Environmental Impact Statement/

Overseas Environmental Impact Statement

Point Mugu Sea Range

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3.3 Marine Habitats

3.3.1 Introduction

This section provides the analysis of potential impacts on marine and estuarine nonliving (abiotic) substrates found in the Point Mugu Sea Range (PMSR) Study Area (Study Area), along with an introduction to the abiotic habitats that occur in the Study Area. The following subsections describe the abiotic habitats in greater detail (Section 3.3.4, Affected Environment) and evaluate the potential impacts of project activities on abiotic substrates (Section 3.3.5, Environmental Consequences).

The Study Area covers a range of marine and estuarine habitats, each supporting communities of organisms that may vary by season and location. The intent of this section is to cover abiotic habitat features and impacts that are not addressed in the individual living resources chapters. The water column and bottom substrate provide the necessary habitats for living resources, including those that form biotic habitats such as aquatic plant beds and rocky reefs, which are discussed in other sections (e.g., Section 3.4, Marine Vegetation; Section 3.5, Marine Invertebrates). The potential for testing and training to impact the chemical quality of abiotic habitat is addressed in a separate section (Section 3.2, Sediments and Water Quality). Potential impacts on organisms and biotic habitats are covered in their respective resource sections. Potential impacts on the water column are not addressed in this section because the effects would not be associated with a change in habitat type, but rather would be limited to changes in water quality, which are addressed in Section 3.2 (Sediments and Water Quality). Further, the water column is discussed as a type of essential fish habitat in the United States Department of the Navy's (Navy's) Essential Fish Habitat Assessment. A summary of the assessment can be found in Section 6.1.3 (Magnuson-Stevens Fishery Conservation and Management Act). Acoustic energy transmitting through the water column may temporarily affect the suitability of the water column as habitat for certain species of invertebrates, fish, marine mammals, and sea turtles. The potential effects on species that use the water column as habitat are addressed in the sections on those specific resources (e.g., Section 3.5, Marine Invertebrates; Section 3.6, Marine Fishes; Section 3.7, Marine Mammals; Section 3.8, Sea Turtles). Therefore, this section only addresses impacts on habitat substrates.

Table 3.3-1 presents the types of habitats discussed in this section in relation to the open ocean areas and bays and harbors in which they occur. Habitat types are derived from *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), which includes a basic classification of intertidal shores, subtidal bottoms, and associated substrates. Whereas there are many classification systems spanning a range of spatial dimensions and granularity (Allee et al., 2000; Cowardin et al., 1979; Howell et al., 2010; Kendall et al., 2001; United Nations Educational Scientific and Cultural Organization, 2009; Valentine et al., 2005), there are basically three types of abiotic substrates based on the grain size of unconsolidated material: "soft bottom" (e.g., sand, mud), "Intermediate" (e.g., cobble, gravel), and "hard bottom" (e.g., bedrock, boulders). Spatial and temporal variation in abiotic substrate is created by the interplay of underlying geology, currents, and water quality at a location. The modified classification system provided in Table 3.3-1 starts at the subsystem level (e.g., intertidal shores and subtidal bottoms) and focuses analysis on a modified class level (e.g., soft shores/bottoms, intermediate shores/bottoms, hard shores/bottoms). The listed subsystems and classes refer to non-living substrates and are differentiated from living structures on the substrate. Living structures on the substrate are termed biotic habitats and include wetland shores, aquatic plant beds (i.e., attached macroalgae, rooted vascular plants), sedentary invertebrate beds, and reefs (e.g., corals, oysters).

Table 3.3-1: Habitat Types Within the Point Mugu Sea Range Study Area

Substrate Type	*Subtypes (Examples)*	*Presence in Study Area*	
		Ocean Area	*Ports and Nearshore Landing Areas*
Intertidal Shores			
Soft Shores	Beach, Tidal Delta/Flat	N/A	Point Mugu Ormond Beach San Nicolas Island
Intermediate Shores	Cobble/Gravel, Mixed	N/A	San Nicolas Island
Hard Shores	Rocky Intertidal	N/A	San Nicolas Island
Subtidal Bottoms			
Soft Bottoms	Channel, Flat, Shoal	Presumed to be widespread throughout the Continental Shelf	San Nicolas Island
Intermediate Bottoms	Cobble/Gravel, Mixed	Relatively common, typically occurring at transitional areas between hard and soft bottoms	San Nicolas Island
Hard Bottoms	Rocky Subtidal	Most common in deeper waters	San Nicolas Island
Intertidal Shore or Subtidal Bottom			
Artificial Structures	Ship wrecks, oil/gas platforms, bulkheads, piers	Found throughout the Study Area in nearshore and offshore locations	N/A

Note: N/A = Not Applicable

The physical characteristics of substrates, whether they are unconsolidated and soft, or hard and rocky, are key factors in structuring sedentary biological communities (Nybakken, 1993). Physical characteristics of the different substrate types represent a viable target for the best available mapping technology (i.e., multibeam sonar) and are useful for characterizing Navy impacts (e.g., explosive charges on soft bottom).

Differences among the physical and chemical environments of various abiotic habitats dictate both the variety and abundance of sessile marine organisms supported. The assessment in this section focuses on the potential for testing and training activities to change or modify the physical properties of abiotic substrates and their ecological functions as habitat for organisms. A physical impact on abiotic marine habitats is anticipated where testing and training activities have the potential to displace sediment, convert one substrate type into another (e.g., bedrock to unconsolidated soft bottom), alter vertical relief, or modify structural complexity.

3.3.2 Region of Influence

The region of influence for the alternatives addressed in this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) includes marine habitats in the PMSR, as well as at Point Mugu and San Nicolas Island. Marine habitats immediately offshore from these areas are addressed where appropriate. The Navy operates instrumentation sites at Santa Cruz, Santa Rosa, and San Miguel islands. However, current activities do not affect marine habitats at these locations, so they are not addressed further in this document for those locations. In addition, while Navy support boats and surface targets transit in and out of Port Hueneme to the PMSR, habitats within the port are not addressed further because vessel transits would not affect marine habitats within Port Hueneme.

Biological components of marine habitat and biological resources that live on and in this unique abiotic habitat are discussed and analyzed in their respective sections. These resources include Marine Vegetation (Section 3.4), Marine Invertebrates (Section 3.5), Marine Fishes (Section 3.6), Marine Mammals (Section 3.7), Sea Turtles (Section 3.8), and Marine Birds (Section 3.9).

3.3.3 Approach to Analysis

In this EIS/OEIS the approach to analysis for marine habitats focuses on the potential impacts on marine and estuarine nonliving (abiotic) substrates and abiotic habitats that occur in the Study Area from military expended materials as physical disturbance and strike stressors. This section evaluates the "significance of impacts" that would result from the alternatives. The "significance of impacts" is evaluated based on the extent or degree to which implementation of an alternative would result in the loss or degradation of sensitive marine habitats (e.g., lagoon, intertidal, and shallow subtidal) in the Study Area. Parts of the Proposed Action that create military expended materials and are analyzed for impacts on marine habitats include air-to-air, air-to-surface, surface-to-surface, and surface-to-air testing and training activities.

