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Point Mugu Sea Range
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3.4 Marine Vegetation

3.4.1 Introduction

This section analyzes potential impacts on marine vegetation found in the Point Mugu Sea Range (PMSR) Study Area (Study Area), along with an introduction to the marine vegetation that occurs in the Study Area. The following subsections describe marine vegetation in greater detail (Section 3.4.4, Affected Environment) and evaluate the potential impacts of project activities on marine vegetation (Section 3.4.5, Environmental Consequences).

Vegetation includes diverse taxonomic/ecological groups of marine algae throughout the Study Area, as well as flowering plants in the coastal and inland waters. For this Environmental Impact Statement/Overseas Environmental Impact Statement analysis, vegetation has been divided into groups that encompass taxonomic categories, distributions, and ecological relationships. These groups include blue-green algae (phylum Cyanobacteria), dinoflagellates (phylum Dinophyta), green algae (phylum Chlorophyta), coccolithophores (phylum Haptophyta), diatoms (phylum Ochrephyta), brown algae (phylum Phaeophyta), red algae (phylum Rhodophyta), and vascular plants (phylums Tracheophyta and Spermatophyte).

The types of vegetation present in the Study Area are described in this section, the affected environmental baseline is discussed in Section 3.4.4 (Affected Environment), and the analysis of environmental consequences is presented in Section 3.4.5 (Environmental Consequences). The distribution and condition of offshore abiotic (non-living) substrates necessary for attached macroalgae and rooted vascular plants (e.g., seagrasses), and the impact of stressors on those substrates, are described in Section 3.3 (Marine Habitats).

3.4.2 Region of Influence

The region of influence for marine vegetation consists of the PMSR, Point Mugu (Mugu Lagoon and sandy beaches/nearshore environment), and the intertidal and nearshore subtidal areas surrounding San Nicolas Island (SNI). While Navy support boats and surface targets transit in and out of Port Hueneme to the PMSR, marine vegetation within the port are not addressed further because vessel transits would not affect marine vegetation within Port Hueneme.

3.4.3 Approach to Analysis

The primary factor used to assess significance of impacts on marine vegetation includes the extent or degree to which implementation of an alternative would result in the loss or degradation of marine vegetation. In addition, the analysis will assess potential impacts on sensitive marine vegetation such as eelgrass or kelp. “Sensitive” species are those that are rare; protected by federal or state statutes or regulations; or have recognized commercial, recreational, or scientific importance. The analysis of potential impacts on marine vegetation from each alternative is presented in Section 3.4.5 (Environmental Consequences).

3.4.4 Affected Environment

This section provides brief summaries of habitat use and general threats that affect or have the potential to affect natural communities of vegetation within the Study Area.

3.4.4.1 General Background

3.4.4.1.1 Habitat Use

Factors that influence the distribution and abundance of vegetation in the coastal and open ocean areas of the Study Area are the availability of light and nutrients, water quality, water clarity, salinity level, seafloor type (important for rooted or attached vegetation), storms and currents, tidal schedule, temperature, and grazing by herbivores (Green & Short, 2003).

Marine ecosystems depend almost entirely on the energy produced by marine vegetation through photosynthesis (Castro & Huber, 2000), which is the transformation of the sun's energy into chemical energy. In the photic zone of the open-ocean and coastal waters, marine algae and flowering plants have the potential to provide oxygen and habitat for many organisms in addition to forming the base of the marine food web (Dawes, 1998).

The affected environment comprises two major ecosystem types, the open ocean and coastal waters; and two major habitat types, the water column and bottom (benthic) habitat. Vegetation grows only in the sunlit portions of the open ocean and coastal waters, referred to as the "photic" or "euphotic" zone, which extends to maximum depths of roughly 660 feet (ft.) (200 meters [m]). Because depth in most of the open ocean exceeds the euphotic zone, benthic habitat for vegetation is limited primarily to the coastal waters.

The euphotic zones of the water column in the Study Area are inhabited by phytoplankton, single-celled (sometimes filamentous or chain forming), free-floating algae primarily of four groups, including diatoms, blue-green algae, dinoflagellates, and coccolithophores. Microscopic algae can grow down to depths with only 1 percent of surface light penetration (Nybakken, 1993). These important groups are summarized below (Levinton, 2009):

- Diatoms dominate the phytoplankton at high latitudes. They are single-celled organisms with shells made of silica, which sometimes form chains of cells.
- Blue-green algae (which are photosynthetic bacteria) are found in and may dominate nearshore waters of restricted circulation or brackish (low salinity) waters as well as the open ocean. Blue-green algae convert atmospheric nitrogen to ammonia, which can then be taken up by marine vascular plants and animals.
- Dinoflagellates are covered with cellulose plates and dominate the phytoplankton at low latitudes year-round and at higher latitudes in summer and autumn. Rapid population increases in dinoflagellates can result in "red tides" and "harmful algal blooms." Toxins produced by some dinoflagellates accumulate in the animals that consume them and can cause poisoning among the higher-level human and marine mammal consumers.
- Coccolithophores are nearly spherical and secrete a skeleton of calcium carbonate plates. They can be dominant in the phytoplankton from tropical to sub-polar seas. They account for approximately one-third of calcium carbonate production in the entire ocean.

