present) from SNI has confirmed that pinniped responses are temporary and short term. To reiterate, neither injury nor mortality of pinnipeds has ever been observed or is likely to occur as a result of launches from SNI. Analyses, quantifications, and findings regarding target and missile launches from SNI have been previously and most recently presented to the public in the current IHA (85 FR 38862; 29 June 2020) and the Letter of Authorization request (85 FR 55257; 4 September 2020). Based on those previous determinations for target and missile launches from SNI, a conservative estimate is that 11,000 California sea lions, 480 harbor seals, and 40 Northern elephant seals will be taken annually by Level B harassment assuming there will be 40 launches per year from SNI under both action alternatives.

3.7.5.2.2 Non-Acoustic Stressors

All stressors other than those involving explosives and overflight of pinniped haulouts at SNI associated with the Proposed Action are non-acoustic in nature. These non-acoustic stressors include energy stressors (high-power microwave systems, and high-energy lasers), physical disturbance and strike (vessels, in-water devices, MEM), entanglement (decelerator/parachutes), ingestion (non-explosive practice munitions, fragments from high explosive munitions, MEM other than munitions), and secondary stressors (explosive byproducts, metals, chemicals) with potential for indirect impacts.

As noted in the preceding subsection, Navy stressors associated with testing and training have been assessed based on multiple previous analyses undertaken by the Navy since 2001, regulations and authorizations issued pursuant to the MMPA by NMFS, Biological Opinions from NMFS, findings from the USFWS, and the review of any applicable best available and latest science since those analyses were conducted. With the exception of physical disturbance and strike stressors involving the use of vessels in some specific contexts, the Navy has repeatedly determined in previous analyses spanning more than a decade that non-acoustic stressors are not likely to result in incidental takes of marine mammals as defined by the MMPA and are likely to have only discountable, insignificant, or negligible impacts on ESA-listed marine mammals (U.S. Department of the Navy, 2002, 2008, 2010a, 2010b, 2012, 2013a, 2013b, 2013c, 2013d, 2014, 2018c). The Navy's most recently completed analysis and conclusions for the adjacent SOCAL Range Complex (U.S. Department of the Navy, 2018c) were reviewed NMFS in preparing regulations pertaining to the MMPA on December 27, 2018 (83 FR 66849), and found by NMFS to be complete and supportable. With regard to the ESA-listed species which are present in the PMSR Study area, NMFS found these stressors were not likely to adversely affect ESA-listed blue, fin, Western North Pacific DPS gray, humpback (both Central America and Mexico DPSs), sei, or sperm

whales, or Guadalupe fur seals (National Marine Fisheries Service, 2018b), which are all the ESA -listed marine mammal species under their jurisdiction in the PMSR Study Area.

There are no significant differences in the Navy's Proposed Action in the PMSR Study Area or significant differences in the environment itself that would otherwise distinguish PMSR from these prior analyses by the Navy and NMFS. The same conclusions reached repeatedly over the last decade by the Navy and NMFS regarding these stressors found that their use lacked sufficient localized intensity and that the nature of the stressors indicated they might result, at most, in a discountable, negligible, or insignificant impact on marine mammals. There has been no emergent science that would call into question the conclusions reached by the Navy or by NMFS in these previous analyses with regard to non-acoustic stressors other than physical disturbance and strike stressors. The intensity of usage at PMSR in the Proposed Action is approximately similar to other intensively used Range Complexes analyzed, therefore, conclusions for those analyses are relevant to the PMSR analysis. For these reasons, only physical disturbance and strike stressors involving vessels, surface targets, and MEM will be carried forward for further detailed analysis and quantification of impacts in the following sections.

3.7.5.2.2.1 Assessing Vessels, Surface Targets, and MEM as Physical Disturbance and Strike Stressors

Navy and NMFS have previously determined that marine mammals are either not likely to respond to physical disturbance as a result of the presence of a Navy vessel, surface targets, and MEM (83 FR 66937), or are not likely to measurably respond in ways that would significantly disrupt normal behavior patterns (National Marine Fisheries Service, 2018b). These behavioral patterns would include, but are not limited to, breeding, feeding or sheltering. Therefore, the effects of these physical disturbances are insignificant or otherwise so minor that the effect cannot be meaningfully evaluated (National Marine Fisheries Service, 2018b). Note that as presented in Section 3.7.5.2.1, the noise from Navy vessels has been analyzed as an acoustic stressor separate from physical disturbance and found by the Navy and NMFS in all previous analyses to have had *de minimis*, discountable, or negligible impacts.

Navy has done a separate and specific analysis and evaluation of vessels, surface targets, and MEM as strike stressors within the PMSR Study Area (see Appendix D, Military Expended Material and Direct Strike Impact Analyses). The basis for the previous determinations by the Navy and NMFS has been the calculated probability that a strike might occur to a marine mammal as a result of the Proposed Action involving either vessels, surface targets, or MEM. The potential for this to occur in the PMSR was evaluated using statistical probability modeling (Appendix D, Military Expended Material and Direct Strike Impact Analyses), which is consistent with previous Navy analyses. The determinations of strike probability for each of the strike sub-stressors (vessels, surface targets, and MEM) are presented in the following subsections.

3.7.5.2.3 Vessels as a Strike Stressor

Reviews of the literature on vessel strikes mainly involve collisions between commercial vessels and whales (Cascadia Research, 2017b; Currie et al., 2017a; Douglas et al., 2008; Jensen & Silber, 2004; Laist et al., 2001; Lammers et al., 2013; Monnahan et al., 2015; Nichol et al., 2017; Redfern et al., 2019; Rockwood et al., 2017). The ability of any ship to detect a marine mammal and avoid a collision depends on a variety of factors, including environmental conditions, ship design, size, speed, and manning, as well as the behavior of the animal (Conn & Silber, 2013; Currie et al., 2017a; Gende et al., 2011; Silber et al., 2010; Vanderlaan & Taggart, 2007; Wiley et al., 2016).

In areas of both high whale density and a high volume of commercial vessel traffic, whales are predicted to be susceptible to elevated risk for commercial vessel strike (McKenna et al., 2015; Moore et al., 2018;

Rockwood et al., 2017). As detailed in Section 3.0.5.5.1 (Vessel Noise), the existing marine environment in the PMSR Study Area is dominated by non-Navy commercial vessel traffic into and out of the Ports of Los Angeles and Long Beach (see Figure 3.0-1). As detailed in that section, vessel traffic in the PMSR Study Area is mainly associated with the ports of Los Angeles and Long Beach, which are adjacent to one another, and together form the busiest commercial port in the U.S. and the sixth busiest commercial port traffic in the world (Port of Los Angeles, 2017). Data from the ports of Los Angeles/Long Beach indicate there are on average in excess of approximately 7,000 commercial vessel transits per year associated with visits to just those ports (American Association of Port Authorities, 2017; Port of Los Angeles, 2017; U.S. Army Corps of Engineers, 2017), which does not account for a substantial number of additional commercial vessels transiting the PMSR bound for other major ports.

For recent five year reporting periods[8], NMFS Technical Memoranda documented 65 vessel strikes to marine mammals off the U.S West Coast (Carretta et al., 2019a) and approximately 28 vessel strikes to marine mammals in Alaska (Helker et al., 2019). While some risk of a vessel strike exists for all the U.S. West Coast waters, 74 percent of blue whale vessel strikes, 82 percent of humpback whale vessel strikes, and 65 percent of fin whale vessel strikes resulting in mortalities occur in the shipping lanes associated with the ports of San Francisco and Los Angeles/Long Beach (Rockwood et al., 2017).

Records of Navy vessel strikes have been kept since 1995. Navy policy (Chief of Naval Operations Instruction 3100.6 H) is to report all whale strikes by Navy vessels. By information agreement, the information from those reports has been provided to National Oceanic and Atmospheric Administration and NMFS on an annual basis. Since 1995, only the Navy and the U.S. Coast Guard have been reporting vessel strikes to NMFS in this manner, so all whale strike statistics are skewed by a lack of comprehensive reporting by all non-Navy vessels that may experience vessel strike. In the 24 years of reporting by the Navy, there have been no known Navy vessel strikes to marine mammals in the PMSR Study Area, up to and including the present (as of the release of this Final EIS/OEIS).

The absence of Navy vessel strikes associated with Navy activities occurring at the PMSR can be attributed to a number of factors related to the differences between Navy vessel design and operation and that of commercial vessels. Table 3.0-11 provides the number of vessels used during the various types of Navy's proposed activities. Activities involving Navy vessel movement would be widely dispersed throughout the Study Area.

Large Navy vessels (greater than 18 m in length) operate differently from commercial vessels in ways important to the prevention of whale collisions. For example, the average speed of large Navy ships ranges between 10 and 15 knots, and submarines generally operate at speeds in the range of 8 and 13 knots, while a few specialized vessels can travel at faster speeds. By comparison, this is slower than most commercial vessels where normal design speed for a container ship is typically 24 knots (Bonney & Leach, 2010). Even given the advent of "slow steaming" by commercial vessels in recent years due to fuel prices (Barnard, 2016; Maloni et al., 2013), this generally reduces the design speed by only a few knots, given that 21 knots would be considered slow, 18 knots is considered "extra slow," and 15 knots is considered "super slow" (Bonney & Leach, 2010). Small Navy craft (less than 50 ft. in length), have much more variable speeds (0–50 knots or more, depending on the mission). While these speeds are considered averages and representative of most events, some Navy vessels need to operate outside of

[8] Strikes occurring in locations along the U.S. West Coast and Alaska are relevant to the PMSR Study Area because many marine mammals the seasonally inhabit or pass through the PMSR Study Area (especially large whales) have seasonal migrations to other portions of the U.S. West Coast and Alaska.

these parameters during certain situations. Differences between most Navy ships and commercial ships also include the following disparities:

- The Navy has several standard operating procedures for vessel safety that could result in a secondary benefit to marine mammals through a reduction in the potential for vessel strike. For example, ships operated by or for the Navy have personnel assigned to stand watch at all times, day and night, when moving through the water (i.e., when the vessel is underway). Watch personnel undertake extensive training in accordance with the U.S. Navy Lookout Training Handbook or civilian equivalent. A primary duty of watch personnel is to ensure safety of the ship, which includes the requirement to detect and report all objects and disturbances sighted in the water that may be indicative of a threat to the ship and its crew, such as debris, a periscope, surfaced submarine, or surface disturbance. Per safety requirements, watch personnel also report any marine mammals sighted that have the potential to be in the direct path of the ship, as a standard collision avoidance procedure. As described in Section 5.3.4.1 (Vessel Movement) of this EIS/OEIS, Navy vessels are required to operate in accordance with applicable navigation rules. Applicable rules include the Inland Navigation Rules (33 CFR 83) and International Regulations for Preventing Collisions at Sea (72 Collision Regulations), which were formalized in the Convention on the International Regulations for Preventing Collisions at Sea, 1972. These rules require that vessels proceed at a safe speed so proper and effective action can be taken to avoid collision and so vessels can be stopped within a distance appropriate to the prevailing circumstances and conditions. In addition to complying with navigation requirements, Navy ships transit at speeds that are optimal for fuel conservation, to maintain ship schedules, and to meet mission requirements. Vessel captains use the totality of the circumstances to ensure the vessel is traveling at appropriate speeds in accordance with navigation rules. Depending on the circumstances, this may involve adjusting speeds during periods of reduced visibility or in certain locations.
- Many Navy ships have their bridges positioned closer to the bow, offering good visibility ahead of the ship.
- There are often aircraft associated with the training or testing activity, which can detect marine mammals in the vicinity or ahead of a vessel's present course.
- Navy ships are generally much more maneuverable than commercial merchant vessels if marine mammals are spotted and it becomes necessary to change direction.
- Navy ships operate at the slowest speed possible consistent with either transit needs, or training or testing need. While minimum speed is intended as a fuel conservation measure particular to a certain ship class, secondary benefits include being better able to spot and avoid objects in the water, including marine mammals.
- In many cases, Navy ships will likely move randomly or with a specific pattern within a sub-area of the Study Area for a period of time, from one day to two weeks, as compared to straight line point-to-point commercial shipping.
- Navy overall crew size is much larger than merchant ships, allowing for more potential observers on the bridge.
- When submerged, submarines are generally slow moving (to avoid detection), and therefore marine mammals at depth with a submarine are likely able to avoid collision with the submarine. When a submarine is transiting on the surface, there are Lookouts serving the same function as they do on surface ships.