Most explosive detonations during testing and training involving the use of high-explosive munitions, including bombs, missiles, and projectile casings, would occur in the air or near the water's surface. Most surface and water column detonations would occur in waters greater than 3 nautical miles from shore at water depths greater than 100 feet and would not be expected to impact the bottom. Therefore, explosives as a stressor to abiotic habitats were not analyzed.

3.3.4 Affected Environment

3.3.4.1 General Background

Abiotic marine habitats vary according to geographic location, underlying geology, hydrodynamics, atmospheric conditions, and suspended particles and associated biogenic features. Sediments may be derived from material eroded from land sources associated with coastal bluff erosion and sediment flows from creeks and rivers, which may create channels, tidal deltas, intertidal and subtidal flats, and shoals of unconsolidated material along the shorelines and estuaries.

The influence of land-based nutrients on habitat type and sediment increases with proximity to streams, bays and harbors, and nearshore waters. In the open ocean, gyres, eddies, and oceanic currents influence the distribution of organisms. Major bottom features in the offshore areas of the range complexes include shelves, banks, breaks, slopes, canyons, plains, and seamounts. Geologic features such as these affect the hydrodynamics of the ocean water column (e.g., currents, gyres, upwellings) as well as living resources present. The distribution of abiotic marine habitats in the Study Area is described in their respective sections below.

The majority of the Study Area lies outside of State waters. State waters extend from shore to 3 nautical miles in California. Therefore, relatively little of the Study Area includes intertidal and shallow subtidal areas in State waters, where numerous ecosystem types are exclusively present (e.g., salt/brackish marsh, seagrass beds, kelp forests, rocky reefs). Intertidal abiotic habitats (e.g., beaches, tidal deltas, mudflats, rocky shores) represent only a small portion of the Study Area; however, they are addressed along with all other habitats (where those habitats overlap with naval testing and training activities).

3.3.4.1.1 Physical Characteristics of the Marine Environment Relevant to Biological Resources

The PMSR spans a biogeographic boundary or transition zone located off Point Conception where the bathymetry and geologic features of the seafloor to the south of Point Conception are more complex and varied than to the north (Kennett, 1982; Pickard & Emery, 1990). Surface and subsurface currents, upwelling, water temperature, salinity, and the transport of sediments and nutrients are all influenced by seafloor topography, although the primary driver is wind (Pickard & Emery, 1990). The variation in the chemical and physical oceanographic characteristics of the marine habitat north and south of Point Conception creates a biogeographic transition zone that effectively limits the range and distribution of some species, which for a number of possible reasons (e.g., temperature, availability of preferred prey) cannot tolerate conditions either north or south of boundary (Blanchette & Gaines, 2006; Hamilton et al., 2009; Horn & Allen, 1978; Santora et al., 2017).

South of Point Conception the coastline bends sharply eastward and follows a long southeasterly curve for approximately 600 kilometers (km), terminating near the U.S.-Mexico border. The large indentation formed in the coastline is referred to as the Southern California Bight (Schiff et al., 2016). Within the bight, the continental shelf is only a few km wide; however, a complex region of basins, channels, banks, ridges, and islands, termed the Continental Borderland, extends beyond the shelf for approximately 200 km to the Patton Escarpment, where water depth reaches approximately 2,000 meters and the seafloor slopes steeply seaward (Figure 3.3-1) (Dailey et al., 1993; Kennett, 1982; U.S. Department of the Navy, 2008). The southeastern portion of the PMSR overlays the northern region of the Continental Borderland and includes the islands of San Miguel, Santa Rosa, Santa Cruz, San Nicolas, and Anacapa. Several large basins are interspersed between the islands (e.g., Santa Barbara Basin and Santa Cruz Basin) and subsurface ridges. As fully enclosed depressions in the seafloor, basins create deep water habitat on the continental borderland with similar oceanographic properties to deep water habitat offshore (Emery, 1960).

3.3.4.1.2 Sea Surface Temperature and the Southern California Bight

The equatorward flowing California Current brings cool, low-salinity, nutrient-rich waters from the northern North Pacific along the west coast of North America (Pickard & Emery, 1990). As the California Current passes Point Conception, it encounters the Santa Rosa-Cortez Ridge and Patton Escarpment and remains largely offshore rather than following the coastline into the Southern California Bight. Closer to shore, the poleward flowing California Countercurrent brings warmer subtropical waters from the equatorial Pacific into the Southern California Bight (Hamilton et al., 2009; Mann & Lazier, 1996). The convergence of the warmer and cooler waters south of Point Conception creates persistent seasonal eddies, upwelling, and nutrient mixing adjacent to the islands and bathymetric features (e.g., ridges) in the Southern California Bight, which drive primary production, prey availability, and species distributions in the region (Blanchette & Gaines, 2006; Emery, 1960; Mann & Lazier, 1996; Santora et al., 2017). Between 2015 and 2020, the average annual sea surface temperatures in the Southern California Bight ranged from approximately 17 to 18 degrees Celsius in the northeast part of the PMSR off Point Conception to approximately 19 to 21 degrees Celsius in the southwest part of the PMSR and farther from shore (Figure 3.3-2). Sea surface temperatures are generally warmer in summer and fall and cooler in winter and spring. Anomalous large-scale events, such as a strong El Niño, can dramatically alter temperatures and affect other related processes like coastal upwelling, which influence the distribution of biological resources.