Other types of algae that can also be abundant in the phytoplankton, although usually less so than the four groups above, include silicoflagellates, green algae, and cryptomonad flagellates (Levinton, 2013).

Vascular plants in the Study Area include seagrasses, cordgrasses, all of which have more limited distributions than algae (which are non-vascular), and typically occur in intertidal or shallow (< 40 ft.) subtidal waters (Green & Short, 2003). The relative distribution of seagrasses is influenced by the availability of suitable substrate occurring in low-wave energy areas at depths that allow sufficient light exposure for growth. Seagrasses as a rule require more light than algae, generally 15–25 percent of surface incident light (Fonseca et al., 1998; Green & Short, 2003). Seagrass species distribution is also influenced by water temperatures (Spalding et al., 2003).

Emergent wetland vegetation of the Study Area is typically dominated by cordgrasses (*Spartina foliosa*), which form dense colonies in salt marshes in some temperate areas, as well as some eelgrass (*Zostera* spp.) (Section 3.4.4.2.4, Seagrasses and Cordgrasses [Phylum Spermatophyta]). These areas tend to be wherever the sediment is adequate to support plant root development in protected, low-energy environments on soft substrate; as well as along the intertidal portions of coastal lagoons, tidal creeks or rivers, or estuaries (Mitsch et al., 2009).

Marine vegetation along the California coast is represented by more than 700 species and varieties of seaweeds (such as corallines and other red algae, brown algae including kelp, and green algae), seagrasses (Leet et al., 2001; Wyllie-Echeverria & Ackerman, 2003), and canopy-forming kelp species (Wilson, 2002) (Table 3.4-1).

Table 3.4-1: Major Groups of Vegetation in the Study Area

Marine Vegetation Groups		***Vertical Distribution in the Study Area[2]***		
Common Name[1] (Taxonomic Group)	***Description***	***Open Ocean***	***Coastal Waters***	***Bays and Harbors***
Green algae (phylum Chlorophyta)	May occur as single-celled algae, filaments, and seaweeds	Sea surface, water column	Water column, bottom	Water column, bottom
Brown algae (phylum Phaeophyta [Ochrophyta])	Brown algae are large multi-celled seaweeds that form extensive canopies, providing habitat and food for many marine species.	Water column	Water column, bottom	Water column, bottom
Red algae (phylum Rhodophyta)	Single-celled algae and multi-celled large seaweeds; some form calcium deposits	Water column	Water column, bottom	Water column, bottom
Vascular plants (phylum Spermatophyta)	Includes seagrasses, cordgrass, and other rooted aquatic and wetland plants in marine and estuarine environments, providing food and habitat for many species	None	Bottom	Bottom

[1]Taxonomic groups are based on Roskov et al. (2015); Ruggiero and Gordon (2015); and the Integrated Taxonomic Information System. Alternative classifications are in brackets [ ]. Phylum and division may be used interchangeably.
[2]Vertical distribution in the Study Area is characterized by an open-ocean oceanographic feature (North Pacific Transition Zone) or by coastal waters of a large marine ecosystem (California Current).

3.4.4.1.2 General Threats

Environmental stressors on marine vegetation are products of human activities (e.g., industrial, residential, and recreational activities) and natural occurrences (e.g., sea level rise, storms, surf, and tides).

Human-made stressors that act on marine vegetation include excessive nutrient input (such as fertilizers), siltation (the addition of fine particles to the ocean), pollution (e.g., oil, sewage, trash) (Mearns et al., 2011), climate change (Arnold et al., 2012; Doney et al., 2012; Martinez et al., 2012; Olsen et al., 2012), fishing practices (Mitsch et al., 2009; Steneck et al., 2002), shading from structures (National Marine Fisheries Service, 2002), harvesting (Wilson, 2002), habitat degradation from construction and dredging, and introduced or invasive species (Hemminga & Duarte, 2000; Spalding et al., 2003). The seagrass and cordgrass taxonomic group is often more sensitive to stressors than the algal taxonomic groups. The great diversity of algae makes generalization difficult, but overall, algae are resilient and colonize disturbed environments created by stressors (Levinton, 2009).

Marine algae and vascular plants are important ecologically and economically, providing an important source of food, essential ecosystem services (e.g., coastal protection, nutrient recycling, food for other animals, and habitat formation), and income from tourism and commercial fisheries (Spalding et al., 2001).