- The Navy will implement mitigation to avoid potential impacts from vessel strikes on marine mammals (see Chapter 5, Standard Operating Procedures and Mitigation). Mitigation includes training Lookouts and watch personnel with the Marine Species Awareness Training (which provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures), requiring vessels to maneuver to maintain a specified distance from marine mammals during vessel movements.
- The Navy will continue to issue a seasonal awareness notification message for Navy ships and aircraft operating in SOCAL to alert them to the seasonal increased presence of concentrations of large whales, including blue, gray, or fin whales as follows: Blue Whale (June–October), Gray Whale (November–March), and Fin Whale (November–May). To maintain safety of navigation and to avoid interactions with large whales during transits, the message instructs vessels to remain vigilant to the presence of large whale species, that when concentrated seasonally, may become vulnerable to vessel strikes. Platforms will use the information from the awareness notification messages to assist their visual observation of applicable mitigation zones during testing and training activities and to aid in the implementation of procedural mitigation. This Navy message is also consistent with a message issued by the U.S. Coast Guard for vessels operating in the 11th district (covering the waters in and around the PMSR) as a Notice to Mariners that also informs operators about the presence of populations of endangered blue, humpback, and fin whales in the area (see U.S. Coast Guard (2019) for further details).

Based on the above, and that the types and level of vessel use on PMSR is not expected to change substantially from what is currently conducted on the sea range under any of the alternatives, the Navy assesses that the likelihood of Navy vessel strike occurring as being so low as to be discountable.

3.7.5.2.4 Military Expended Materials as a Strike Stressor

This section analyzes the strike potential to marine mammals from the following categories of military expended materials: (1) all sizes of non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expendable targets and target fragments. For a discussion of the types of activities that use military expended materials see Section 3.0.5.8.2 (Military Expended Materials). As discussed in Section 3.7.5.2.2 (Non-Acoustic Stressors), the Navy and NMFS have previously determined that potential impacts from fragments associated with high-explosive munition detonations from military expended materials as ingestion stressors are not likely to result in incidental takes of marine mammals as defined by the MMPA and are likely to have only discountable, insignificant, or negligible impacts on ESA-listed marine mammals. As a result, only strike stressors involving vessels, in water devices, and MEM have been carried forward for further detailed analysis.

As presented in the statistical probability model analyses presented in Appendix D (Military Expended Material and Direct Strike Impact Analyses), the primary concern is the potential for a marine mammal to be hit with a military expended material at or near the water's surface, which could result in injury or death. While disturbance or strike from an item falling through the water column is possible, it is not very likely because the objects generally sink slowly through the water based on the weights of expended materials and can be avoided by most marine mammals. Therefore, the discussion of military expended materials strikes will focus on the potential of a strike at the surface of the water.

While no strike from military expended materials has ever been reported or recorded, the possibility of a strike still exists. Therefore, the potential for marine mammals to be struck by military expended

materials was evaluated using statistical probability modeling to estimate potential direct strike exposures to a marine mammal under a worst-case scenario.

As presented in Appendix D (Military Expended Material and Direct Strike Impact Analyses) and to estimate potential direct strike exposures, a worst-case scenario was analyzed using the marine mammal with the highest average seasonal density in areas with the highest military expended material expenditures in the PMSR Study Area. This is considered a worst-case scenario because, as described below, probability calculations of a single military item hitting an animal assumes all activities would be conducted during the season with the highest marine mammal densities and that all marine mammals have the equal densities.

For all the remaining marine mammal species with lesser densities, this highest likelihood approach would overestimate the likelihood or probability of a strike. Direct strike exposures of marine mammal species protected under the ESA were estimated in the PMSR using the highest density within the range as representative for the entire range. In this way, the appropriate ESA conclusions would be based on an overestimate of the probabilities of a strike for those species.

Input values include munitions data (frequency, footprint and type), size of the training or testing area, marine mammal density data, and size of the animal. To estimate the potential of military expended materials to strike a marine mammal, the impact area of all military expended materials was totaled over one year in the area with highest combined amounts of military expended materials for each of the two action alternatives.

The analysis of the potential for a marine mammal strike is influenced by the following assumptions:

- The model is two-dimensional and assumes that all marine mammals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend up to 90 percent of their time under the water (Costa & Block, 2009).
- The model also does not take into account the fact that most of the projectiles fired during testing and training activities are fired at targets, and most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force.
- The model assumes the animal is stationary and does not account for any movement of the marine mammal or any potential avoidance of the testing or training activity.

The potential of fragments from high explosive munitions or expended material other than munitions to strike a marine mammal is likely lower than for the worst-case scenario calculated above because those events happen with much lower frequency. Fragments may include metallic fragments from the exploded target, as well as from the exploded munitions.

Marine mammal species that occur in the Study Area may be exposed to the risk of military expended material strike, with the exception of the sea otters in the shallow nearshore waters around SNI where these stressors would not occur.

The model output in Appendix D (Military Expended Material and Direct Strike Impact Analyses), provides a reasonably high level of certainty that marine mammals would not be struck by military expended materials. These results are summarized in the following sections discussing impacts under each alternative.

As discussed in Section 3.7.4.2.1.2 (Habitat and Geographic Range) for blue whales, Section 3.7.4.2.4.2 (Habitat and Geographic Range) for gray whales, and Section 3.7.4.2.5.2 (Habitat and Geographic Range)

for humpback whales, these species are engaging in migratory and feeding behaviors within designated Biologically Important Areas (Calambokidis et al., 2015; Ferguson et al., 2015b) in the PMSR Study Area. Marine mammals in those areas may be affected by military expended materials from Navy testing and training. Physical disturbance from military expended materials may result in a momentary behavioral response and but would not result in marine mammals avoiding these areas or result in the abandonment of behaviors in these areas.

The results presented in Appendix D (Military Expended Material and Direct Strike Impact Analyses) indicate that, even for the marine mammal species with the highest density in the Study Area and using conservative assumptions, the probability of any marine mammal being struck during testing and training activities by MEM is low enough to be discountable. For this reason and consistent with all previous analyses undertaken by the Navy and by NMFS, consideration of MEM as a strike stressor is not carried forward for analysis under the various alternatives.

3.7.5.2.5 Summary of Stressor Assessment

Based on the information presented in the preceding subsections, Table 3.7-3 provides a summary interpretation of the previous determinations, as promulgated in National Environmental Policy Act analyses, MMPA regulations and authorizations, and ESA Biological Opinions for the same or similar Navy activities that have been analyzed occurring off Southern California, Washington, Oregon, Northern California, Alaska, Hawaii, the Mariana Islands, the Gulf of Mexico, and in the Atlantic. These determinations have been consistent over more than a decade, across all these separate ocean areas and all marine mammal species habitats where the same type of Navy activities as proposed for the PMSR occur (National Marine Fisheries Service, 2017a, 2018b; U.S. Department of the Navy, 2002, 2008, 2010c, 2013d, 2015a, 2017b, 2018a, 2018c, 2020a). Reaching the same conclusions for multiple locations indicates that oceanographic features (e.g., bathymetry, water temperature, ocean bottom-type, underwater acoustic propagation), specific marine mammal species, and their use of specific habitats have not been found to make any significant difference in those determinations. It should be noted that the Navy recognizes there are differences between the number of activities occurring at PMSR and the number of the same or similar activities occurring at the locations that were the settings for the determinations provided in this summary. Firstly, these previous findings were arrived at based on qualitative factors and were not made based on a specific number of actions or exposures resulting from Navy's actions. The findings by the Navy and NMFS that exposures to some stressors are discountable, negligible, or insignificant has been because, in most cases, there is no reasonably conceivable way that Navy actions would result in a number or level of exposures that would be meaningful to a marine mammal from those sources. As noted in those previous analyses where applicable, there are scientific findings indicating there is a basis for possible significant impacts to occur at very high levels of acute exposure or a high levels of chronic exposure, but it has been clear from those findings, and from Navy reporting since 2006, that acute or chronic levels of exposure will not result from Navy's activities at-sea because those activities are either much more dispersed in time and space or never occur with the intensity required to be considered either acute or chronic. The determinations made previously were based on the best available science. The Navy has and will continue to fund research and monitor emergent scientific literature to assess if any new science has provided findings that may call into question the determinations summarized below. Secondly, the

activities proposed in the various alternatives at PMSR involve the same marine mammal species[9], the same type of events analyzed, and had the same stressors impact conclusions (National Marine Fisheries Service (2018b); U.S. Department of the Navy (2018c), and 83 FR 66849; December 27, 2018) including for the 3,400 km^2 portion of the Hawaii-Southern California Training and Testing Study Area that overlaps with the PMSR. Additionally, to further insure that determinations for the SOCAL Range Complex were applicable in the remainder of the PMSR, the Navy acoustic modeling was used to compare estimated sound sources' range to effects for the proposed Navy activities at the PMSR with the same sources and activities in the SOCAL Range Complex, which found those ranges to be equal in both range complexes to the limits of the current modeling methodology.

Table 3.7-3: Summary of Stressors Assessed for Potential Marine Mammal Impacts Associated with the Same or Similar Testing and Training Activities

Activity Category	Stressor	Potential Impacts	MMPA Determination	ESA Determination
Air-to-Air	Acoustic – aircraft noise	Harassment of marine mammals as a result of hearing aircraft overflight noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Physical Disturbance and Strike	Injury or behavioral disturbance resulting from MEM falling from the air and directly striking a marine mammal at or near the surface	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Ingestion	Injury if MEM is consumed by a marine mammal	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Entanglement	Injury and potential mortality if a marine mammal becomes entangled in decelerator/parachute suspension lines	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
Air-to-Surface	Acoustic – aircraft noise	Harassment of marine mammals as a result of hearing aircraft overflight noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – vessel noise	Harassment of marine mammals as a result of hearing vessel noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species

[9] The one exception is that harbor porpoise may be present in the nearshore northern margin of the PMSR, but harbor porpoise spatial and temporal overlap are unlikely to co-occur with the very limited number of Navy activities that may take place in that portion of the Study Area.