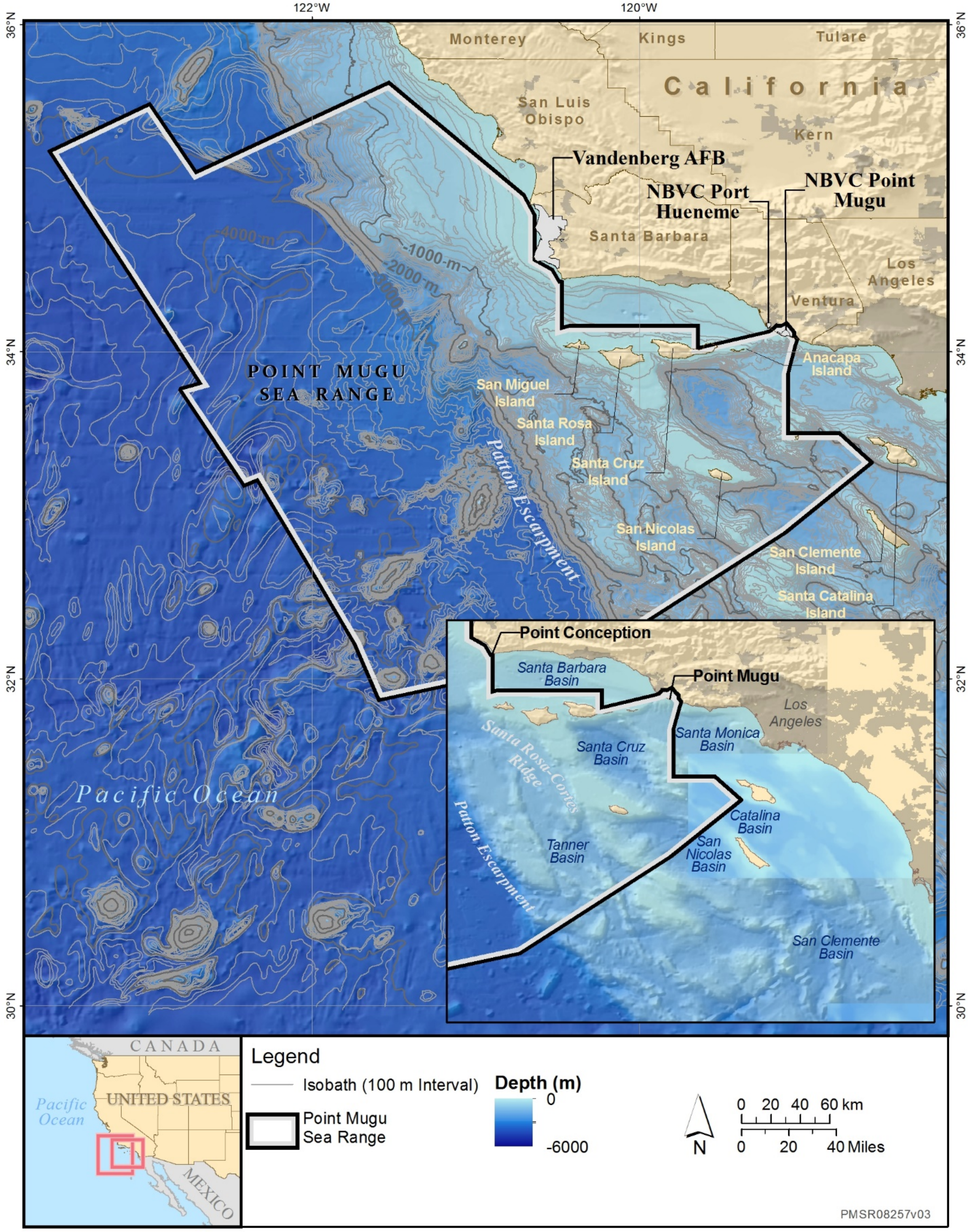

Figure 3.3-1: Bathymetry in the Region of Influence

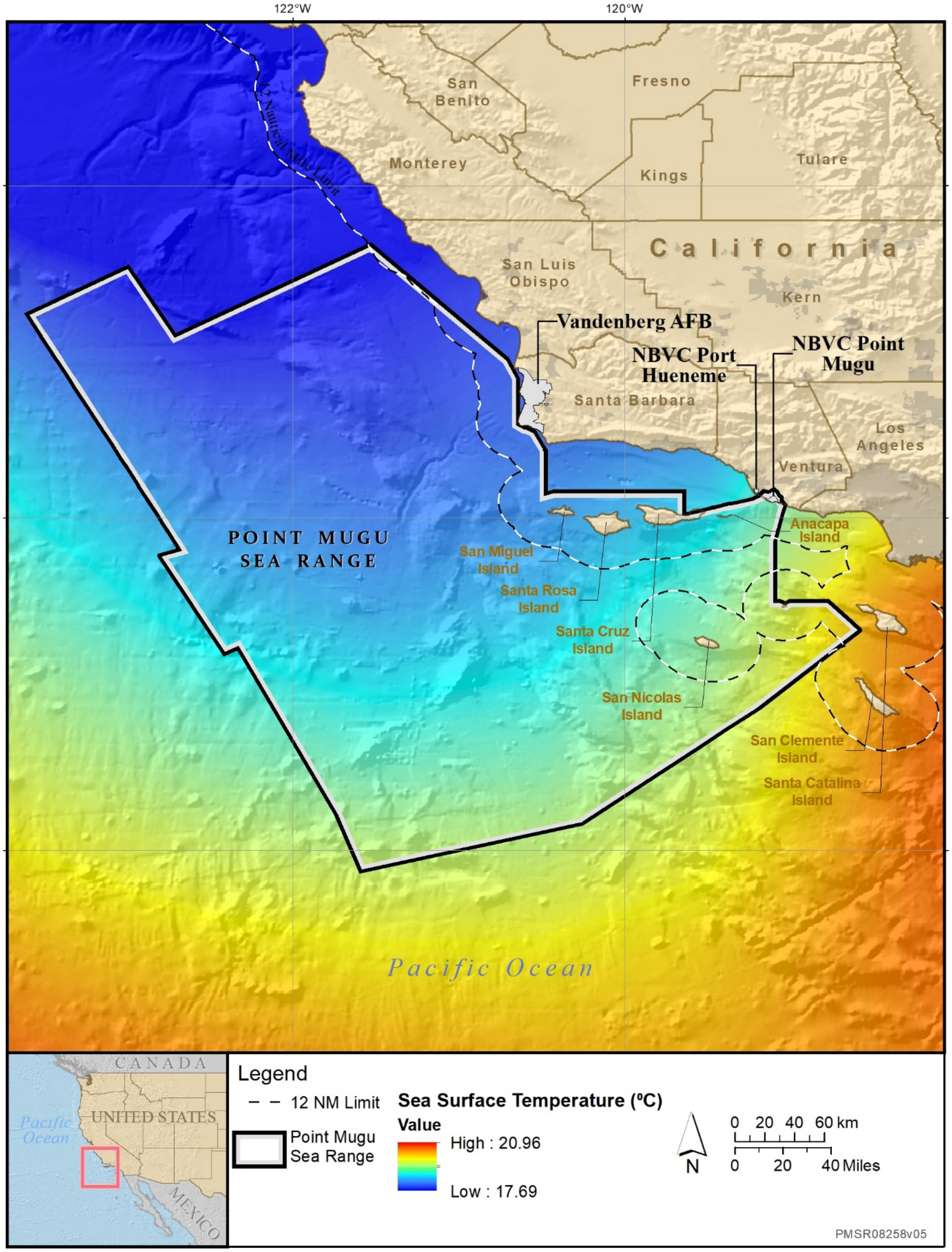

Figure 3.3-2: Average Annual Sea Surface Temperature in the Point Mugu Sea Range

3.3.4.1.3 Primary Production as an Indicator of a Biogeographic Transition Zone

Primary production in the ocean can be estimated by satellite-based measurements of the concentration of chlorophyll-a (Harvey et al., 2015; Millán-Núñez et al., 1997), where higher concentrations are indicative of upwelling and areas of higher primary production (Kilpatrick et al., 2018; Mann & Lazier, 1996; Polovina et al., 2001). Chlorophyll-a concentrations and primary production in the PMSR vary seasonally and are typically highest in summer and lowest in spring, when the California Countercurrent weakens and may even temporarily reverse direction and flow southeast along the coastline (Emery, 1960). The difference in chlorophyll-a concentration north and south of Point Conception is evident in satellite images and is another indication of a biogeographic transition zone (Kilpatrick et al., 2018).