3.4.4.1.2.1 Water Quality

Water quality in the Study Area may be impacted by the introduction of harmful contaminants from diverse sources unrelated to either action alternative (see Section 3.2, Sediments and Water Quality). Common ocean pollutants include toxic compounds such as metals, pesticides, herbicides, and other organic chemicals; excess nutrients from fertilizers and sewage; and detergents, oil, plastics, and other solids. Coastal pollution and agricultural runoff may cause rapid population increases in dinoflagellates known as harmful algal blooms and toxic red tide events in the Study Area (Hayes et al., 2007). Toxins produced by some dinoflagellates accumulate in the animals that consume them and can cause poisoning among the higher-level human and marine mammal consumers. Coastal development and pollution, particularly storm water runoff and point source discharges, affect water quality of bays and coastal areas throughout the world. Depending on the proximity to and nature of the discharge, sediment and water quality may be degraded, which in turn can impact marine vegetation communities. Erosion and sedimentation may also affect sediment and water quality of coastal areas during storm runoff from urban streets into rivers and streams.

Oil in runoff from land-based sources, natural seeps, and accidental spills (such as offshore drilling and oil tanker leaks) are some of the major sources of oil pollution in the marine environment (Levinton, 2009). The type and amount of oil spilled, weather conditions, season, location, oceanographic conditions, and the method used to remove the oil (containment or chemical dispersants) are some of the factors that determine the severity of the impacts. Sensitivity to oil varies among species and within species, depending on the life stage; generally, early life stages are more sensitive than adult stages (Hayes et al., 1992). The tolerance to oil pollutants varies among the types of marine vegetation, but their exposure to sources of oil pollutants makes them all vulnerable.

Oil pollution, as well as chemical dispersants used in response to oil spills, can impact seagrasses directly by smothering the individuals, or indirectly by lowering their ability to combat disease and other stressors (U.S. National Response Team, 2010). Seagrasses that are totally submerged are less susceptible to oil spills since they largely escape direct contact with the pollutant. Depending on various factors, oil spills can result in a range of effects from no impact to long-lasting impacts, such as decreases in eelgrass density (Kenworthy et al., 1993; Peterson, 2001). Algae are relatively resilient to oil spills. Contact with oil can cause death, leaf loss, and failure to germinate (Hoff et al., 2002). Salt marshes can also be severely impacted by oil spills, with long-term effects (Culbertson et al., 2008).

3.4.4.1.2.2 Commercial Industries

As described in Chapter 3 (Affected Environment and Environmental Consequences), large-scale harvesting of kelp beds occurred historically along the California coast, but no longer occurs. Small-scale commercial operations, however, continue to harvest kelp, primarily for abalone feed (Wilson, 2002). The California Department of Fish and Wildlife, which issues exclusive leases to harvest-designated beds for up to 20 years, manages kelp harvesting. Although they are not limited in the amount, California regulations prohibit commercial harvesters from cutting attached *Macrocystis pyrifera* and *Nereocystis luetkeana* (giant and bull kelp) from deeper than 4 ft. (1.2 m) below the water's surface (14 California Code of Regulations 165[c][2]), which protects the reproductive structures at the kelp's base and allows vegetative re-growth (Wilson, 2002).

3.4.4.1.2.3 Disease and Parasites

Marine algae and vascular plants may be susceptible to disease caused by other marine organisms, which may impact individuals or populations. In particular, eelgrass is vulnerable to a wasting disease caused by a marine pathogen that has caused devastating population loss in the past (Ralph & Short, 2002). Certain species of microscopic algae (e.g., dinoflagellates and diatoms) can form algal blooms, which can pose serious threats to human health and wildlife species. Harmful algal blooms can deplete oxygen within the water column and block sunlight that other organisms need to live, and some algae within algal blooms release toxins that are dangerous to human and ecological health (Center for Disease Control and Prevention, 2004). These algal blooms have a negative economic impact of hundreds of millions of dollars annually worldwide (National Centers for Coastal Ocean Science, 2010). Additional information on harmful algal blooms can be accessed on the Centers for Disease Control and the National Oceanic and Atmospheric Administration websites. There are no parasites in the Study Area that affect marine vegetation.

3.4.4.1.2.4 Invasive Species

Invasive vegetation species are present throughout the Study Area. *Caulerpa taxifolia* and *Codium fragile tomentosoide* are invasive green algal species found in some areas of Southern California (Dobroski et al., 2015; Gagnon et al., 2015). In addition, *Sargassum muticum* (Japanese wireweed) and *Sargassum horneri* (devil weed) are invasive brown algal species found in Southern California (Dobroski et al., 2015; Marks et al., 2015). *Sargassum muticum* was introduced from the Sea of Japan and now occupies portions of the California coast (Dobroski et al., 2015; Monterey Bay Aquarium Research Institute, 2009). *Sargassum horneri* is native to western Japan and Korea. Since *Sargassum horneri* was first discovered in Long Beach Harbor in 2003, the species continues to increase its spatial extent and can now be found near harbors and anchorages from Santa Barbara, California, to Isla Natividad in Baja California (Mexico) (Marks et al., 2015). Specifically, *Sargassum horneri* was detected in Southern California in 2003. It has spread rapidly throughout California and has been documented at several of the Channel Islands (U.S. Department of the Navy, 2015). Both species of Sargassum have been documented in intertidal areas on SNI (Graham et al., 2016).