Table 3.7-3: Summary of Stressors Assessed for Potential Marine Mammal Impacts Associated with the Proposed Testing and Training Activities (continued)

Activity Category	Stressor	Potential Impacts	MMPA Determination	ESA Determination
Air-to-Surface (continued)	Acoustic – weapons noise	Harassment of marine mammals as a result of hearing weapons firing noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – Explosives at surface	Harassment under MMPA, injury to hearing, non-auditory injury, and mortality	May result in takes of marine mammals	May adversely affect ESA-listed species
	Physical Disturbance and Strike	Injury or behavioral disturbance resulting from MEM falling from the air and directly striking a marine mammal at or near the surface	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Ingestion	Injury if MEM is consumed by a marine mammal	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Entanglement	Injury and potential mortality if a marine mammal becomes entangled in decelerator/parachute suspension lines	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Indirect Effects (Secondary Stressors)	Explosives, explosive byproducts, unexploded ordnance, metals, and chemicals impacting marine mammal prey or habitat	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species

Table 3.7-3: Summary of Stressors Assessed for Potential Marine Mammal Impacts Associated with the Proposed Testing and Training Activities (continued)

Activity Category	Stressor	Potential Impacts	MMPA Determination	ESA Determination
Surface-to-Air	Acoustic – aircraft noise	Harassment of marine mammals as a result of hearing aircraft overflight noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – vessel noise	Harassment of marine mammals as a result of hearing vessel noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – weapons noise	Harassment of marine mammals as a result of hearing weapons firing noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – Missile and target launches from San Nicolas Island	Behavioral disturbance of pinnipeds as a result of hearing launch noise	May result in takes of hauled-out pinnipeds	NA, no ESA-listed marine mammal species present onshore
	Physical Disturbance and Strike	Injury or behavioral disturbance resulting from MEM falling from the air and directly striking a marine mammal at or near the surface	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Ingestion	Injury if MEM is consumed by a marine mammal	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Entanglement	Injury and potential mortality if a marine mammal becomes entangled in decelerator/parachute suspension lines	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species

Table 3.7-3: Summary of Stressors Assessed for Potential Marine Mammal Impacts Associated with the Proposed Testing and Training Activities (continued)

Activity Category	Stressor	Potential Impacts	MMPA Determination	ESA Determination
Surface-to-Surface	Acoustic – aircraft noise	Harassment of marine mammals as a result of hearing aircraft overflight noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – vessel noise	Harassment of marine mammals as a result of hearing vessel noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – weapons noise	Harassment of marine mammals as a result of hearing weapons firing noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – Explosives at surface or near the surface	Harassment under MMPA, injury to hearing, non-auditory injury, and mortality	May result in takes of marine mammals	May adversely affect ESA-listed species
	Acoustic – Missile and target launches from San Nicolas Island	Behavioral disturbance of pinnipeds as a result of hearing launch noise	May result in takes of hauled-out pinnipeds	Discountable, Not likely to affect ESA-listed species (Guadalupe Fur Seal)
	Acoustic – Missile and target launches from Point Mugu	Behavioral disturbance to hauled out harbor seals	May result in takes of hauled-out pinnipeds	NA, no ESA species present
	Physical Disturbance and Strike	Injury or behavioral disturbance resulting from MEM falling from the air and directly striking a marine mammal at or near the surface	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Ingestion	Injury if MEM is consumed by a marine mammal	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species

Table 3.7-3: Summary of Stressors Assessed for Potential Marine Mammal Impacts Associated with the Proposed Testing and Training Activities (continued)

Activity Category	Stressor	Potential Impacts	MMPA Determination	ESA Determination
Surface-to-Surface (continued)	Indirect Effects (Secondary Stressors)	Explosives, explosive byproducts, unexploded ordnance, metals, and chemicals impacting marine mammal prey or habitat	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
Subsurface to Surface	Acoustic – missile ejection underwater noise	Harassment of marine mammals as a result of submarine ejecting missile from launch tube	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – missile in-flight noise	Harassment of marine mammals as a result of hearing missile in-air ignition or overflight noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic – Explosives at surface or near the surface	Harassment under MMPA, injury to hearing, non-auditory injury, and mortality as a result of missile detonation at or near the surface	May result in takes of marine mammals	May adversely affect ESA-listed species
	Physical Disturbance and Strike	Injury or behavioral disturbance resulting from MEM falling from the air and directly striking a marine mammal at or near the surface	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Ingestion	Injury if MEM is consumed by a marine mammal	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Indirect Effects (Secondary Stressors)	Explosives, explosive byproducts, unexploded ordnance, metals, and chemicals impacting marine mammal prey or habitat	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species

Table 3.7-3: Summary of Stressors Assessed for Potential Marine Mammal Impacts Associated with the Proposed Testing and Training Activities (continued)

Activity Category	Stressor	Potential Impacts	MMPA Determination	ESA Determination
Electronic Warfare	Acoustic – aircraft noise	Harassment of marine mammals as a result of hearing aircraft overflight noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic –vessel noise	Harassment of marine mammals as a result of hearing vessel noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Physical Disturbance and Strike	Injury or behavioral disturbance resulting from MEM falling from the air and directly striking a marine mammal at or near the surface	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Ingestion	Injury if MEM is consumed by a marine mammal	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Entanglement	Injury and potential mortality if a marine mammal becomes entangled in decelerator/parachute suspension lines	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Indirect Effects (Secondary Stressors)	Explosives, explosive byproducts, unexploded ordnance, metals, and chemicals impacting marine mammal prey or habitat	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species

Table 3.7-3: Summary of Stressors Assessed for Potential Marine Mammal Impacts Associated with the Proposed Testing and Training Activities (continued)

Activity Category	Stressor	Potential Impacts	MMPA Determination	ESA Determination
Directed Energy Weapons	Acoustic – aircraft noise	Harassment of marine mammals as a result of hearing aircraft overflight noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Acoustic –vessel noise	Harassment of marine mammals as a result of hearing vessel noise	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Energy (HEL and HPM)	Minor Injury or harassment if marine mammal is at the surface at the same time HEL or HPM system is off target (i.e., malfunctions) and energy is incident upon the surface	Would not result in the take of marine mammals	Discountable or insignificant and would have no adverse effect on ESA-listed species
	Physical Disturbance and Strike	Injury or behavioral disturbance resulting from MEM falling from the air and directly striking a marine mammal at or near the surface	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Ingestion	Injury if MEM is consumed by a marine mammal	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species
	Entanglement	Injury and potential mortality if a marine mammal becomes entangled in decelerator/parachute suspension lines	Would not result in the take of marine mammals	Discountable or insignificant and not likely to adversely affect ESA-listed species

Notes: ESA = Endangered Species Act, MMPA = Marine Mammal Protection Act, MEM = Military Expended Material(s), HEL = High Energy Laser, HPM = High Power Microwave, NA = not applicable

3.7.5.3 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. The 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 mammals, but would not measurably change the overall distribution or abundance of marine mammals.

3.7.5.4 Alternative 1 (Preferred Alternative)

A comparison of operational tempo proposed for each alternative, and proposed types and level of activities, are provided in Section 2.4.3.2 (Alternative 1: Projected Maximum Activity Levels Plus New Requirements [Preferred Alternative]).

3.7.5.4.1 Acoustic Stressors

The numbers of potential impacts estimated for individual species of marine mammals from acoustic stressors under Alternative 1 in comparison to the current baseline conditions are shown in Appendix C (Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface).

3.7.5.4.1.1 Explosives

There is a potential for impacts from explosives to occur anywhere within the Study Area where sound and energy from explosives and the species overlap, although the locations for Navy testing and training activities using explosives generally would not occur in any areas less than 3 NM from the California coast and the Channel Islands (except SNI), or heavily used commercial vessel shipping lanes because of standard operating procedures and safety associated with range clearance, and would not occur within the National Marine Sanctuary boundaries. Navy activities that use explosives are analyzed as occurring in all seasons of the year and any marine mammals that are present may be exposed to sound and energy from explosions associated with those activities.

The numbers of explosives used under Alternative 1 are presented in Table 3.0-7. For a discussion of the general science and potential impacts from underwater explosions on mysticetes, odontocetes, and pinnipeds, see Section 3.7.5.2.1.2 (Explosives as an Acoustic Stressor). The analyses for the effects to each species under Alternative 1 are presented in the subsections that follow.

Mysticetes

Potential impacts on mysticetes from exposure to explosive energy and sound may include PTS, TTS, and behavioral reactions; masking; and physiological stress (see 83 FR 66849, U.S. Department of the Navy (2017c), and Section 3.7.5.2.1, Acoustic [explosives; weapons firing, launch, and impact noise; vessel noise; aircraft noise; explosives], for details). TTS would recover fully, and PTS would leave some residual hearing impairment. Recovery from threshold shift begins almost immediately after the noise exposure ceases and can take a few minutes to a few days, depending on the severity of the initial shift, to recover (Finneran et al., 2010; Kastelein et al., 2012a; Kastelein et al., 2012b; Popov et al., 2013; Popov

et al., 2011; Supin & Popov, 2015). Threshold shifts do not necessarily affect all hearing frequencies equally, and typically manifest themselves at the exposure frequency or within an octave above the exposure frequency. Noise from explosions is broadband with most energy below a few hundred Hertz; therefore, any reduction in hearing sensitivity from exposure to explosive sounds is likely to be broadband with effects predominantly at lower frequencies. Mysticetes that do experience threshold shift (i.e., TTS or PTS) from exposure to explosives may have reduced ability to detect biologically important sounds (e.g., social vocalizations). For example, during the short period that a mysticete experiences TTS, social calls from conspecifics could be more difficult to detect or interpret, the ability to detect predators may be reduced, and the ability to detect and avoid sounds from approaching vessels or other stressors might be reduced. It is unclear how or if mysticetes use sound for finding prey or feeding; therefore, it is unknown whether a TTS would affect a mysticete's ability to locate prey or success in feeding.

Research and observations (see Section 3.7.5.2.1.6, Behavioral Reactions to Impulse Noise) show that if mysticetes are exposed to impulsive sounds such as those from explosives, they may react in a variety of ways, which may include alerting, startling, breaking off feeding dives and surfacing, diving or swimming away, changing vocalization, or showing no response at all. Overall and in consideration of the context for an exposure, mysticetes have been observed to be more reactive to acoustic disturbance when a noise source is located directly in their path or the source is nearby (somewhat independent of the sound level) (Dunlop et al., 2016; Dunlop et al., 2018; Ellison et al., 2011; Friedlaender et al., 2016; Malme et al., 1985; Richardson et al., 1995; Southall et al., 2007). Mysticetes disturbed while migrating could pause their migration or change direction and route around the disturbance. Animals disturbed while engaged in other activities such as feeding or reproductive behaviors may be more likely to ignore or tolerate the disturbance and continue their natural behavior patterns. Because noise from most activities using explosives is short term and intermittent, and because detonations usually occur within a small area, behavioral reactions from mysticetes, if they occur at all, are likely to be short term and of little to no consequence (see Pirotta et al. (2018) and Ellison et al. (2011)). Additionally, and as detailed in Section 3.7.5.2.1.9 (Land-Based Launch Noise Near Pinniped Haulout Sites), mysticetes that seasonally return to the PMSR Study Area are likely to have been exposed on multiple occasions to explosions from seal bombs used by fishermen. Based on the science indicating the importance an animal's experience of contextual factors in regards to behavioral reactions when exposed to a sound source (Demarchi et al., 2012; Ellison et al., 2011; Finneran & Branstetter, 2013; Nowacek et al., 2007; Richardson et al., 1995; Southall et al., 2007; Southall et al., 2019b; St. Aubin & Dierauf, 2001), exposure to sound from underwater explosions should not be a novel experience and therefore should be less likely to result in a significant behavioral reaction.