3.3.4.1.4 Shore Habitats

3.3.4.1.4.1 Description

Point Mugu Lagoon

Point Mugu Lagoon is a large, shallow estuary or saltwater marsh. It is one of the largest lagoons in Southern California and is relatively undisturbed. Coastal salt marsh is considered a sensitive and declining resource by several regulatory agencies, including the California Department of Fish and Game and U.S. Fish and Wildlife Service. Wetlands are specifically addressed under the jurisdiction of the U.S. Army Corps of Engineers section 404 permit process (section 404, 33 United States Code [U.S.C.] sub-section 1251 et seq.). Clean Water Act (as amended [33 U.S.C. section 1251 et seq.]) permit provisions regulating dredge and fill operations are enforced by the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency, with technical input from the U.S. Fish and Wildlife Service. Coastal salt marsh at Point Mugu Lagoon is defined by the presence of hydrophytic (salt-tolerant) vegetation and water levels that fluctuate daily due to tidal action (U.S. Department of the Navy, 2002). Impacts on the lagoon are discussed further in Section 3.2 (Sediments and Water Quality) but are not discussed further in this section.

Soft Shores

Soft shores include all aquatic habitats that have three characteristics: (1) unconsolidated substrates with less than 25 percent area cover of stones, boulders, or bedrock; (2) unconsolidated sediment composed of predominantly sand or mud; and (3) primarily intertidal water regimes (Cowardin et al., 1979). Note that a shoreline covered in vegetation (e.g., marsh) could still have a soft substrate foundation. Soft shores include beaches, tidal flats/deltas, and streambeds of the tidal riverine and estuarine systems.

Intermittent or intertidal channels of the riverine system and intertidal channels of the estuarine system are classified as streambed. Intertidal flats, also known as tidal flats or mudflats, consist of loose mud, silt, and fine sand with organic-mineral mixtures that are regularly exposed and flooded by the tides (Karleskint et al., 2006). Muddy and fine sediment tends to be deposited where wave energy is low, such as in sheltered bays and estuaries (Holland & Elmore, 2008). Mudflats are typically un-vegetated but may be covered with encrusting microscopic algae (e.g., diatoms) or sparsely vegetated with low-growing aquatic plants (e.g., seagrass). Muddy intertidal habitat occurs most often as part of a patchwork of intertidal habitats that may include rocky shores, tidal creeks, sandy beaches, and salt marshes. A flat area of unconsolidated sediment that is covered in aquatic plants could be considered an aquatic bed growing on soft shore habitat. While river deltas are created by soil deposits forming from the outflow of the water, such as at the mouth of the Mississippi River, tidal deltas are depositions of sediment left by the diurnal tides and their resulting currents. Therefore, tidal (or tide-dominated) deltas typically occur in locations of large tidal ranges or high tidal current speeds (SEPM Strata, 2013).

Beaches form through the interaction of waves and tides, as particles are sorted by size and deposited along the shoreline (Karleskint et al., 2006). Wide flat beaches with fine-grained sands occur where wave energy is limited. Narrow steep beaches of coarser sand form where energy and tidal ranges are high (Speybroeck et al., 2008). Three zones characterize beach habitats: (1) dry areas above the mean high water, (2) wrack lines (the area where seaweed and debris are deposited at high tide), and (3) a high-energy intertidal zone (area between high and low tide).

Intermediate Shores

Intermediate shores include all aquatic habitats with the following three characteristics: (1) substrates with at least 25 percent cover in particles smaller than stones, (2) predominantly gravel or cobble-sized unconsolidated substrate, and (3) primarily intertidal water regimes. These areas may or may not be stable enough for attached vegetation or invertebrates, depending on overlying hydrology and water quality. Note that a shoreline with vegetation (e.g., macroalgae, seagrass) could still have an intermediate substrate foundation.

Hardened Shores

Rocky shores include intertidal aquatic habitats characterized by bedrock, stones, or boulders that cover 75 percent or more of an area (Cowardin et al., 1979). Note that a shoreline covered in vegetation could still have a hard substrate foundation. Rocky intertidal shores are areas of bedrock occupying the area between high and low tide lines (Menge & Branch, 2001). Extensive rocky shorelines can be interspersed with sandy areas, estuaries, or river mouths.

Environmental gradients between hard shorelines and subtidal habitats are determined by wave action, depth, frequency of tidal inundation, and stability of substrate (Cowardin et al., 1979). Where wave energy is extreme, only rock outcrops may persist. In lower-energy areas, a mixture of rock sizes will occur in the intertidal zone. Intertidal rocky shores provide substrate for attached macroalgae and sessile invertebrates.

3.3.4.1.4.2 Distribution

Soft Shores

Tidal flats occur on a variety of scales in virtually all estuaries and bays in Southern California. About 82 percent of Southern California's coastline is sandy beach habitat (Allen & Pondella, 2006). The Study Area has extensive beaches (Figure 3.3-3), although few stretches are undisturbed by human activity (U.S. Department of Commerce et al., 2008).

Intermediate Shores

Intermediate intertidal habitats occur on the Channel Islands and along the mainland within the Study Area. The majority of intermediate shores occur in transitional areas between hard shores and soft shores. Intermediate shorelines also may occur at beaches where hard substrate underlies sand, and rocks become exposed during periods of shoreline erosion.

Hard Shores

In Southern California, rocky intertidal habitat is most extensive on the offshore Channel Islands (as shown in Figure 3.3-3). Hard shores are localized in distribution along the mainland of Southern California. In numerous locations within the PMSR Study Area, artificial hard substrates (e.g., rock riprap, seawalls) have been placed to reduce storm damage and erosion along shorelines and in estuaries.