Other invasive algae in the Study Area includes *Undaria pinnatifida* (or wakame), which is an edible seaweed native to Japan and found along the California coast (Dobroski et al., 2015; Global Invasive

Species Database, 2005). This species was recorded on docks and hulls of docked vessels in Port Hueneme Harbor in May 2008 (Merkel & Associates Inc., 2008). They primarily occur in harbors but have also been found in open coast sites. This rapid and uncontrolled spread has ecological and economic consequences that will require further research (Kaplanis et al., 2016).

The invasive alga, *Caulerpa taxifolia*, was discovered in San Diego County's Agua Hedionda Lagoon in 2000, and subsequently in Huntington Harbor (Los Angeles Regional Water Quality Control Board, 2018). *Caulerpa* surveys of Port Hueneme were conducted in 2006 and 2008, with no recorded occurrence of *caulerpa* in the harbor (Merkel & Associates Inc., 2008).

3.4.4.1.2.5 Climate Change

The impacts of anthropogenically induced climate change on the marine environments include rising sea levels, ocean acidification, increased sea temperature, and an increase in severe weather events. All of these changes may have impacts on vegetation in the Study Area.

Rising sea levels will alter the amount of sunlight reaching various areas, which may decrease the photosynthetic capabilities of vegetation in those areas. However, the fast growth and resilient nature of vegetation may enable most species to adapt to these changes (Harley et al., 2006). Increased sea temperature may lead to several impacts that could affect vegetation. Warmer waters may lead to a greater stratification in the water column, which may support harmful algal blooms (Lehmköster, 2015). The stratification may also inhibit upwelling, as seen during El Niño events, which would prevent nutrients from circulating to the surface (Lehmköster, 2015). Additionally, increased sea temperatures may lead to changes in the composition of vegetation communities (Schiel et al., 2004). These changes in community composition could impact biological interactions. Increases in severe weather events may lead to increased erosion and sedimentation in the marine environments and higher energy wave action that could increase impacts on vegetation by physical disturbance, such as marine vascular plants becoming unrooted.

Vegetation is susceptible to water quality changes from erosion and disturbances from storm events. Increased storm events are expected to impact species diversity in kelp ecosystems (Byrnes et al., 2011). The impacts of ocean acidification on vegetation are poorly understood (Harley et al., 2006). Ocean acidification may impact the ecological function of coralline algae by decreasing habitat-forming capabilities (Ragazzola et al., 2016).

3.4.4.1.2.6 Marine Debris

Marine debris (especially plastics) is a threat to many marine ecosystems, particularly in coastal waters adjacent to urban development. Microplastics (generally considered to be particles less than 5 millimeters in size), which may consist of degraded fragments of larger plastic items or intentionally manufactured items (e.g., abrasive plastic beads found in some personal care products or used in blast-cleaning), are of concern because of their durability, long lifespan, and potential to enter marine food webs (Setala et al., 2016). Marine debris may injure marine vegetation if it is large and is pulled around by tidal influences and currents (Gregory, 2009). Refer to Section 3.2 (Sediments and Water Quality) for a more detailed discussion of marine debris and the associated effects on water quality.

Marine debris, including large amounts of plastic, is present throughout the entire Study Area (Cooper & Corcoran, 2010; Dameron et al., 2007). Bottom trawl studies of anthropogenic marine debris on the continental shelf and upper slope of the U.S. West Coast (Washington to Southern California) revealed that debris was widespread throughout the area investigated (Keller et al., 2010). Recent studies in the

Southern California Bight found that marine debris (primarily plastic) occurred in about one-third of seafloor areas surveyed (Moore et al., 2016). Microplastic particles were more prevalent in shallow nearshore areas (ports, marinas, bays, and estuaries) than in offshore areas.

3.4.4.2 Marine Vegetation in the Study Area

Southern California's benthic macroalgae is represented by over 700 varieties of seaweeds, red and coralline algae, brown algae, green algae, and seagrasses (Leet et al., 2001). Benthic macroalgae are intensely zone specific, and individual species dominate a specific substrate at a specific depth profile (U.S. Department of the Navy, 2015). The most common macroalgae groups in the Study Area are described below and presented in Table 3.4-1. Some algal species that are free floating at the ocean surface, such as phytoplankton, are not discussed further because of their patchy distribution and are not expected to be impacted by project activities.