Research and observations of auditory masking in marine mammals due to impulsive sounds are discussed in Section 3.7.5.2.1.5 (Masking). Explosions introduce low-frequency, broadband sounds into the environment, which could mask hearing thresholds in mysticetes that are nearby, although sounds from explosions last for only a few seconds at most. Masking due to these short duration detonations would not be significant. Activities that have multiple, repeated detonations, such as some naval gunfire exercises, could result in masking for mysticetes near the target impact area over the duration of the event. Potential impacts on mysticetes from masking are similar to those discussed above for TTS, with the primary difference being that the effects of masking are only present when the sound from the explosion is present, and the effect is over the moment the sound is no longer detectable. In addition, the ubiquitous and near-continuous presence of broadband commercial vessel noise, with energy concentrated below a few hundred Hertz (Section 3.0.5.5.1, Vessel Noise), and the prevalent use of seal

bombs by fishermen (Bland, 2017), is likely to overwhelm noise from the Navy's comparatively infrequent use of explosives, except possibly in close proximity to the detonation site. For these same reasons, and due to the short durations and intermittent use of explosives; physiological stress, if it results at all, is also likely to be short term and intermittent. Long-term consequences from physiological stress due to the sound of explosives would not be expected.

Blue Whales

Blue whales may be exposed to sound or energy from explosions associated with Navy activities throughout the year. The quantitative analysis, using the number of explosives per year under Alternative 1, estimates behavioral reactions and TTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

As described in Section 3.7.4.2.1.2 (Habitat and Geographic Range), three of nine feeding areas for blue whales identified by Calambokidis et al. (2015) along the U.S. West Coast overlap (one wholly and two partially) with the PMSR Study Area (note that these three areas are designated on a seasonal time frame from June through October). Navy testing and training activities that use explosives could occur year round within the Study Area. However, activities using explosives generally would not take place in the Point Conception/Arguello to Point Sal Feeding Area or the Santa Barbara Channel and San Miguel Feeding Area, because both areas are close to the northern Channel Islands, the National Park/National Marine Sanctuary, oil production platforms, and major vessel routes leading to and from the ports of Los Angeles and Long Beach (Figure 3.7-2). There is partial overlap between the Santa Barbara Channel–San Miguel Feeding Area and the Channel Islands National Marine Sanctuary, and there is no Navy testing and training involving the use of explosives within the National Marine Sanctuary boundaries.

In contrast to the two feeding areas to the north, the area encompassed by the SNI feeding area overlaps a part of the PMSR that has been in high use for Navy testing and training activities for decades; the Proposed Action is for continued use of the area into the future consistent with the past levels of activity. Over the years, there has been very little change in Navy testing and training off SNI, and no significant changes in use are proposed in this EIS/OEIS. The waters within Warning Area 289, which overlap with the SNI Feeding Area are essential for testing and training given their proximity to SNI. The area is used during activities requiring an aerial target impact area, missile launches from SNI, aerial and ship-based gunnery events, and sea surface missile launches. Moving these activities farther from SNI and outside of the SNI Feeding Area would not be possible, because the added distance would substantially limit the capabilities of ground-based telemetry systems, antennas, surveillance, and metric radar systems, as well as command transmitter systems located at Point Mugu, Laguna Peak, Santa Cruz Island, and SNI. These systems are required to measure, monitor, and control various test platforms in real time; collect transmitted data for post-event analysis; and enable surveillance of the area to ensure the safety of the public. Optimal functional distance for some of the ground-based radar systems is 10–200 NM and may be limited by line-of-sight for some systems. Ground-based telemetry systems rely on using in-place fiber optic cables directly linked to remote locations or microwave to transmit signals. The ground-based command transmitter system provides safe, controlled testing of unmanned targets, platforms and missiles, including unmanned aircraft, boat, or ship targets, ballistic

missiles and other long-range vehicles, all within a 40-mile radius of the transmitter. The command transmitter system also provides flight termination capability for weapons and targets that are considered too hazardous for test flights. Relocating ground-based instrumentation to other locations would result in an extensive cost to the Navy, or potentially reduce military readiness.

As discussed above for mysticetes in general, and in light of the underwater acoustic environment at PMSR (as detailed in Section 3.7.5.2.1.9, Land-Based Launch Noise Near Pinniped Haulout Sites), blue whale behavioral reactions to explosions would most likely be short term and mild to moderate, and may even be ignored, especially when the animals are engaged in important biological behaviors, such as feeding, that may override a startle response due to an explosion. Routine civilian use of seal bombs have been documented over many years with thousands of those explosions occurring each year at multiple monitoring sites in and around SNI and the PMSR (Baumann-Pickering et al., 2013; Bland, 2017; Debich et al., 2015a; Debich et al., 2015b; Rice et al., 2017; Rice et al., 2018b; Širović et al., 2016; Wiggins et al., 2019; Wiggins et al., 2018). As a result of the documented widespread use of civilian marine mammal deterrents in the area, the occasional detonations of explosives at or near the ocean surface during Navy testing and training activities should not be a novel experience to blue whales returning to the PMSR Study Area.

Blue whales are known to return to feeding areas regardless of the location's proximate krill productivity in any one year (Abrahms et al., 2019a). However, in an anomalous year or season when the area provides limited prey for the whales, they may spend little actual time in the area and move elsewhere in search of prey (Becker et al., 2018; Mate et al., 2017; Mate et al., 2018c; Mate et al., 2015b; Rockwood et al., 2020). Given the combinations of relatively short time periods and small impact areas of individual Navy testing and training activities in the PMSR and the seasonal variability of blue whale occurrence, a dynamic management approach (see Abrahms et al. (2019b); (Becker et al., 2016); Dunn et al. (2016); Hazen et al. (2018); Lewison et al. (2015); D'Aloia et al. (2019); Hyrenbach et al. (2000); Maxwell et al. (2020); Oestereich et al. (2020); Perez-Jorge et al. (2015)) may be the most effective means of mitigating impacts on individuals and the population. The current geographic mitigation approach is implemented within a static boundary and is based on an average multi-year occurrence trend, which may not be as effective in mitigating impacts particularly when prey availability in the area is low. As presented in Chapter 5 (Standard Operating Procedures and Mitigation), the Navy has focused on avoiding or reducing potential impacts on marine mammals by implementing mitigation wherever and whenever marine mammals are detected within the vicinity of a Navy activity.

Although they are still listed as endangered under the ESA, the most current information suggests that the blue whale population in the North Pacific may have recovered (Campbell et al., 2015; Carretta et al., 2019c; Carretta et al., 2015; International Whaling Commission, 2016; Monnahan, 2013; Monnahan et al., 2014; National Marine Fisheries Service, 2018c; Širović et al., 2015b; Smultea, 2014). Considering that the Navy has used the PMSR and other range complexes along the U.S. West Coast for decades coincident in space and time with the apparent recovery of the blue whale population, it is reasonable to conclude that significant impacts on blue whale feeding behaviors from the proposed testing and training activities are unlikely to occur within the SNI Blue Whale Feeding Area.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of Eastern North Pacific stock blue whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 1 may affect and is likely to adversely affect ESA-listed blue whales. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

Bryde's Whales

Bryde's whales may be exposed to sound or energy from explosions associated with Navy activities throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no effects to Bryde's whales. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of Eastern Tropical Pacific stock Bryde's whales.

Fin Whales

Fin whales may be exposed to sound or energy from explosions associated with Navy activities throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates behavioral reactions, TTS, and PTS (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock fin whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 1 may affect and is likely to adversely affect ESA-listed fin whales. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

Gray Whales

Gray whales may be exposed to sound or energy from explosions associated with Navy activities throughout the year. Almost all of the approximately 21,000 gray whales moving through the PMSR are from the non-endangered Eastern North Pacific stock, and all of the modeled impacts are for this stock. For the Eastern North Pacific stock of gray whales, the quantitative analysis using the number of explosives per year under Alternative 1 estimates behavioral reactions and TTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Data from satellite tags have indicated that on rare occasions a few endangered Western North Pacific individual gray whales may be present in the Study Area as they migrate through on their way to or from Mexican waters (Mate et al., 2015a). Based on the best available science and the prior findings from NMFS, Navy activities should have no significant impact, if any, on gray whale migration behavior with no anticipated effect on reproduction or survival from Level B harassment (see 83 FR 66846; 80 FR 73556; and National Marine Fisheries Service (2018b)). For the Western North Pacific stock of gray whales, the quantitative analysis using the number of explosives per year under Alternative 1 estimates no acoustic exposures resulting from Navy's activities. Considering the factors presented above for mysticetes and the mitigation

measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

As presented in Section 3.7.4.2.4.2 (Habitat and Geographic Range), four migration areas for gray whales are located north of Point Conception, and a fifth area is located contiguous to and south of Point Conception (Calambokidis et al., 2015). Collectively, all five areas are active migration areas from October through July, although each individual area has its own specific date range depending on what portion of the northbound or southbound migration it is meant to cover. Based on an average speed of approximately 6.2 km per hour for migrating gray whales (Mate et al., 2015a), it would take approximately 65 hours for a gray whale moving continuously along a direct route to cross through the entirety of the PMSR Study Area (a distance of approximately 400 km). The whales would cross the PMSR twice a year during their annual southbound and northbound migrations. Navy testing and training activities that use explosives could occur year round within the PMSR, but generally they would occur farther offshore than the shallow-water, nearshore habitat preferred by gray whales during their migration.

As noted in Section 3.7.5.2.1.9 (Land-Based Launch Noise Near Pinniped Haulout Sites), civilian use of seal bombs has been documented over many years, with thousands of explosions occurring each year at multiple monitoring sites in and around the PMSR Study Area. Seal bombs are also used within the gray whale migration path along the U.S. West Coast and off Alaska, suggesting that migrating gray whales have likely been exposed to sound from explosions at multiple locations and over multiple years (Baumann-Pickering et al., 2013; Bland, 2017; Debich et al., 2015a; Debich et al., 2015b; Kerosky et al., 2013; Oleson & Hildebrand, 2012; Rice et al., 2015; Rice et al., 2017; Rice et al., 2018b; Širović et al., 2016; Trickey et al., 2015; Wiggins et al., 2019; Wiggins et al., 2017; Wiggins et al., 2018). As a result the occasional detonation of explosives at or near the ocean surface during Navy testing and training activities would not be a novel experience to most gray whales migrating through the PMSR Study Area and is unlikely to significantly delay or cause a whale to abort its migration.