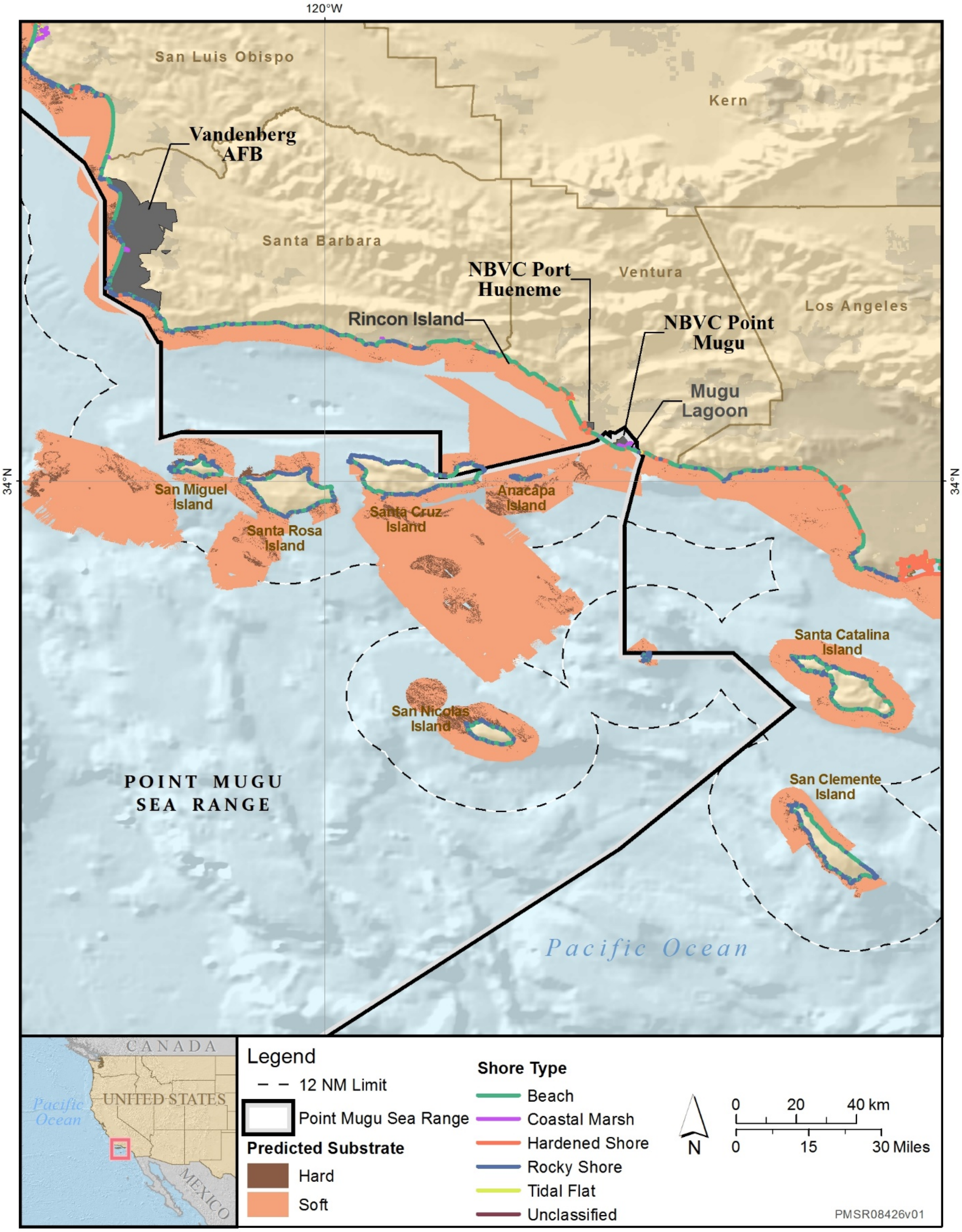

Figure 3.3-3: Map of Shore Types and Bottom Substrate Composition in the Point Mugu Sea Range Study Area

3.3.4.1.5 Bottom Habitats

3.3.4.1.5.1 Description

Soft Bottom

Soft bottoms include all aquatic habitats with the following three characteristics: (1) at least 25 percent cover of particles smaller than stones, (2) predominantly mud or sand unconsolidated sediment, and (3) primarily subtidal water regimes (Cowardin et al., 1979). Soft bottom forms the substrate of channels, shoals, subtidal flats, and other features of the bottom. Sandy channels emerge where strong currents connect estuarine and ocean water columns. Shoals or capes form where sand is deposited by interacting, sediment-laden currents. Subtidal flats occur between soft shores and channels or shoals. The continental shelf extends seaward of the shoals and inlet channels and includes relatively coarse-grained, soft bottom habitats. Relatively finer-grained sediments collect off the shelf break, continental slope, and abyssal plain. Organisms characteristic of soft bottom environments, such as worms and clams, may be found at all depths where there is sufficient oxygen and sediment accumulation (Nybakken, 1993).

Intermediate Bottom

Intermediate bottom includes all aquatic habitats with the following three characteristics: (1) substrates with at least 25 percent cover in particles smaller than stones, (2) predominantly gravel or cobble-sized unconsolidated substrate, and (3) primarily subtidal water regimes. These areas may or may not be stable enough for attached vegetation or sedentary invertebrates, depending on overlying hydrology and water quality.

Hard Bottom

Hard bottom includes all aquatic habitats with substrates having a surface of stones, boulders, or bedrock (75 percent or greater coverage) (Cowardin et al., 1979). Subtidal rocky habitat occurs as extensions of intertidal rocky shores and as isolated offshore outcrops. The shapes and textures of the larger rock assemblages and the fine details of cracks and crevices are determined by the type of rock, the wave energy, and other local variables (Davis, 2009). Maintenance of mostly low-relief hard bottom (e.g., bedrock) requires wave energy or currents sufficient to sweep sediment away (Lalli & Parsons, 1993) or offshore areas lacking a significant sediment supply; therefore, rocky reefs are rare on broad coastal plains near sediment-laden rivers and are more common on high-energy shores and beneath strong bottom currents, where sediments cannot accumulate.

In deep waters of the Pacific Ocean, there are also a number of chemosynthetic communities (cold seeps and thermal vents), which tend to support unique biotic communities. A cold seep, or cold vent, is an area of the ocean floor where chemical fluid seepage occurs. Cold seeps develop unique topography over time, where reactions between methane and seawater create carbonate rock formations and reefs. Cold seeps occur in association with multiple fault systems off Southern California. Hard substrate in the abyssal zone and some locations landward of the deep ocean are typically devoid of encrusting or attached organisms due to the scarcity of drifting food particles in the deep ocean (Nybakken, 1993).

3.3.4.1.5.2 Distribution

Soft and hard bottom habitats occur in the Study Area, as shown in Figure 3.3-3. However, the distribution of the two bottom types varies across the Study Area. Most of the bottom within the Study Area has not been extensively mapped (see Figure 3.3-3). The majority of the mapped Study Area consists of soft bottom with some hard bottom regions. It should be noted that percent of bottom area does not account for the vertical relief of some hard bottom areas, which contribute disproportionately to hard bottom community biomass.

Soft Bottom

Soft bottom is the dominant habitat type in the Study Area. However, only a small portion of bottom type is mapped reliably, and that portion tends to be nearshore. Some studies suggested that soft bottom habitat accounts for about 70–90 percent of the subtidal habitat (Allen & Pondella, 2006). Sandy sediments are common in nearshore and shelf break portions of the Study Area, while silt, clay, and mud sediments are common between the shelf break and nearshore sand sediments. Beaches are an important habitat at Point Mugu and make up over 85 percent of the mainland shoreline (U.S. Department of the Navy, 2016).

Intermediate Bottom

Intermediate habitat occurs at transitional areas where hard bottom near the shore gives way to the soft bottom habitat in the open ocean. Intermediate bottoms occur throughout the Study Area; however, there is no mapped intermediate bottom data available in the PMSR Study Area.

Hard Bottom

Hard bottom habitat includes rocky outcrops and ridges, banks, and seamounts and other areas of seafloor that are exposed because of ocean currents. Hard bottom habitats are localized off the Southern California coast, and the potential for transitional intermediate bottom habitats is as well. Less than 2 percent of the coastal seafloor in Southern California is composed of hard bottom habitat (California Department of Fish and Game, 2009). Shallow hard bottom communities are relatively uncommon and patchy in the Study Area. The distribution of hard bottom habitat in the Study Area has not been mapped extensively (see Figure 3.3-3) (Whitmire & Clarke, 2007). Hard bottoms are most common offshore of the Southern California portion of California near rocky headlands, along steep shelf areas, and near the shelf break and submarine canyons (Allen & Pondella, 2006).

3.3.4.1.6 Artificial Structures

3.3.4.1.6.1 Description

Artificial habitats in the Study Area include artificial reefs and shipwrecks and are shown in Figure 3.3-4. Artificial reefs are designed and deployed to supplement the ecological services provided by coral or rocky reefs. Artificial reefs range from simple concrete blocks to highly engineered structures. Vessels that are unintentionally sunk in the Study Area may be colonized by encrusting and attached marine organisms if there is a larval source and enough nutrition (e.g., detritus) drifting through the water column. Wrecks in the abyssal zone and some locations landward of the deep ocean are typically devoid of encrusting or attached organisms due to the scarcity of drifting food particles in the deep ocean (Nybakken, 1993).