3.4.4.2.1 Green Algae (Phylum Chlorophyta)

Green algae are single-celled and multi-celled organisms in the phylum Chlorophyta that may form large colonies of individual cells (Roskov et al., 2015). Green algae may be found in the water column and benthic habitats. Only 10 percent of the estimated 7,000 species of green algae are found living in the marine environment (Castro & Huber, 2000). These species are important primary producers that play a key role at the base of the marine food web. Green algae are found in areas with a wide range of salinity, such as bays and estuaries, and are eaten by various organisms, including zooplankton and snails. Common intertidal and subtidal species in the Study Area include *Ulva* spp., *Codium fragile*, and *Codium setchellii/hubbsii* (Kenner, 2018; National Park Service, 2013).

3.4.4.2.2 Brown Algae (Phylum Phaeophyta)

Brown and golden-brown algae are large multi-celled marine species with structures varying from fine filaments to thick leathery forms (Castro & Huber, 2000). Most species are attached to the seafloor in coastal waters (such as kelp), although a species with both attached and free-floating forms (*Sargassum muticum* [invasive]) occurs within the Study Area. Common subtidal brown algae in the Study Area includes *Dictyota* spp./*Pachydictyon* spp., *Desmarestia* spp., and *Cystoseira* spp. (Kenner, 2018; National Park Service, 2013).

Kelp is a general term that refers to brown algae of the order Laminariales. Kelp plants are made of three parts: the leaf-like blade(s), the stipe (a stem-like structure), and the holdfast (a root-like structure that anchors the plant to the bottom). The following five species of canopy-forming kelp occur in the coastal waters of the California coast: giant kelp (*Macrocystis pyrifera*), bull kelp (*Nereocystis luetkeana*), elk horn kelp (*Pelagophycus porra*), feather boa kelp (*Egregia menziesii*), and chain bladder kelp (*Stephanocystis osmundacea*).

The dominant kelp in the Study Area is giant kelp. Canopy coverage of giant kelp around SNI is presented in Figure 3.4-1. Since the first statewide survey in 1967, the total area of kelp canopies has generally declined; the greatest decline occurred along the mainland coast of Southern California (Wilson, 2002; Young et al., 2016). The canopy coverage of kelp beds varies under changing oceanographic conditions and is also influenced by the level of harvesting, invasive species, coastal pollution, and development (Wilson, 2002). Giant kelp is the most conspicuous brown algae occurring extensively along the coast of Southern California. It can live up to eight years and reach lengths of 197 ft. (60 m). The leaf-like fronds can grow up to 23.6 inches (60 centimeters) per day (Leet et al., 2001).