In an early study investigating the behavior of migrating gray whales exposed to an impulsive source in their migration path, a startle response was observed in 42 percent of the cases, but the change in behavior, when it occurred, did not persist (Malme et al., 1984; Malme et al., 1988; Richardson, 1995). As discussed above for mysticetes in general, if a gray whale were to react to sound from an explosion, it may pause its migration until the noise ceases or moves, or it may choose an alternate route around the location of the sound source if the source was directly in the whale's migratory path. As with most other mysticetes, gray whale reactions to explosions are most likely to be short term and mild to moderate if they occur at all. Therefore, significant impacts on gray whale migration behaviors from testing and training activities at PMSR are unlikely to occur.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of Eastern North Pacific stock gray whales but would not result in the incidental harassment of Western North Pacific gray whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 1 may affect but is not likely to adversely affect ESA-listed Western North Pacific gray whales. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

Humpback Whales

Humpback whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year, when those animals are seasonally present in the area. The quantitative

analysis of explosives under Alternative 1 estimates behavioral reactions and TTS may occur for Mexico DPS humpback whales and a behavioral reaction may occur for Central America DPS humpback whales (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects). These estimates are without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

As detailed in Section 3.7.4.2.5.2 (Habitat and Geographic Range), there are two identified biologically important humpback whale feeding areas that overlap with a portion of the PMSR Study Area (Calambokidis et al., 2015) (Figure 3.7-4). These feeding areas are called the Morro Bay to Point Sal Feeding Area (designated from April to November) and the Santa Barbara Channel–San Miguel Feeding Area (designated from March to September) (Calambokidis et al., 2015). Navy testing and training activities that use explosives could occur year round within the Study Area, although they generally would not occur in the these relatively nearshore feeding areas, because both areas are close to the northern Channel Islands, the National Park/National Marine Sanctuary, oil production platforms, and major vessel routes leading to and from the ports of Los Angeles and Long Beach. There is partial overlap between the Santa Barbara Channel–San Miguel Feeding Area and the Channel Islands National Marine Sanctuary and there is no Navy testing and training involving the use of explosives within the National Marine Sanctuary boundaries.

As detailed in Section 3.7.4.2.5.2 (Habitat and Geographic Range), there are two critical habitat areas, or units, overlapping with the PMSR that were designated by NMFS on April 21, 2021 (86 FR 21082). The designated critical habitat areas are identified as units 17 and 18. In finalizing the critical habitat, NMFS excluded the proposed area identified as unit 19, because avoiding likely economic and national security impacts outweighed the benefits of designating the unit as critical habitat. The final critical habitat for humpback whales in the vicinity of the PMSR is shown in Figure 3.7-5.

Considering that there are no explosives being detonated underwater, the Navy does not anticipate impacts on humpback whale critical habitat or humpback whale prey as a result of the proposed testing and training activities within the PMSR Study Area. The Navy's proposed testing and training activities would not destroy or adversely modify humpback whale critical habitat.

That acoustic context as detailed in Section 3.7.5.2.1.9 (Land-Based Launch Noise Near Pinniped Haulout Sites), includes thousands of fishing related in-water explosions (i.e., seal bombs) occurring at multiple sites in the Southern California. Given the routine and widespread use of civilian explosive marine mammal deterrents, and that proximity to an impulsive source such as an explosion are important factors in the response of humpback whales to noise (Dunlop et al., 2015; Dunlop et al., 2016; Dunlop et al., 2018; Ellison et al., 2011), it is unlikely that Navy activities involving the detonation of explosives at or near the surface in offshore areas away from the coast would have any meaningfully effect on humpback whale feeding behavior in the designated areas.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock humpback whales. Pursuant to the ESA, the use of explosives during Navy activities as

described under Alternative 1 may affect and is likely to adversely affect ESA-listed Mexico DPS and Central America DPS humpback whales. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

Minke Whales

Minke whales may be exposed to sound or energy from explosions associated with Navy activities throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates behavioral reactions and TTS may occur to minke whales. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock minke whales.

Sei Whales

Sei whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no effects to sei whales. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock sei whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 1 may affect but is not likely to adversely affect ESA-listed sei whales. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

Odontocetes

As noted in Section 3.7.5.2.1.9 (Land-Based Launch Noise Near Pinniped Haulout Sites), given the prevalence of explosions from seal bombs used by fishermen, any Navy activities using explosives are unlikely to be novel experiences for most odontocetes inhabiting the waters of Southern California. For these same reasons and due to the durations and intermittent use of explosives by Navy, physiological stress, if resulting at all, from Navy's activities is also likely to be short term and intermittent. Long-term consequences from physiological stress due to the sound from explosives would not be expected for odontocetes.

Baird's Beaked Whales

Baird's beaked whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no effects to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock of Baird's beaked whales.

Bottlenose Dolphins

Bottlenose dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no effects to the California Coastal stock of bottlenose dolphins. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of bottlenose dolphins estimates behavioral reactions, TTS, and PTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California Coastal stock of bottlenose dolphins and may result in the incidental harassment of the California, Oregon, and Washington stock of bottlenose dolphins.

Cuvier's Beaked Whales

Cuvier's beaked whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no effects to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock of Cuvier's beaked whales.

Dall's Porpoises

Dall's porpoises may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of Dall's porpoises estimates behavioral reactions, TTS, and PTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of Dall's porpoises.

Dwarf Sperm Whales

Dwarf sperm whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates behavioral reactions, TTS, and PTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of Dwarf sperm whales.

Harbor Porpoises

Harbor porpoise should only be present in the nearshore edge of the PMSR north of Point Conception, which is not where Navy activities using explosives would be located. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no acoustic exposures to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

As detailed in Section 3.7.4.3.8.2 (Habitat and Geographic Range), the designated Morro Bay harbor porpoise small and resident population area partially overlaps the northern nearshore portion of the PMSR Study Area. Navy activities that use explosives could occur year round within the Study Area, although generally they would not occur in the relatively nearshore location of the designated area given the location is encumbered by proximity to the coastline, oil production platforms, and commercial vessel traffic transiting along the California coast. As provided above, the Navy's acoustic effects model predicts no exposures to harbor porpoise resulting from the use of explosives; therefore, impacts would not be anticipated within the identified small and resident population area for harbor porpoises.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of Morro Bay stock of harbor porpoises.

Killer Whales

Killer whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no acoustic exposures to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5

(Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of Eastern North Pacific Offshore stock or Eastern North Pacific Transient/West Coast Transient stock killer whales.

Long-Beaked Common Dolphins

Long-beaked common dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of long-beaked common dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of long-beaked common dolphins.

Mesoplodont Beaked Whales

Mesoplodont beaked whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no acoustic exposures to individuals in the Mesoplodont beaked whale management group (the six Mesoplodont beaked whale species in are *M. densirostris*, *M. carlhubbsi*, *M. ginkgodens*, *M. perrini*, *M. peruvianus*, and *M. stejnegeri*). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock of Mesoplodont beaked whales.

Northern Right Whale Dolphins

Northern right whale dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of Northern right whale dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5

(Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of Northern right whale dolphins.

Pacific White-Sided Dolphins

Pacific white-sided dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of Pacific white-sided dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of Pacific white-sided dolphins.

Pygmy Killer Whales

Pygmy killer whales are only likely to be present in the PMSR Study Area in the warm season and when water temperatures are above normal as occurred in 2014. The quantitative analysis conservatively assumes their annual presence, but using number of explosives per year under Alternative 1 estimates no acoustic exposures to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pygmy Sperm Whales

Pygmy sperm whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of pygmy sperm whales estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of pygmy sperm whales.

Risso's Dolphins

Risso's dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of Risso's dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of Risso's dolphins.

Short-Beaked Common Dolphins

Short-beaked common dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California, Oregon, and Washington stock of short-beaked common dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of short-beaked common dolphins.

Short-Finned Pilot Whales

Short-finned pilot whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates no acoustic exposures to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock of short-finned pilot whales.

Sperm Whales

Sperm whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under

Alternative 1 estimates behavioral reactions and TTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of sperm whales. Under Alternative 1, pursuant to the ESA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may affect and is likely to adversely affect ESA-listed sperm whales. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

Striped Dolphins

Striped dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 estimates a behavioral effect and a TTS effect may occur, but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of the California, Oregon, and Washington stock of striped dolphins.

Pinnipeds

As noted in Section 3.7.5.2.1.9 (Land-Based Launch Noise Near Pinniped Haulout Sites), given the prevalence of explosions from seal bombs used by fishermen, the sound from explosives should not be a novel experience for pinnipeds in the PMSR Study Area. As a result, the sound from explosives occurring at or near the water surface in association with Navy testing and training activities should not generally result in significant behavioral reactions by pinnipeds.

Phocids (true seals)

Harbor Seals

Harbor seals may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California stock of harbor seals estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for pinnipeds and the mitigation measures that

would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of the California stock of harbor seals.

Northern Elephant Seals

Northern elephant seals may be exposed to underwater sound or energy from explosions associated with Navy activities. The quantitative analysis using the number of explosives per year under Alternative 1 for the California stock of northern elephant seals estimates behavioral reactions, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of the California stock of northern elephant seals.

Otariids (eared seals)
California Sea Lions

California sea lions may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the U.S stock of California sea lions estimates behavioral reactions and TTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of the U.S. stock of California sea lions.

Guadalupe Fur Seals

Guadalupe fur seals may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the Mexico stock of Guadalupe fur seals estimates a behavioral reaction and a TTS effect may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and

Mitigation). Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of the Mexico stock of Guadalupe fur seals. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 1 may affect and is likely to adversely affect ESA-listed Guadalupe fur seals. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

Northern Fur Seals

Northern fur seals may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 1 for the California stock of northern fur seals estimates no acoustic exposures for the species. Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 1, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of the California stock of northern fur seals.

Mustelidae – Sea Otters
Southern Sea Otters

Southern sea otters may be exposed to underwater sound or energy from explosions associated with Navy activities. Within the PMSR Study Area, southern sea otters are only expected to be present in shallow water areas close to the shore around SNI, which is not where Navy activities using explosives would be generally be located. Impacts on southern sea otters are not expected to result from the proposed activities involving the use of explosives. Long-term consequences from physiological stress due to the sound of explosives would not be expected.

As noted in Section 3.7.4.6.1 (Southern Sea Otter [*Enhydra lutris nereis*]) the provisions in the MMPA sections 101 and 102 and in the ESA sections 4 and 9 and do not apply to the incidental taking of southern sea otters during Navy military readiness activities such as those detailed under the alternatives in the Proposed Action. The USFWS has previously noted that Department of Defense actions have not posed a threat to the SNI colony of southern sea otters, and the average growth rate for the colony has exceeded the growth rate for sea otters inhabiting the central California coastline (Hatfield et al., 2016; Hatfield et al., 2018; Tinker et al., 2017; U.S. Department of the Navy, 2017a; U.S. Department of the Navy et al., 2016). Historically, Navy activities have not triggered any regulatory requirements pursuant to the MMPA or ESA for sea otters (National Oceanic and Atmospheric Administration, 2014; U.S. Department of the Navy, 2002; U.S. Fish and Wildlife Service, 2012b, 2012c).

The Navy and USFWS will coordinate as needed under any applicable statutory requirements for sea otters at SNI.