Man-made structures that are either deliberately or unintentionally submerged underwater create artificial habitats that mimic some characteristics of natural habitats, such as providing hard substrate and vertical relief (Broughton, 2012). Artificial reef habitats have been intentionally created with material from sunken ships, rock and stone, concrete and rubble, car bodies, tires, scrap metal, and various other materials. Artificial habitats also have been created as a result of structures built for other purposes (e.g., breakwaters, jetties, piers, wharves, bridges, oil and gas platforms, fish aggregating devices) or unintentional sinking of vessels (i.e., shipwrecks).

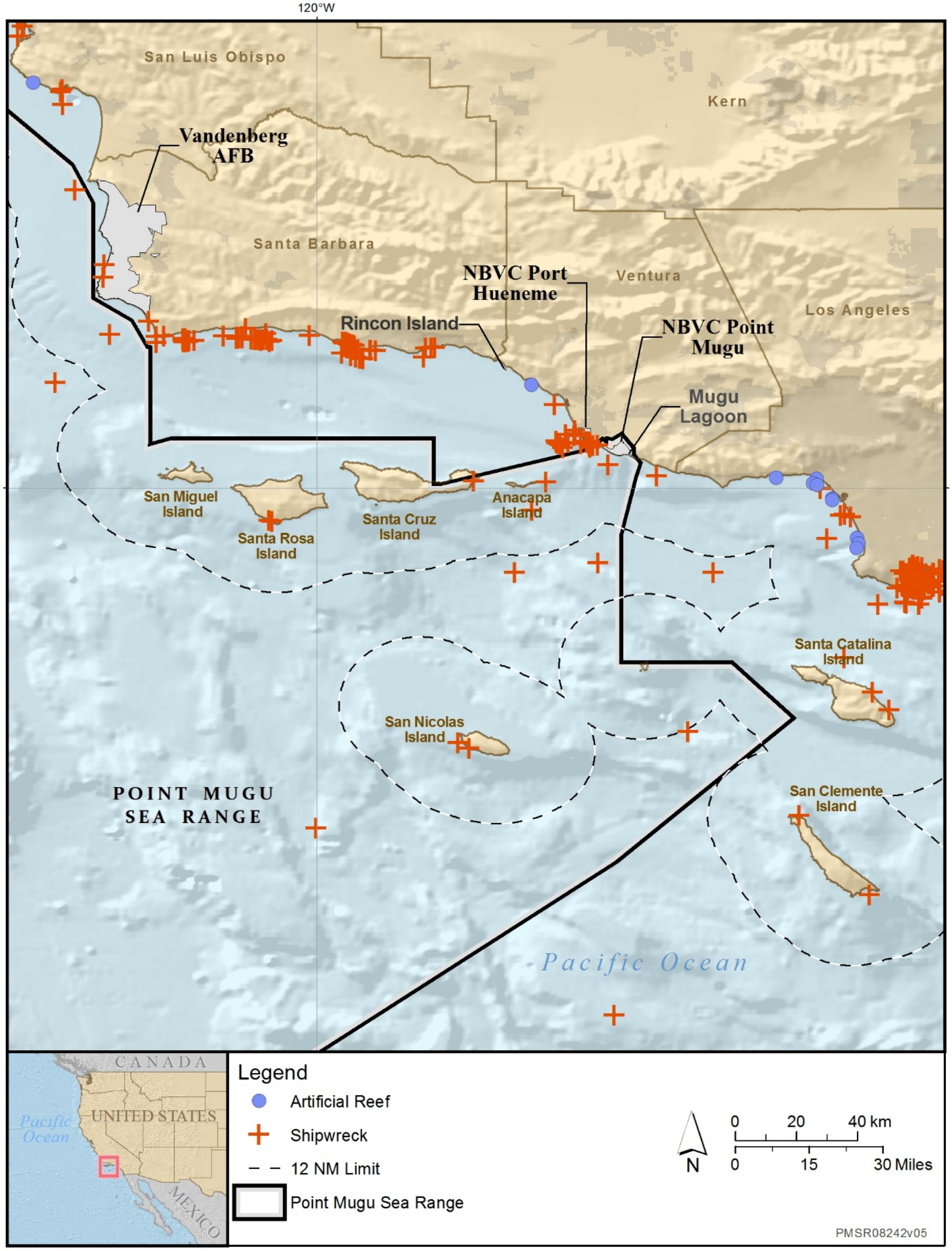

Figure 3.3-4: Map of Artificial Structures and Shipwrecks in the Point Mugu Sea Range Study Area

Some artificial structures provide ecological functions similar to natural hard bottom habitats, such as providing attachment substrate for algae and sessile invertebrates, which in turn supports a community of mobile organisms that may forage, shelter, and reproduce there (National Oceanic and Atmospheric Administration, 2007). Other structures may or may not support sessile organisms and only temporarily attract mobile organisms. Factors such as the materials, structural features, and surface area of the artificial structure, as well as local environmental conditions, influence the variety and abundance of sessile organisms that may become established and the relative success of attracting or enhancing local fish populations (Ajemian et al., 2015; Broughton, 2012; Macreadie et al., 2011; Powers et al., 2003; Ross et al., 2016).

3.3.4.1.6.2 Distribution

Artificial shoreline structures (e.g., piers, docks) in the Study Area occur at or along pierside locations (Section 1.2.3, Naval Base Ventura County Range Areas and Facilities), including facilities associated with Navy. The centroid points of mapped artificial structures in waters of the Study Area are depicted on Figure 3.3-4. Fifteen shipwrecks fall within the Study Area. Not shown on Figure 3.3-4 are shipwrecks that are “address restricted” due to status on the National Register of Historic Places and ship hulks sunk during Naval sinking exercises (U.S. Department of the Navy, 2018b). Artificial reefs occur along the shoreline near the Study Area; however, none occur within the Study Area bounds.

Some of the known shipwrecks within the Study Area are the Pan Pacific, San Francisco, San Giuseppe, Southland, Reaper, Amber Rose, Berkley, Chickasaw, Los Angeles, Louisa, and other unknown or unnamed wrecks. These ships include cargo ships, oil screws, steam schooners, and other unknown ship types (California State Lands Commission, 2018).

Most artificial reefs in marine waters have been placed and monitored by individual state programs; national and state databases of artificial reefs are not available (National Oceanic and Atmospheric Administration, 2007). A 2001 report identified more than 100 artificial reefs in Southern California (California Department of Fish and Game, 2001b), including some offshore Atascadero, San Luis Obispo, Pitas Point, and other areas near the Study Area (California Department of Fish and Game, 2001a, 2001b). In addition to deploying reefs to enhance fish habitat, California has constructed some artificial reefs specifically to replace or enhance degraded rocky reef and kelp habitat (California Department of Fish and Game, 2009). Artificial reefs near the Study Area, such as those offshore Pitas Point, successfully support and provide habitat for mature kelp forests (California Department of Fish and Game, 2009).