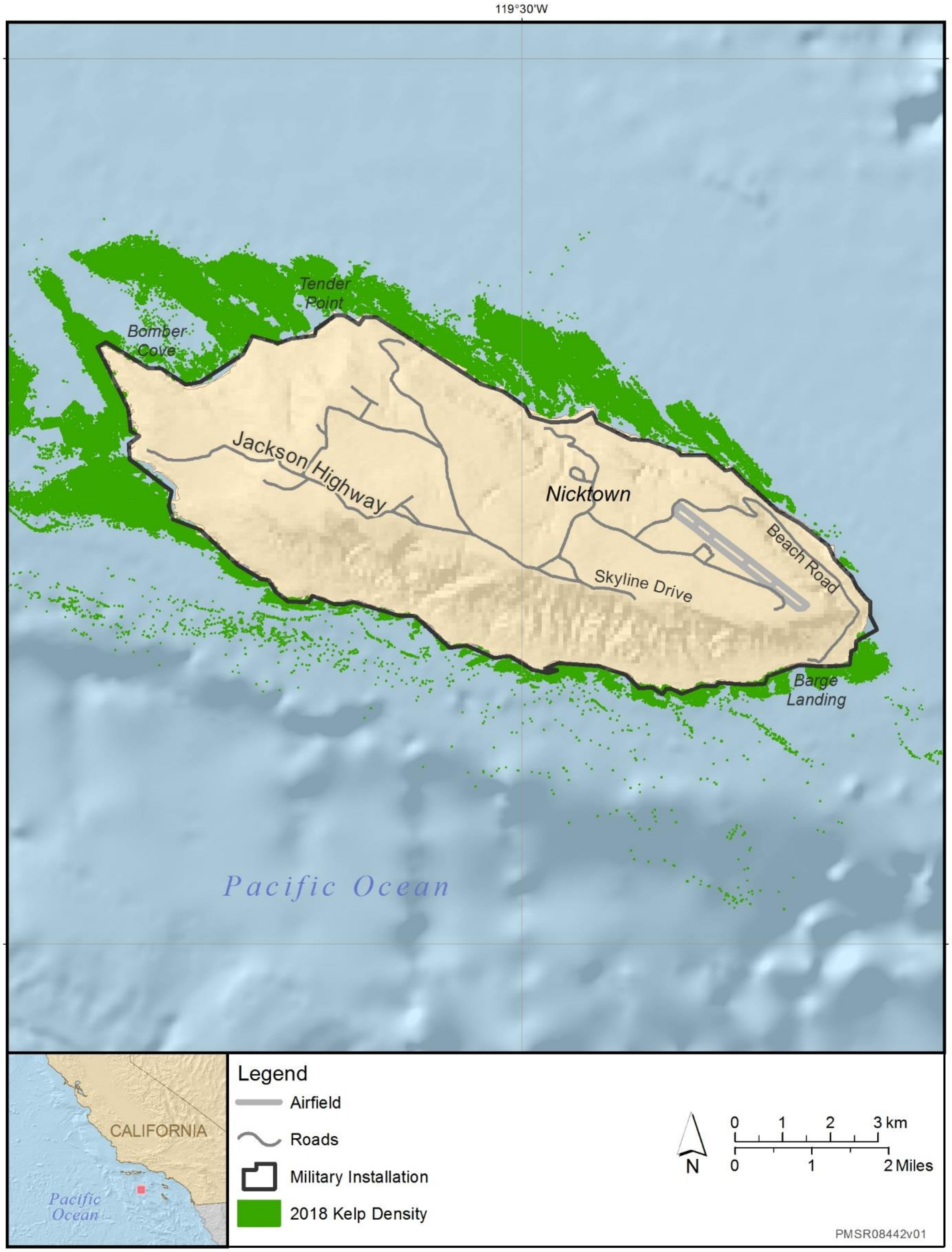

Figure 3.4-1: Kelp Canopy Density Around San Nicolas Island, 2018

Kelp forests at SNI are well distributed within the nearshore waters and display temporal and spatial variability between years based on oceanographic circulation, growth conditions, and grazing pressure (U.S. Department of the Navy, 2015).

Bull kelp growth can exceed 3.9 inches (10 centimeters) per day. Bull kelp attaches to rocky substrates and can grow up to 164 ft. (50 m) in length in nearshore areas. In turbid waters, the offshore edge of kelp beds occurs at depths of 49–59 ft. (15–18 m), which can extend to a depth of 98.4 ft. (30 m) in the clear waters around the Channel Islands off the coast of Southern California (Wilson, 2002). The kelp beds along the California coast and off the Channel Islands are the most extensive and elaborate submarine forests in the world (Rodriguez et al., 2001). El Niño events tend to have a direct influence on the region and have the potential to affect kelp populations, especially when these events are major (Grove et al., 2002).

3.4.4.2.3 Red Algae (Phylum Rhodophyta)

Red algae are predominately marine, with approximately 4,000 species worldwide (Castro & Huber, 2000). Red algal species exist in a range of forms, including single and multicellular forms (Roskov et al., 2015), from fine filaments to thick calcium carbonate crusts. Within the Study Area, they occur in the water column and bottom habitats of coastal waters, primarily in hard bottom and intertidal zones. Common subtidal species in the Study Area include *Gelidium* spp*., Gigartina* spp., *Callophyllis* spp., *Botryoglossum* spp., and *Laurencia pacifica* (National Park Service, 2013).

3.4.4.2.4 Seagrasses and Cordgrasses (Phylum Spermatophyta)

Seagrasses and cordgrasses are flowering marine plants in the phylum Spermatophyta (Roskov et al., 2015). These marine flowering plants create important habitat and are a food source for many marine species. These marine vascular plants are found only in coastal waters, attached to the bottom.

3.4.4.2.4.1 Seagrasses

Seagrasses are unique among flowering plants because they grow submerged in shallow marine environments. Except for some species that inhabit the rocky intertidal zone, seagrasses grow in shallow, subtidal, or intertidal sediments, and can extend over a large area to form seagrass beds (Garrison, 2004; Phillips & Meñez, 1988). Seagrass beds provide important ecosystem services as a structure-forming keystone species (Arnold et al., 2012; Buhl-Mortensen et al., 2010; U.S. National Response Team, 2010). They provide suitable nursery environment for commercially important organisms (e.g., crustaceans, fish, and shellfish) and are also a food source for numerous species (e.g., turtles) (Nagaoka et al., 2012). Seagrass beds combat coastal erosion, promote nutrient cycling through the breakdown of detritus (Dawes, 1998; Dawes et al., 1997), and improve water quality. Seagrasses also contribute a high level of primary production to the marine environment, which supports high species diversity and biomass (Spalding et al., 2003). Seagrasses are uprooted by dredging and scarred by boat propellers (Hemminga & Duarte, 2000; Spalding et al., 2003), which can take years to recover from.