3.7.5.4.1.2 Other Acoustic Stressors Under Alternative 1 (Preferred Alternative)

As detailed in Section 3.7.5.2.1 (Acoustic [explosives; weapons firing, launch, and impact noise; vessel noise; aircraft noise; explosives]) and based on the best available science and prior consultations with

NMFS, the Navy has determined that all other acoustic stressors used during testing and training at sea, including weapons firing, launch, and impact noise; vessel noise; and aircraft noise have had *de minimis*, discountable, negligible impacts, or no impacts on marine mammals. The Navy has determined that acoustic stressors may affect ESA-listed marine mammals, consistent with NMFS recent findings (National Marine Fisheries Service, 2018b) and as indicated in the most recent proposed MMPA authorization (see 83 FR 66937, Thursday, December 27, 2018). Under Alternative 1, pursuant to the MMPA, Navy use of other acoustic stressors does not have the potential to result in the taking of marine mammals. Under Alternative 1, pursuant to the ESA, Navy use of other acoustic stressors may affect ESA-listed marine mammals. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

3.7.5.4.2 Physical Disturbance and Strike Stressors Under Alternative 1 (Preferred Alternative)

Under Alternative 1, physical disturbance and strike stressors would generally increase over the current baseline level of activity. As detailed previously in Section 3.7.5.2.3 (Vessels as a Strike Stressor), there have been no known Navy vessel strikes of marine mammals in association with the Navy activities at the PMSR in excess of two decades of record keeping. For this reason, vessel use under Alternative 1 is not likely or otherwise expected to result in vessel strikes in the future. As also detailed in that previous section, in-water devices and MEM have been analyzed in Appendix D (Military Expended Material and Direct Strike Impact Analyses) to determine the probability of a strike occurring as a result of these substressors. Based on that analysis and the previous findings from Navy and NMFS, vessels, in-water devices, and MEM are not likely to impact marine mammals.

Pursuant to the MMPA, physical disturbance and strike associated with Alternative 1 including vessels, in-water devices, and MEM will not result in the unintentional taking of marine mammals. Pursuant to the ESA, other acoustic stressors associated with Alternative 1 may affect ESA-listed marine mammals. The Navy has consulted with NMFS, as required by section 7(a)(2) of the ESA.

3.7.5.5 Alternative 2

A comparison of operational tempo proposed for each alternative, and proposed types and level of activities, are provided in Section 2.4.3.3 (Alternative 2: Historical Peak Activity Levels Plus New Requirements).

3.7.5.5.1 Acoustic Stressors

The numbers of potential impacts estimated for individual species of marine mammals from acoustic stressors under Alternative 2 in comparison to both Alternative 1 and current baseline are shown in Appendix C (Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface). The numbers presented are without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation).

3.7.5.5.1.1 Explosives

There is a potential for impacts from explosives on occur anywhere within the Study Area where sound and energy from explosives and the species overlap, although this generally would not occur in any areas close to the California coast, the Channel Islands, or heavily used commercial vessel shipping lanes because of standard operating procedures and safety associated with range clearance. Navy activities that use explosives are analyzed as occurring in all seasons of the year and any marine mammals that are present may be exposed to sound and energy from explosions associated with those activities.

As presented previously, there would overall be fewer explosives used under Alternative 2 in comparison to Alternative 1. For a discussion of the general science and potential impacts from underwater explosions on mysticetes, odontocetes, pinniped, and sea otter, see Section 3.7.5.4.1.1 (Explosives) under Alternative 1. The analyses for the effects to each species under Alternative 2 are presented in the subsections that follow.

Mysticetes

Blue Whales

Blue whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis, using the number of explosives per year under Alternative 2 estimates behavioral reactions and TTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects). Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

As described in Section 3.7.4.2.1.2 (Habitat and Geographic Range), three of nine feeding areas for blue whales identified by Calambokidis et al. (2015) along the U.S. West Coast overlap (one wholly and two partially) with the PMSR Study Area in July through October seasonal time-frame. Navy testing and training activities that use explosives could occur year round within the Study Area. However, activities using explosives generally would not take place in the Point Conception/Arguello to Point Sal Feeding Area or the Santa Barbara Channel and San Miguel Feeding Area, because both areas are close to the northern Channel Islands, the National Park/National Marine Sanctuary, oil production platforms, and major vessel routes leading to and from the ports of Los Angeles and Long Beach (Figure 3.7-2).

In contrast to the two feeding areas to the north, the area encompassed by the SNI Feeding Area has been routinely used for Navy testing and training activities for decades and is proposed for continued use into the future. Over the years, there has been very little change in Navy testing and training off SNI, and no significant changes in use are proposed in this EIS/OEIS. The waters within Warning Area 289, which overlap with the SNI Feeding Area, are essential for testing and training given their proximity to SNI. The area is used during activities requiring an aerial target impact area, missile launches from SNI, aerial and ship-based gunnery events, and sea surface missile launches. Explosions occurring during these activities would occur at or near the surface and may expose feeding blue whales to underwater noise, resulting in a behavioral reaction (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). As discussed above for mysticetes in general and in light of the underwater acoustic environment at PMSR (as detailed in Section 3.7.5.2.1.9, Land-Based Launch Noise Near Pinniped Haulout Sites), blue whale reactions to explosions are most likely to be short term and mild to moderate, and may even be ignored, especially when the animals are engaged in important biological behaviors, such as feeding, that may override a startle response due to an explosion. Therefore, significant impacts on blue whale feeding behaviors from testing and training are unlikely to occur within the SNI Blue Whale Feeding Area.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of Eastern North Pacific

stock blue whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 2 may affect and is likely to adversely affect ESA-listed blue whales.

Bryde's Whales

Bryde's whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no effects to Bryde's whales. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of Eastern Tropical Pacific stock Bryde's whales.

Fin Whales

Fin whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates behavioral reactions, TTS, and PTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock fin whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 2 may affect and is likely to adversely affect ESA-listed fin whales.

Gray Whales

Gray whales may be exposed to sound or energy from explosions associated with Navy activities when they are migrating through the PMSR. For the Eastern North Pacific stock of gray whales, the quantitative analysis using the number of explosives per year under Alternative 2 estimates behavioral reactions and TTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). For the Western North Pacific stock of gray whales, the quantitative analysis using the number of explosives per year under Alternative 2 estimates no acoustic exposures. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

As presented in Section 3.7.4.2.4.2 (Habitat and Geographic Range), four migration areas for gray whales are located north of Point Conception, and a fifth area is located contiguous with the other four,

encompassing the entire Southern California Bight and extending well offshore of the Channel Islands (Calambokidis et al., 2015). Collectively, all five areas are active mitigation areas from October through July, although each individual area has its own specific date range depending on what portion of the northbound or southbound migration it is meant to cover. Based on an average speed of approximately 6.2 km per hour for migrating gray whales (Mate et al., 2015a), it would take approximately 65 hours for a gray whale moving continuously along a direct route to cross through the entirety of the PMSR Study Area (a distance of approximately 400 km). The whales would cross the PMSR twice a year during their annual southbound and northbound migrations. Navy testing and training activities that use explosives could occur year round within the PMSR, but generally they would occur farther offshore than the shallow-water, nearshore habitat preferred by gray whales during their migration.

As discussed above for mysticetes in general, if a gray whale were to react to sound from an explosion, it may pause its migration until the noise ceases or moves, or it may choose an alternate route around the location of the sound source if the source was directly in the whale's migratory path. As with most other mysticetes, gray whale reactions to explosions are most likely to be short term and mild to moderate if they occur at all. Therefore, significant impacts on gray whale migration behaviors from testing and training activities at PMSR are unlikely to occur.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of Eastern North Pacific stock gray whales but would not result in the incidental harassment of Western North Pacific gray whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 2 may affect but is not likely to adversely affect ESA-listed Western North Pacific gray whales.

Humpback Whales

Humpback whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis of explosives under Alternative 2 for Mexico DPS humpback whales estimates behavioral reactions and TTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). The quantitative analysis of explosives under Alternative 2 for Central America DPS humpback whales estimates no acoustic exposures would occur. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

There are two biologically important humpback whale feeding areas that overlap with a portion of the PMSR Study Area (Calambokidis et al., 2015) (Figure 3.7-4). These feeding areas are identified as the Morro Bay to Point Sal Feeding Area (designated from April to November) and the Santa Barbara Channel–San Miguel Feeding Area (designated from March to September) (Calambokidis et al., 2015). Navy testing and training activities that use explosives could occur year round within the Study Area, although they generally would not occur in the these relatively nearshore feeding areas, because both areas are close to the northern Channel Islands, the National Park/National Marine Sanctuary, oil production platforms, and major vessel routes leading to and from the ports of Los Angeles and Long Beach. Given that acoustic context, as detailed in Section 3.7.5.2.1.9 (Land-Based Launch Noise Near

Pinniped Haulout Sites), and proximity to an impulsive source such as an explosion are important factors in the response of humpback whales to noise (Dunlop et al., 2015; Dunlop et al., 2016; Dunlop et al., 2018; Ellison et al., 2011), it is unlikely that the use of explosives in the PMSR offshore would have any meaningfully effect on humpback whale feeding behavior in the designated areas.

As detailed in Section 3.7.4.2.5.2 (Habitat and Geographic Range), there are two critical habitat areas, or units, overlapping with the PMSR that were designated by NMFS on April 21, 2021 (86 FR 21082). The designated critical habitat areas are identified as units 17 and 18. In finalizing the critical habitat, NMFS excluded the proposed area identified as unit 19, because avoiding likely economic and national security impacts outweighed the benefits of designating the unit as critical habitat. The final critical habitat for humpback whales in the vicinity of the PMSR is shown in Figure 3.7-5.

Considering that there are no explosives being detonated underwater, the Navy does not anticipate impacts on humpback whale critical habitat or humpback whale prey as a result of the proposed testing and training activities within the PMSR Study Area. The Navy's proposed testing and training activities would not destroy or adversely modify humpback whale critical habitat.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock humpback whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 2 may affect and is likely to adversely affect ESA-listed Mexico DPS. The use of explosives during Navy activities as described under Alternative 2 may affect and is likely to adversely affect Central America DPS humpback whales.

Minke Whales

Minke whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no acoustic exposures to minke whales. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock of minke whales.

Sei Whales

Sei whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no acoustic exposures to sei whales. Considering the factors presented above for mysticetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock sei whales. Pursuant to the ESA, the use of explosives during Navy

activities as described under Alternative 2 may affect but is not likely to adversely affect ESA-listed sei whales.

Odontocetes

Baird's Beaked Whales

Baird's beaked whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no acoustic exposures to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the incidental harassment of California, Oregon, and Washington stock of Baird's beaked whales.

Bottlenose Dolphins

Bottlenose dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no acoustic exposures to the California Coastal stock of bottlenose dolphins. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of bottlenose dolphins estimates a behavioral reaction and TTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives would not result in the unintentional taking of California Coastal stock of bottlenose dolphins. Under Alternative 2, pursuant to the MMPA and based on results predicted by the Navy's Acoustic Effects Model, Navy use of explosives may result in the incidental harassment of California, Oregon, and Washington stock of bottlenose dolphins.

Cuvier's Beaked Whales

Cuvier's beaked whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no acoustic exposures to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of California, Oregon, and Washington stock of Cuvier's beaked whales.

Dall's Porpoises

Dall's porpoises may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of Dall's porpoises estimates behavioral reactions, TTS, and PTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stocks would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of Dall's porpoises.

Dwarf Sperm Whales

Dwarf sperm whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates behavioral reactions, TTS, and PTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of Dwarf sperm whales.

Harbor Porpoises

Harbor porpoise should only be present in the nearshore edge of the PMSR north of Point Conception, which is not where Navy activities using explosives would be located. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no effects to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

As detailed in Section 3.7.4.3.8.2 (Habitat and Geographic Range), the designated Morro Bay harbor porpoise small and resident population area partially overlaps the northern nearshore portion of the PMSR Study Area. Navy testing and training activities that use explosives could occur year round within the Study Area, although they generally would not occur in the relatively nearshore designated area given the location is encumbered by proximity to the coastline, oil production platforms, and commercial vessel traffic transiting along the California coast. As provided above, acoustic effects modeling estimates no exposures to harbor porpoise resulting from the use of explosives; therefore, impacts would not be anticipated within the identified small and resident population area for harbor porpoises.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of Morro Bay stock of harbor porpoises.