There are 19 offshore oil and gas agreements in California state waters, but only four offshore oil platforms within California state waters (California State Lands Commission, 2015). These platforms are located offshore of Orange County and Santa Barbara County. Bordering the Study Area, they act as artificial reefs close to the shoreline. Rincon Island is a small oil and gas production platform consisting of approximately 1,500 acres of tidal and submerged habitat off the coast of Ventura County (see Figure 3.3-4). The lease for this facility was terminated in 2017 and is in the process of being decommissioned (California State Lands Commission, 2017).

3.3.4.1.7 General Threats

Estuarine and ocean environments worldwide are under pressure from a variety of human activities, such as coastal development, shoreline stabilization, dredging, flood control, and water diversion; the input of pollution and marine debris; destructive fishing practices; offshore energy and resource development and extraction; and global climate change (Boehlert & Gill, 2010; Clark et al., 2016; Clarke et al., 2014; Crain et al., 2009; National Oceanic and Atmospheric Administration Marine Debris Program, 2016). These activities produce a range of physical and chemical stressors on habitats. Primary threats to marine habitats include habitat loss, degradation, or modification. Although stressors may be similar or widespread geographically, their effects on marine habitats are not random or equal. Human activities vary in their spatial distribution and intensity of impact (Halpern et al., 2008). Accordingly, their effects on habitats will vary depending on local differences in the duration, frequency, and intensity of stress; scale of effect; and environmental conditions. Areas where heavy concentrations of human activity co-occur with naval testing and training activities have the greatest potential for cumulative stress on the marine ecosystem (see Chapter 4, Cumulative Impacts, for more information).

3.3.4.1.7.1 Urbanization

Habitat loss and degradation are the primary threats of urbanization. Coastal development has resulted in loss of coastal dune and wetland habitats, modification of shorelines and estuaries, and degradation of water quality (Crain et al., 2009; Lotze et al., 2006). In addition, development has resulted in a proliferation of artificial structure habitats, such as breakwaters, jetties, rock groins, seawalls, oil and gas platforms, docks, piers, wharves, and underwater cables and pipelines, as well as artificial reefs.

Maintenance of coastal infrastructure, ports, and harbors disturbs or modifies intertidal and subtidal habitats, the extent of which varies depending on the type, scale, or frequency of the activity. For example, maintenance has increased the use of shoreline stabilization measures (engineered structures, beach nourishment) to reduce storm-related damages to coastal infrastructure. Flood control or shoreline stabilization measures may have temporary or long-term impacts on beach habitats and may also affect adjacent intertidal and subtidal habitats due to suspended sediment and sedimentation, altered sediment supply and transport dynamics, or creation of artificial substrates (Bacchiocchi & Airoldi, 2003). Periodic dredging and excavation of sediment is undertaken to maintain navigable channels, tidal exchange, or flood control capacity in bays and estuaries. Sediment removal directly disturbs subtidal soft bottom habitat and may indirectly disturb or modify adjacent habitats (Newell et al., 1998). A number of factors may influence maintenance frequency, including sediment characteristics, shoreline and watershed characteristics, oceanographic conditions, and climate.

Tourism is an important economic driver of development in coastal areas and represents an additional stressor in urbanized areas. Within the highly urbanized portion of the Study Area, human visitation and disturbances impact rocky intertidal (trampling, overturning of rocks, collecting) and sandy beach (mechanical beach grooming) habitats (Dugan et al., 2003; Garcia & Smith, 2014; Murray et al., 1999).

3.3.4.1.7.2 Water Quality

Pollution of marine waters and the accumulation of contaminants in marine sediments pose threats to marine ecosystems, public health, and local economies of coastal regions (Crain et al., 2009). Marine and estuarine water and sediment quality may be influenced by industrial and wastewater discharges, soil erosion, stormwater runoff, vessel discharges, marine construction, and accidental spills. Activities that disturb or remove marine sediments also impact water quality and may alter physical and chemical properties of sediments at and adjacent to the disturbance due to sediment resuspension and sedimentation. Generally, threats to water and sediment quality are greater in waterbodies adjacent to watersheds with substantial urban or agriculture land uses. For more detailed discussion of water quality and potential impacts, see Section 3.2 (Sediments and Water Quality).

3.3.4.1.7.3 Commercial Industries

A variety of commercial development, operations, and activities impact marine habitats and associated organisms (e.g., oil/gas development, telecommunications infrastructure, steam and nuclear power plants, desalinization plants, alternative energy development, shipping and cruise vessels, commercial fishing, aquaculture, and tourism operations) (Crain et al., 2009). Commercial activities are conducted under permits and regulations that require companies to avoid and minimize impacts on marine habitats, especially sensitive hard bottom and biogenic habitats (e.g., coral reefs, shellfish beds, and vegetated habitats).

Marine habitats may be directly impacted during marine construction (e.g., cable laying and burial, dredging, pipeline installation, pile driving, work boat anchoring), commercial bottom fishing, and commercial vessel anchoring. Generally, disturbance impacts on soft bottom habitats are temporary; however, there is the potential to degrade the quality of soft bottom habitat for biological resources depending on the extent and frequency of disturbance (Newell et al., 1998). Hard bottom and biogenic habitats are most vulnerable to damage or degradation by commercial industry development and operations. For example, anchors, anchor chains, or cables may damage habitats and abrade and remove organisms from hard bottom surfaces. Commercial fishing use of dredges and bottom trawls impacts bottom topography and sediments and may degrade habitat quality and associated biological communities (Clark et al., 2016). Abandoned or lost fishing gear may alter the structure of abiotic habitats and result in abrasion or entanglement of organisms.

Indirect impacts on habitats may occur from commercial development, discharges, or accidental spills that degrade water or sediment quality. For example, a large artificial reef was constructed off Southern California to partially mitigate impacts on hard bottom and vegetated habitats from cooling water discharges from a nearby nuclear generating station (Reed et al., 2010). Threats associated with impacts on water and sediment quality are further described in Section 3.3.4 (Affected Environment). Accidental spills have the potential to contaminate and degrade marine habitats by coating hard bottom or biogenic substrates as well as mixing into bottom sediments (Hanson et al., 2003). Many factors determine the degree of environmental damage from oil spills, including the type of oil, size and duration of the spill, geographic location, season, and types of habitats and resources present. Effects of oil on bottom habitats include potential long-term impacts on fish and wildlife populations.

3.3.4.1.7.4 Climate Change

All marine ecosystems are vulnerable to the widespread effects of climate change, which include increased ocean temperatures, sea level rise, ocean acidification, and changes in precipitation patterns (Hoegh-Guldberg & Bruno, 2010; Scavia et al., 2002). Rising ocean temperatures will cause waters to expand and ice caps to melt, driving sea levels to rise at various rates depending on geographic location and local environmental conditions. Sea level rise will have the greatest impacts on intertidal and coastal ecosystems that have narrow windows of tolerance to flooding frequency or depth (Crain et al., 2009). Changes in ocean temperatures also are projected to alter ocean circulation, upwelling, and nutrient distribution patterns. It is projected that wet tropical areas and mid-latitude land will experience more frequent and extreme precipitation, which will increase erosion-related sedimentation and runoff to coastal habitats (Keener et al., 2012). The climatic effects will be superimposed upon, and interact with, a wide array of current stresses, including excess nutrient loads, overfishing, invasive species, habitat destruction, and chemical contamination (Scavia et al., 2002).