Seagrasses that occur in the coastal areas of the Study include eelgrass (*Zostera marina* and *Zostera pacifica*), surfgrass (*Phyllospadix scouleri* and *Phyllospadix torreyi*), widgeon grass (*Ruppia maritima*), and shoal grass (*Halodule wrightii*) (Jones et al., 2013; Spalding et al., 2003). The distribution of underwater vegetation is patchy along the California coast. In Southern California, eelgrass and surfgrass are the dominant native seagrasses (Wyllie-Echeverria & Ackerman, 2003). Eelgrass (*Z. marina*) has been historically present in Mugu Lagoon (U.S. Department of the Navy, 2013). Information regarding the distribution of eelgrass habitat within SNI waters is limited; only one location, Coast Guard Beach, has been documented to support a persistent community (Engle & Miller, 2003), though additional eelgrass communities may occur within other protected areas along the southeast side of the island (U.S. Department of the Navy, 2015).

Beds of eelgrass (*Z. marina*) form an important and productive benthic habitat in shallow bays throughout Southern California. Eelgrass habitats rank among the most productive habitats in the ocean (Nybakken, 1993) and are an important component of the bay food webs. As has occurred in bays and estuaries all along the Pacific coast and elsewhere in the world, eelgrass beds have suffered substantial losses and impacts due to their location in sheltered waters where human activity is concentrated. However, these losses were historic due to bay fill and deepening.

Today, various state and federal regulatory frameworks protect eelgrass beds, and any impacts are fully mitigated. National Marine Fisheries Service policy recommends no net loss of eelgrass habitat function in California and encourages the use of eelgrass mitigation banking and in-lieu fee programs when impacts on eelgrass habitat cannot be avoided (National Marine Fisheries Service, 2014). For example, the U.S. Navy has several established eelgrass mitigation sites (banks) throughout San Diego Bay to compensate for current losses and to bank future losses to eelgrass habitat (U.S. Department of the Navy & Unified Port of San Diego, 2013).

3.4.4.2.4.2 Cordgrasses

Cordgrasses are temperate salt-tolerant land plants that inhabit salt marshes, mudflats, and other softbottom coastal habitats (Castro & Huber, 2000). California cordgrass (*Spartina foliosa*) can be found in salt marshes and mudflats within Southern California, including the southern bank of Mugu Lagoon (U.S. Department of the Navy, 2013). Salt marshes develop in intertidal, protected low-energy environments, usually in coastal lagoons, tidal creeks, rivers, or estuaries (Mitsch & Gosselink, 2007). The structure and composition of salt marshes provide important ecosystem services. Salt marshes support commercial fisheries by providing habitat for wildlife, protecting the coastline from erosion, filtering fresh water discharges into the open ocean, taking up nutrients, and breaking down or binding pollutants before they reach the ocean (Dreyer & Niering, 1995; Mitsch et al., 2009). Salt marshes also are carbon sinks (carbon reservoirs) and facilitate nutrient cycling (Bouillon et al., 2009; Chmura, 2009). Carbon sinks are important in reducing the impact of climate change (Laffoley & Grimsditch, 2009), and nutrient cycling facilitates the transformation of important nutrients through the environment. However, sinking salt marshes may damage cordgrasses, a process known as marsh subsidence.

3.4.5 Environmental Consequences

The U.S. Navy considered all potential stressors that would potentially impact marine vegetation. 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 the Analysis) could impact marine vegetation, as defined in this section in the Study Area. Table 3.4-2 presents the proposed testing and training activities and stressors that could potentially affect marine vegetation. The only stressor analyzed for habitats is physical disturbance and strikes from military expended materials. Other stressors such as acoustic, explosives, entanglement, and ingestion were analyzed in several previous Navy environmental documents (U.S. Department of the Navy, 2018a, 2018b) and determined to not be applicable to marine vegetation because (1) they don't overlap with where marine vegetation would occur, or (2) they are stressors that do not apply to marine vegetation (e.g., acoustics, due to the lack of hearing capabilities of vegetation).

Table 3.4-2: Summary of Stressors Analyzed for Marine Vegetation from Testing and Training Activities Within the Point Mugu Sea Range

Activity Category	Stressor	Potential Impacts
Air-to-Air	Physical Disturbance/Strike (military expended material)	Potential loss of small amount of marine vegetation would be within the range of natural variability. No long-term changes to marine vegetation abundance or diversity. The impacts would be less than significant.
Air-to-Surface		
Surface-to-Air		
Surface-to-Surface		
Subsurface-to-Surface		

The evaluation of the impacts from physical strike and disturbance stressors on marine vegetation focuses on proposed activities that may cause vegetation to be damaged by an object that is moving through the water (e.g., vessels) or dropped into the water (e.g., military expended materials). Not all activities are proposed throughout the Study Area. Wherever appropriate, specific geographic areas of potential impact are identified.

The categories of military expended materials that have the potential to affect marine vegetation include (1) all sizes of non-explosive practice munitions; (2) fragments of high-explosive munitions; (3) expended targets; and (4) expended materials other than munitions, such as miscellaneous accessories (e.g., canisters, endcaps, pistons). Military expended materials can potentially impact marine vegetation on the seafloor by disturbing, crushing, or shading, which may interfere with photosynthesis. In the event that some marine vegetation is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of marine vegetation and military expended materials is limited. Marine vascular plants generally grow in waters that are sheltered from wave action such as estuaries, lagoons, and bays (Phillips & Meñez, 1988). Locations for the majority of Navy testing and training activities where military materials are expended do not provide this type of habitat.