Killer Whales

Killer whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no effects to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of Eastern North Pacific Offshore stock or Eastern North Pacific Transient/West Coast Transient stock killer whales.

Long-Beaked Common Dolphins

Long-beaked common dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of long-beaked common dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of long-beaked common dolphins.

Mesoplodont Beaked Whales

Mesoplodont beaked whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no effects to the species in the Mesoplodont beaked whale management group (the six Mesoplodont beaked whale species in are *M. densirostris*, *M. carlhubbsi*, *M. ginkgodens*, *M. perrini*, *M. peruvianus*, and *M. stejnegeri*). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of California, Oregon, and Washington stock of Mesoplodont beaked whales.

Northern Right Whale Dolphins

Northern right whale dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of Northern right whale dolphins estimates behavioral reactions and TTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of Northern right whale dolphins.

Pacific White-Sided Dolphins

Pacific white-sided dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of Pacific white-sided dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of Pacific white-sided dolphins.

Pygmy Killer Whales

Pygmy killer whales are only likely to be present in the PMSR Study Area in the warm season and when water temperatures are above normal, as occurred in 2014. The quantitative analysis conservatively assumes their annual presence, but using number of explosives per year under Alternative 2 estimates no acoustic exposures to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pygmy Sperm Whales

Pygmy sperm whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of pygmy sperm whales estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine

Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of pygmy sperm whales.

Risso's Dolphins

Risso's dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of Risso's dolphins estimates a behavioral reaction and a TTS effect may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of Risso's dolphins.

Short-Beaked Common Dolphins

Short-beaked common dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California, Oregon, and Washington stock of short-beaked common dolphins estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of short-beaked common dolphins.

Short-Finned Pilot Whales

Short-finned pilot whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no effects to the species. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5

(Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of California, Oregon, and Washington stock of short-finned pilot whales.

Sperm Whales

Sperm whales may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates a TTS may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation) to sperm whales. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of California, Oregon, and Washington stock of sperm whales. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 2 may affect and is likely to adversely affect ESA-listed sperm whales.

Striped Dolphins

Striped dolphins may be exposed to sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 estimates no effects to striped dolphins. Considering the factors presented above for odontocetes and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of the California, Oregon, and Washington stock of striped dolphins.

Phocids (True Seals)

Harbor Seals

Harbor seals may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California stock of harbor seals estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of the California stock of harbor seals.

Northern Elephant Seals

Northern elephant seals may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California stock of northern elephant seals estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of the California stock of northern elephant seals.

Otariids (Eared Seals)

California Sea Lions

California sea lions may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the U.S stock of California sea lions estimates behavioral reactions, TTS, and PTS effects may occur (refer to Appendix C, Predicted Marine Mammal Effects Resulting from Navy Activities Involving Use of Explosives at or Near the Ocean's Surface, for the quantification of effects), but without consideration of any avoidance or reduction in the number of effects resulting from the implementation of the measures presented in Chapter 5 (Standard Operating Procedures and Mitigation). Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 may result in the unintentional taking of the U.S. stock of California sea lions.

Guadalupe Fur Seals

Guadalupe fur seals may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the Mexico stock of Guadalupe fur seals estimates no effects for the species. Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of the Mexico stock of Guadalupe fur seals. Pursuant to the ESA, the use of explosives during Navy activities as described under Alternative 2 may affect and is likely to adversely affect ESA-listed Guadalupe fur seals.

Northern Fur Seals

Northern fur seals may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. The quantitative analysis using the number of explosives per year under Alternative 2 for the California stock of northern fur seals estimates no effects for the species. Considering the factors presented above for pinnipeds and the mitigation measures that would be implemented as described in Chapter 5 (Standard Operating Procedures and Mitigation), long-term consequences for the species or stock would not be expected.

Pursuant to the MMPA, the use of explosives during Navy activities as described under Alternative 2 would not result in the unintentional taking of the California stock of northern fur seals.

Mustelidae – Sea Otters

Southern Sea Otters

Southern sea otters may be exposed to underwater sound or energy from explosions associated with Navy activities occurring throughout the year. Within the PMSR Study Area, southern sea otters are only expected to be present in shallow water areas close to the shore around SNI, which is not where Navy activities using explosives would be located. Impacts on southern sea otters are not expected to result from the proposed activities involving the use of explosives. Long-term consequences from physiological stress due to the sound of explosives would not be expected given the results of the past and ongoing monitoring of the population at SNI (Hatfield et al., 2016; Hatfield et al., 2018; Tinker et al., 2017; U.S. Department of the Navy, 2017a; U.S. Department of the Navy et al., 2016). As noted in Section 3.7.4.6.1 (Southern Sea Otter [*Enhydra lutris nereis*]), the provisions in the MMPA sections 101 and 102 and the ESA sections 4 and 9 and do not apply to the incidental taking of southern sea otters during Navy military readiness activities, such as those detailed under the alternatives in the Proposed Action. The USFWS has previously noted that Department of Defense actions have not posed a threat to the SNI colony of southern sea otters, and the average growth rate for the colony has been higher than that for sea otters inhabiting the central California coastline. Historically, Navy activities have not triggered any regulatory requirements pursuant to the MMPA or ESA for sea otters (National Oceanic and Atmospheric Administration, 2014; U.S. Department of the Navy, 2002; U.S. Fish and Wildlife Service, 2012b, 2012c). The Navy and USFWS will coordinate as needed under any applicable statutory requirements for sea otters at SNI.

3.7.5.5.1.2 Other Acoustic Stressors under Alternative 2

As detailed in Section 3.7.5.2.1 (Acoustic [explosives; weapons firing, launch, and impact noise; vessel noise; aircraft noise; explosives]) and based on the best available science and prior consultations with NMFS (84 FR 18809), the Navy has determined that all other acoustic stressors used during testing and training at-sea, including weapons firing, launch, and impact noise; vessel noise; and aircraft noise, have had *de minimis*, discountable, negligible impacts, or no impacts on marine mammals. The Navy has determined that acoustic stressors may affect ESA-listed marine mammals, consistent with NMFS recent findings in this regard (National Marine Fisheries Service, 2018c). Under Alternative 2, pursuant to the MMPA, Navy use of other acoustic stressors would not result in the unintentional taking of marine mammals. Under Alternative 2, pursuant to the ESA, Navy use of other acoustic stressors may affect ESA-listed marine mammals.

3.7.5.5.2 Physical Disturbance and Strike Stressors Under Alternative 2

Under Alternative 2, physical disturbance and strike stressors would generally increase compared to the baseline level of activity but be at a lower level than Alternative 1. As detailed previously in Section 3.7.5.2.3 (Vessels as a Strike Stressor), there have been no known Navy vessel strikes of marine mammals in association with the Navy activities at the PMSR in excess of two decades of record keeping. For this reason, vessel use under Alternative 2 is not likely or otherwise expected to result in vessel strikes in the future. As also detailed in that previous section, in-water devices, and MEM have been analyzed in Appendix D (Military Expended Material and Direct Strike Impact Analyses) to determine the probability of a strike occurring as a result of these substressors. Based on that analysis and the previous findings from Navy and NMFS, vessels, in-water devices, and MEM are not likely to impact marine mammals.

Pursuant to the MMPA, physical disturbance and strike associated with Alternative 2 including vessels, in-water devices, and MEM would not result in the unintentional taking of marine mammals. Pursuant to the ESA, other acoustic stressors associated with Alternative 2 may affect ESA-listed marine mammals.

3.7.5.6 Indirect Effects

Navy testing and training activities could pose indirect impacts on marine mammals via habitat or prey as a result of explosives by-products, metals, chemicals, and transmission of disease and parasites. Analysis of the potential impacts on sediment and water quality are discussed in Section 3.2 (Sediments and Water Quality). Based on authorizations pursuant to the MMPA reached by NMFS for all other Navy areas analyzed in the Pacific and Atlantic and because testing and training activities are similar in nature to those analyzed in the Pacific and Atlantic regions, indirect effects would be discountable, negligible, or insignificant. Pursuant to the MMPA, indirect effects (secondary stressors) are not expected to result in mortality, Level A harassment, or Level B harassment of any marine mammal. Pursuant to ESA, indirect effects may affect but are not likely to adversely affect certain ESA-listed marine mammals and would have no effect on marine mammal critical habitats.

3.7.5.7 Consideration of Results from Monitoring of Navy Activities At-Sea

It has long been recognized that even when multiple years of marine mammal survey data are available for analysis, the ability for researchers to assess the magnitude and direction of trends in the abundance of individual marine mammal populations is often limited (Forney, 2000; Forney et al., 1991; Gerrodette, 1987; Moore & Barlow, 2017; Moore & Barlow, 2014; Taylor et al., 2007). For example, even for waters off the U.S. West Coast that have relatively good survey coverage over decades, it cannot be conclusively determined if the sperm whale population in this region is increasing, decreasing, or has remained static (Moore & Barlow, 2017). Additional types of information must therefore be considered when assessing the likely impacts of Navy activities on marine mammal populations.

Since 2006, the Navy, non-Navy marine mammal scientists, and research groups and institutions have conducted scientific monitoring and research in and around ocean areas in the Atlantic and Pacific where the Navy has been and proposes to continue testing and training. There have been three rounds of analysis for Navy training and testing activities at-sea in various Navy range complexes in the Pacific by the Navy and NMFS (see for example 83 FR 66846, December 27, 2018). Data collected from Navy monitoring, scientific research findings, and annual reports have been provided to NMFS, and this

public[10] record is an important contribution to the analysis of potential impacts on marine mammals. For example, these data provide information relevant to species distribution, habitat use, and evaluation of potential responses to Navy activities.

Monitoring is performed using a variety of methods, including visual surveys from surface vessels and aircraft, as well as passive acoustics before, during, and after Navy activities have been conducted. The Navy also has continued to contribute to funding of basic research, including behavioral response studies specifically designed to determine the effects to marine mammals from the Navy's main mid-frequency surface ship anti-submarine warfare sonar and other acoustic sources of potential impact.