Southern California beaches and rocky intertidal habitats are particularly vulnerable to sea level rise because development infrastructure limits shoreline retreat along much of the urbanized coastline

(Messner et al., 2013). Potential climate change impacts on biogenic habitats are discussed in Section 3.4 (Marine Vegetation) and Section 3.5 (Marine Invertebrates).

3.3.4.1.7.5 Marine Debris

In the past decade, marine debris has been increasingly recognized as a key threat to marine ecosystems throughout the world. The Marine Debris Act (33 U.S.C. 1951 et seq.) defines marine debris as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment. Artificial substrate that provides hard bottom habitat for marine organisms is discussed in Section 3.5 (Marine Invertebrates). This section focuses on the aspects of marine debris that pose a threat to marine habitats. The accumulation of marine debris can alter and degrade marine habitats through physical damage (e.g., abrasion, shearing); changes to the physical and chemical composition of sediments; and reductions in oxygen and underwater light levels (National Oceanic and Atmospheric Administration Marine Debris Program, 2016). Accumulation or concentration also can degrade the aesthetic appeal of coastal habitats for recreational use, decrease visitation and tourism, require costly cleanups, and impact local economies (Leggett et al., 2014).

3.3.5 Environmental Consequences

The Navy considered all potential stressors and their potential impact on marine habitats. The following stressor category has been analyzed for marine habitats: physical disturbance and strike. 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 habitats in the Study Area. Table 3.3-2 presents the proposed testing and training activities and stressors that could potentially affect marine habitats. The only stressor analyzed for marine habitats is physical disturbance and strikes from military expended materials. Military expended materials that may cause physical disturbance or strike include (1) all sizes of non-explosive practice munitions, (2) fragments from high-explosive munitions, (3) expendable targets, and (4) expended materials other than munitions.

Other stressors, such as acoustic, explosives, entanglement, and ingestion, were analyzed in several previous Navy environmental documents (U.S. Department of the Navy, 2018a, 2018c) and determined to not be applicable because they do not apply to marine habitats. A summary of potential impacts on essential fish habitat from proposed testing and training activities is presented in Chapter 6 (Other Regulatory Considerations).

Table 3.3-2: Summary of Stressors Analyzed for Marine Habitats from Testing and Training Activities Within the PMSR

Activity	*Stressor*	*Potential Impacts*
Air-to-Air	Physical Disturbance/Strike (military expended material)	Military expended materials from testing and training with aerial or surface targets and ordnance could impact marine habitats as they come into contact with the seafloor.
Air-to-Surface		
Surface-to-Surface		
Surface-to-Air		
Subsurface-to-Surface		

3.3.5.1 No Action Alternative

Under the No Action Alternative, proposed testing and training activities would not occur within the PMSR. Other military activities not associated with this Proposed Action would continue to occur. Physical disturbance and strike 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 habitat, but would not measurably improve the overall distribution or quality of marine habitat.

3.3.5.2 Alternative 1 (Preferred Alternative)

A comparison of operational tempo proposed for each alternative, and proposed types and level of activities, are provided in Section 2.2 (Proposed Action). Under Alternative 1, the amount of military expended materials associated with testing and training activities that have a potential physical disturbance and strike risk to marine habitat would increase compared to current environmental baseline conditions (see Table 3.0-12). As shown in Table D-4 under Alternative 1 for the total impact area in Appendix D (Military Expended Material and Direct Strike Impact Analyses), approximately 0.73 acres of seafloor habitat within the PMSR Study Area (36,000 square miles [approximately 23 million acres] of controlled sea and associated airspace), much less than 1 percent of the total area, would be potentially impacted by military expended material proposed for use during testing and training activities in a single year. This is an increase over the current environmental baseline.

The potential for military expended materials to physically impact marine substrates as they come into contact with the seafloor depends on several factors. These factors include, but are not limited to, the size, shape, type, density, and speed of the material through the water column; the amount of the material expended; the frequency of testing and training; water depth, water currents, or other disturbances; and the type of substrate. Most of the kinetic energy of the expended material, however, is dissipated within the first few feet of the object entering the water, causing it to slow considerably by the time it reaches the substrate. Because the damage caused by a strike is proportional to the force of the strike, slower speeds result in lesser impacts. Due to the water depth at which most testing and training events take place, a direct strike on either hard bottom or artificial structures (e.g., artificial reefs and shipwrecks) is unlikely to occur with sufficient force to damage the substrate. In softer substrates (e.g., sand, mud, silt, clay, and composites), the impact of the expended material coming into contact with the seafloor, if large enough and striking with sufficient momentum, may result in a depression and a localized redistribution of sediments as they are temporarily suspended in the water column. There may also be redistribution of unconsolidated sediment in areas with sufficient flow to move the sediment, creating a pattern of scouring on one side of the material and deposition on the other.

Under Alternative 1, military expended materials associated with testing and training activities are not likely to result in the degradation or loss of habitat in the Study Area. Much of the Study Area encompasses sandy bottom and rocky substrate that is not considered “sensitive” and would not be affected by military expended materials. Therefore, impacts on marine habitats under Alternative 1 would be less than significant.

3.3.5.3 Alternative 2

A comparison of operational tempo proposed for each alternative, and proposed types and level of activities, are provided in Section 2.2 (Proposed Action).

Under Alternative 2, the amount of military expended materials associated with testing and training activities that have a potential physical disturbance and strike risk to marine habitat would decrease compared to Alternative 1, but increase compared to the current environmental baseline conditions (see Table 3.0-12). As shown in Table D-4 under Alternative 2 for the total impact area in Appendix D (Military Expended Material and Direct Strike Impact Analyses), approximately 0.32 acre of seafloor habitat within the PMSR Study Area (36,000 square miles [approximately 23 million acres] of controlled sea and associated airspace), much less than 1 percent of the total area, would be potentially impacted by military expended material proposed for use during testing and training activities in a single year. This is less than the amount of habitat impacted under Alternative 1 and represents an increase over the current environmental baseline.

As described above for Alternative 1, military expended materials associated with testing and training activities are not likely to result in the degradation or loss of habitat in the Study Area. Much of the Study Area encompasses sandy bottom and rocky substrate that is not considered “sensitive” and would not be affected by military expended materials. Therefore, impacts on marine habitats under Alternative 2 would be less than significant.

3.3.5.4 Indirect Effects

As discussed in Section 3.3.4 (Affected Environment), indirect impacts on marine habitat may occur from sediment removal that may indirectly disturb or modify adjacent habitats; commercial development, discharges, or accidental spills that degrade water or sediment quality; accumulation of marine debris that physically alter the habitat or degrade its aesthetic qualities for tourists; and disturbance of the water column by vessels, in-water devices, or towed in-water devices temporarily increasing the local turbidity. Other secondary stressors (i.e., impacts on habitat or prey) are not applicable to habitats as they are not susceptible to impacts from secondary stressors and are not analyzed further in this section.

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