The potential for impacts on marine vegetation from a physical disturbance and strike by military expended materials would depend on the presence and amount of vegetation and number of military expended materials. Most deposition of military expended materials occurs within the confines of established testing and training areas. These areas are largely away from the coastline, and the potential for impacts on vegetation is low.

A comparison of the baseline annual operational tempo and the Action Alternatives is presented in Table 2-2. A summary of potential impacts on essential fish habitat from proposed Navy testing and training activities is presented in Chapter 6 (Other Regulatory Considerations).

3.4.5.1 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 vegetation, but would not measurably improve the overall distribution or abundance of marine vegetation.

3.4.5.2 Alternative 1 (Preferred Alternative)

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 vegetation would increase compared to current environmental baseline conditions (see Table 3.0-12). Depending on the size and type or composition of the expended materials and where they happen to strike vegetation, individuals could be killed, fragmented, covered, buried, sunk, or redistributed. This type of disturbance would not likely differ from conditions created by waves or rough weather. Testing and training activities that would generate military expended material large enough to damage marine vegetation would generally occur in offshore areas where substrates are likely soft bottom and the presence of marine vegetation is extremely low. Even if an activity takes place in nearshore waters (water depth approximately 100 ft. [30 m]), habitat at this depth is primarily sandy bottom, so that marine vegetation would not be impacted. Military expended materials used for testing and training activities are not expected to pose a risk to marine vegetation because (1) the relative coverage of marine algae in the Study Area is low, (2) the impact area of military expended materials is very small relative to marine algae distribution, and (3) marine vegetation overlap with areas where the stressor occurs is very limited. Therefore, impacts on marine vegetation would be less than significant under Alternative 1.

3.4.5.3 Alternative 2

Under Alternative 2, the amount of military expended materials associated with testing and training activities that would be a potential physical disturbance and strike risk to marine vegetation would decrease compared to Alternative 1 and increase compared to current environmental baseline conditions (see Table 3.0-12). As described above for Alternative 1, military expended materials associated with testing and training activities would not likely impact marine vegetation within the Study Area because most of the testing and training activities would occur in offshore areas where the substrate is dominated by soft bottom and the presence of marine vegetation is extremely low. These areas are typically away from the coastline, and the potential for impacts on vegetation is low. Even if an activity takes place in nearshore waters (water depth approximately 100 ft. [30 m]), habitat at this depth is primarily sandy bottom and is too deep for the presence of kelp beds, so marine vegetation would not be impacted.

As stated above for Alternative 1, military expended materials used for testing and training activities are not expected to pose a risk to marine vegetation because (1) the relative coverage of marine algae in the Study Area is low, (2) the impact area of military expended materials is very small relative to marine algae distribution, and (3) marine vegetation overlap with areas where the stressor occurs is very limited. Therefore, impacts on marine vegetation would be less than significant under Alternative 2.

3.4.5.4 Indirect Effects

This section analyzes potential impacts on marine vegetation exposed to stressors indirectly through impacts on habitat. Prey availability as a stressor discussed for other biological resources is not applicable to vegetation and will not be analyzed further in this section.

Section 3.2 (Sediments and Water Quality) and Section 3.3 (Marine Habitats) consider the impacts on marine sediments and water quality and abiotic habitats from explosives and explosion byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). One example of a local impact on water quality could be an increase in cyanobacteria associated with munitions deposits in marine sediments. Cyanobacteria may proliferate when iron is introduced to the marine environment, and this proliferation can affect adjacent habitats by releasing toxins and creating hypoxic conditions. Introducing iron into the marine environment from munitions or infrastructure is not known to cause toxic red tide events; rather, these harmful events are more associated with natural causes (e.g., upwelling) and the effects of other human activities (e.g., agricultural runoff and other coastal pollution) (Hayes et al., 2007). Explosives byproducts present no indirect impact on marine vegetation through sediment or water.

Other materials that are re-mobilized after their initial contact with the seafloor (e.g., by waves or currents) may continue to strike or abrade marine vegetation. Indirect physical strike and disturbances are relatively unlikely because most expended materials are denser than the surrounding sediments (e.g., metal) and are likely to remain in place as the surrounding sediment moves. Potential indirect physical strike and disturbance impacts may cease when (1) the military expended material is too massive to be mobilized by typical oceanographic processes, (2) the military expended material becomes encrusted by natural processes and incorporated into the seafloor, or (3) the military expended material becomes permanently buried. Although individual organisms could be impacted by secondary physical strikes, the viability of populations or species would not be impacted.

Therefore, based on the information provided above, no indirect effects would impact marine vegetation.

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