Testing and training events in the PMSR are, in comparison to other Navy range complexes such as SOCAL, less frequent and generally smaller in scope. As a result, the majority of the Navy's monitoring and research effort has been focused on those other locations where Navy activities are more numerous and generally more intense. Research funded by the Navy that has included the PMSR Study Area includes, but is not limited to the following efforts:

- As required by the 2016 NDAA, the Navy has conducted monitoring and research within the Southern Sea Otter Military Readiness Areas to determine the effects of military readiness activities on the growth of the southern sea otter population and on the nearshore ecosystem. The resulting monitoring and research was designed in consultation with the USFWS and involves four (quarterly) surveys every year (U.S. Department of the Navy et al., 2016). The initial results of that work have been reported to Congress, with subsequent follow-on reports to be provided every three years thereafter as was required (U.S. Department of the Navy, 2017a; U.S. Department of the Navy et al., 2016). Findings from these reports will continue to be reviewed by the Navy and USFWS to ensure the plan continues to adequately monitor interactions between military readiness activities and the sea otter population.
- The Navy has funded a number of passive acoustic monitoring efforts in the PMSR Study Area as well as locations farther to the south in the SOCAL Range Complex. These studies have helped to characterize the soundscape resulting from general anthropogenic sound as well as the Navy testing and training sound energy contributions (Baumann-Pickering et al., 2013; Baumann-Pickering et al., 2015a; Baumann-Pickering et al., 2018; Curtis et al., 2020; Debich et al., 2015a; Debich et al., 2015b; Hildebrand et al., 2012; Rice et al., 2018a; Rice et al., 2017; Rice et al., 2018b; Širović et al., 2016; Širović et al., 2017; Širović et al., 2015b; Wiggins et al., 2018).
- Fieldwork involving photo-ID, biopsy, visual survey, and satellite tagging of blue, fin, and humpback whales were undertaken by Oregon State University. This research provided seasonal movement tracks, distribution, and behavior of these species in addition to biopsy samples used for sex determination and individual identifications (Mate et al., 2016; Mate et al., 2018b, 2018c; Mate et al., 2015b). The findings from this work have been instrumental in supplementing our understanding of the use of BIAs in the PMSR Study Area for these species.
- The Navy, in collaboration with the NMFS Southwest Fisheries Science Center and Bureau of Ocean Energy Management, has contributed to the marine mammal survey of the California Current Ecosystem as part of the Pacific Marine Assessment Program for Protected Species. The effort in 2018 included visual and acoustic surveys with opportunistic collections of skin samples

[10] Navy monitoring reports are available at the Navy website (www.navymarinespeciesmonitoring.us/) and also at the NMFS website (www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities).

biopsies, photos for identification catalogues, and the tagging of individual animals. The forthcoming report by the NMFS Southwest Fisheries Science Center on this survey will provide abundance data for marine mammals in the area as well as data with application across broad areas of marine mammal research.

- The Navy has been conducting missile launches at SNI in accordance with authorizations under the MMPA since 2001 ((National Marine Fisheries Service, 2014a); (National Marine Fisheries Service, 2019e)). Associated with those authorizations, monitoring reports submitted to NMFS included recorded sound level measurements from the launches and documented the behavior of hauled out pinnipeds before, during, and after those launches by direct observation and in video recordings (Burke, 2017; Holst et al., 2011; Holst & Greene Jr., 2005, 2006; Holst & Greene Jr., 2008; Holst & Greene Jr., 2010; Holst & Lawson, 2002; Holst et al., 2003; Ugoretz, 2014, 2015, 2016; Ugoretz & Greene Jr., 2012).

The majority of the testing and training activities Navy is proposing for the foreseeable future in the Study Area are similar if not nearly identical to activities that have been occurring in the same locations for decades. In the PMSR Study Area, there are no Major Exercises, testing and training events are, by comparison to other Navy areas, less frequent and are in general small in scope, so as a result the majority of Navy's research effort has been focused elsewhere. For this reason, the vast majority of scientific field work, research, and monitoring efforts have been expended in the SOCAL Range Complex and Hawaii, where Navy training and testing activities have been more concentrated. Since 2006, the Navy has been submitting exercise reports and monitoring reports to NMFS for the Navy's range complexes in the Pacific and the Atlantic. These publicly available exercise reports, monitoring reports, and the associated research findings have been integrated into adaptive management decisions regarding the focus for subsequent research and monitoring as determined in collaborations between Navy, NMFS, Marine Mammal Commission, and other marine resource subject matter experts using an adaptive management approach. For example, see the 2019 U.S. Navy Annual Marine Species Monitoring Report for the Pacific that was made available to the public in September 2020.

The monitoring and research as presented on the Navy's Marine Species Monitoring webpage include efforts that occurred on the PMSR, but also research occurring elsewhere that remains directly relevant to the analysis in the PMSR Final EIS/OEIS. All relevant research efforts have been considered or cited in the Final EIS/OEIS. There are multiple studies that overlap with, but are not specific to the PMSR on the Navy webpage; see for example references cited on passive acoustic monitoring (Baumann-Pickering et al., 2013; Baumann-Pickering et al., 2015a; Baumann-Pickering et al., 2018; Debich et al., 2015a; Debich et al., 2015b; Hildebrand et al., 2012; Rice et al., 2018a; Rice et al., 2017; Rice et al., 2018b; Širović et al., 2016; Širović et al., 2017; Širović et al., 2015b; Wiggins et al., 2018) and multiple satellite tagging studies by Mate et al. dated 2015 to 2020.

These reporting, monitoring, and research efforts have added to the baseline data for marine mammals inhabiting the Study Area. In addition, subsequent research and monitoring has continued to broaden the sample of observations regarding the general health of marine mammal populations in locations where Navy has been conducting training and testing activities for decades, which has been considered in the analysis of marine mammal impacts presented in this EIS/OEIS. This public record of training and testing activities, monitoring, and research from across the Navy range complexes in the Pacific and Atlantic now spans more than 14 years. Given that this record involves many of the same Navy training and testing activities being considered for the Study Area, includes all the marine mammal taxonomic families present in the Study Area, many of the same species, and some of the same populations as they

seasonally migrate from other range complexes, this compendium of Navy reporting is directly applicable to the PMSR Study Area.

Based on the monitoring to date, it has been the Navy's assessment and that of NMFS that it was unlikely there would be impacts on populations of marine mammals (such as whales, dolphins, and pinnipeds) having any long-term consequences as a result of the proposed continuation of testing and training in the Study Area. This assessment of likelihood is based on four indicators from areas in the Pacific where Navy training and testing has been ongoing for decades: (1) evidence suggesting or documenting increases in the numbers of marine mammals present, (2) examples of documented presence and site fidelity of species and long-term residence by individual animals of some species, (3) use of training and testing areas for breeding and nursing activities, and (4) 13 years of comprehensive monitoring data indicating a lack of any observable effects to marine mammal populations such as direct mortalities or strandings occurring as a result of Navy training and testing activities. The evidence to date suggests the continuing viability of marine mammal populations where Navy trains and tests, and an absence of any direct evidence suggesting Navy training and testing has had or may have any long-term consequences to marine mammal populations. Barring any evidence to the contrary, therefore, what limited evidence there is from the monitoring reports and additional other focused scientific investigations should be considered in the analysis of impacts on marine mammals. For the PMSR Study Area in particular the examples include

- information suggesting that the ESA-listed blue whale population in the Pacific, which includes the PMSR Study Area as part of their habitat, may have recovered and been at a stable level based on recent surveys and scientific findings (Barlow, 2016; Calambokidis & Barlow, 2020; Campbell et al., 2015; Carretta et al., 2017c; International Whaling Commission, 2019a, 2019b; Monnahan et al., 2015; Rockwood et al., 2017; Širović et al., 2015b). Data from sightings from the 1950s to 2012 indicate an increased abundance off Southern California from historical records (Smultea, 2014) consistent with photo identification data gathered between 2015 to 2018 off the U.S. West Coast suggesting a possible slight increase in abundance since the 1990s (Calambokidis & Barlow, 2020);
- gray whales in the Eastern North Pacific having recovered and no longer listed under the ESA (Durban et al., 2017; International Whaling Commission, 2014);
- indications of fin whales in the California, Oregon, and Washington stock increasing in number (Becker et al., 2020a; Schorr et al., 2019; Širović et al., 2015b; Smultea, 2014; Smultea et al., 2014; Towers et al., 2018) consistent with the highest-yet abundances of fin whales in the 2014 NMFS survey of the U.S. West Coast (Barlow, 2016), and fin whale densities reaching "current ecosystem limits" (Moore and Barlow, 2011);
- humpback whales in the PMSR Study Area from the threatened Mexico DPS and the endangered Central America DPS having substantially increased in number (Becker et al., 2020a), with a growth rate estimated to have been 8.2 percent since the 1980s (Calambokidis & Barlow, 2020);
- on the SOCAL Range Complex where the Navy has been intensively training and testing for decades, documented long-term residency by individual Cuvier's beaked whales and a population with higher densities than expected based on other nearby regions (Curtis et al., 2020; Falcone & Schorr, 2012; Falcone et al., 2009; Hildebrand & McDonald, 2009; Schorr et al., 2014; Schorr et al., 2018a, 2019; Schorr et al., 2020);
- passive acoustic monitoring data gathered from the Southern California Anti-Submarine Warfare Range between August 2010 and October 2019 has indicated that Cuvier's beaked whale

abundance on the range significantly increased over the 10-year period from 2010 to 2019 (DiMarzio et al., 2020).

- the small and resident Morro Bay population of harbor porpoise has rebounded, having increased in number roughly seven-fold from when monitoring began in 1986 and increased at almost 10 percent a year after 2001, when most coastal set-gillnetting had ceased (Forney et al., 2020; National Marine Fisheries Service, 2021).
- sperm whale population abundance and trends based on line-transect surveys conducted off the U.S. West Coast from 1991 to 2014 include a high level of uncertainty, but indicate that sperm whale abundance has appeared stable with some evidence for an increasing number of sperm whales (Becker et al., 2020a; Carretta et al., 2020c; Moore & Barlow, 2017; Moore & Barlow, 2014).
- the population of Guadalupe fur seals, which is listed as threatened under the ESA, has been growing and has been expanding their range along the Pacific coast (Aurioles-Gamboa & Camacho-Rios, 2007; D'Agnese et al., 2020; Etnier, 2002; Lambourn et al., 2012; National Marine Fisheries Service, 2017b; Norris, 2017a, 2019; Norris & Elorriaga-Verplancken, 2020; Rick et al., 2009) with the population having increased about nine-fold at a rate of approximately 15 percent per year since 1985 (Valdivia et al., 2019);
- trend analysis and survey data indicate that the California sea lion population may be nearing the estimated carrying capacity (Carretta et al., 2020c); and
- the sea otter population at SNI has increased by 22 percent per year between 2017 and 2020 (Yee et al., 2020), which is higher than the trend for the remainder of the population along the California coast (Hatfield et al., 2018; Hatfield et al., 2019a; Tinker et al., 2021).

To summarize, the evidence from reporting, monitoring, and research over more than a decade indicates that while the Proposed Action will result in the incidental harassment of marine mammals and may include injury to some individuals, these impacts are expected to be inconsequential at the level of their marine mammal populations. There is no direct evidence that routine Navy training and testing spanning decades has negatively impacted marine mammal populations at any Navy Range Complex or the PMSR Study Area. In fact, for some of the most intensively used Navy training and testing areas, evidence such as the continued multi-year presence of long-term resident individual animals and small populations (Baird, 2018; Baird et al., 2015; Baird et al., 2017; Baird et al., 2018; Baird et al., 2016; Curtis et al., 2020; Lammers et al., 2017; Schorr et al., 2014; Schorr et al., 2018a; Schorr et al., 2020; Tinker & Hatfield, 2016; U.S. Department of the Navy, 2017e), resident females documented with and without calves from year to year, high abundances on the Navy ranges for some species in comparison to other off-range locations, and positive population growth rates (Calambokidis & Barlow, 2020; Curtis et al., 2020; Moore & Barlow, 2017; Schorr et al., 2018a, 2019; Schorr et al., 2020; U.S. Department of the Navy, 2017e) provide indications of generally healthy marine mammal populations. It therefore remains that based on the best available science, including data developed in exercise and monitoring reports submitted to NMFS for over a decade, that long-term consequences for marine mammal populations are unlikely to result from Navy activities in the PMSR Study Area.

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