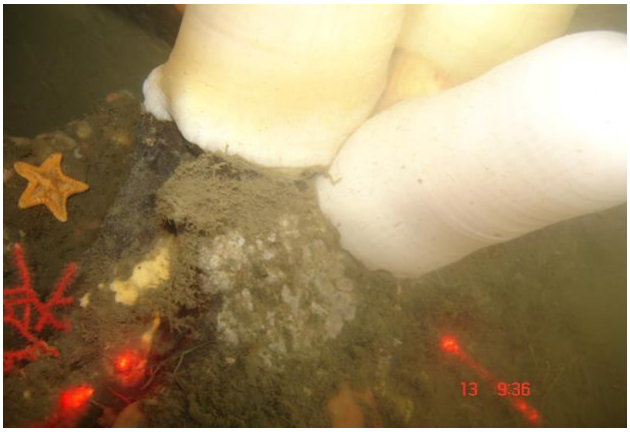
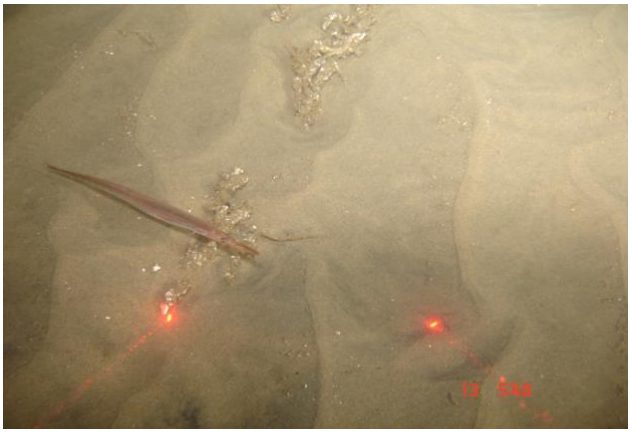
Marine Aquatic Habitats and Associated Biological Communities and Resources Near Manchester Beach, California

December 2018





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1 Introduction

The purpose of this scientific review is to 1) present a broad overview of the subtidal habitats and associated macrobenthic biota observed offshore of coastal Central and Northern California, based on ROV and scientific diver surveys conducted in the coastal waters of California, and 2) to characterize the seafloor habitats and associated macrobenthic communities that are expected to be potentially present along a proposed fiber optic cable route located offshore Manchester Beach near Point Arena, California. For the purposes of this review, the analysis of seafloor habitats and associated marine taxa covers the water depth range of 0-185 m (0-600 feet). For fish and marine mammals, the analysis extends out to 549 meters (1,800 feet) water depth.

Figure 1 provides an illustration of the study area around Manchester Beach, California and provides a graphical presentation of coastal bathymetry and topography as well as nearby Marine Protected Areas.

2 Previous ROV Surveys Offshore California

Beginning in 1999, visual and photographic surveys have been conducted for multiple fiber optic cable routes and landings and State MPAs in California coastal waters. For the purposes of this review and analysis, these include:

- Global West fiber optic cable project, San Diego, Manhattan Beach, Santa Barbara, and Morro Bay (SAIC 2000a);
- Tycom fiber optic cable project, Hermosa Beach (MBC 2001);
- SEA-US 1 fiber optic cable project, Hermosa Beach (AMS 2016);
- MCI/WorldCom fiber optic cable project, Montana del Oro/Morro Bay (SAIC-SLO 1999);
- AT&T US/China fiber optic cable project, Morro Bay and Point Arena (SAIC 2000c);
- AT&T AAG S-5 fiber optic cable project, Montana del Oro/Morro Bay (AMS 2008); and
- Monterey Bay Aquarium Research Institute (MBARI) MARS fiber optic cable project, Monterey Bay (MBARI 2004);
- Point Arena MPA (MARE 2017);
- 10-mile MPA (MARE 2017); and
- Noyo River (MARE 2017).

In addition to the above listed surveys that primarily employed ROVs to conduct the visual surveys, some routes employed SCUBA divers to survey and assess the shallower water segments of the route and landfall locations. These include:

- Pacific Crossing and Pan American Crossing fiber optic cable landing, Grover Beach (AMS 1998);
- Tycom fiber optic cable project, Hermosa Beach (MBC 2001).

Finally, the effects of physical disturbance to coastal subtidal hard substrate habitats and associated marine biota and the recovery of those marine communities following disturbance has been extensively studied in conjunction with offshore oil and gas exploration and production operations in the Pacific Outer Continental Shelf. The results of these scientific investigations are best presented in:

- A Survey of Prominent Anchor Scars and the Level of Disturbance to Hard-Substrate Communities in the Point Arguello Region (Hardin *et. al.* 1993);

- Recolonization of Deep-Water Hard Substrate Communities: Potential Impacts from Oil and Gas Development (Lissner *et al.* 1991).

These studies collectively provide insight into the types of subtidal habitat observed along the California coast, in water depths ranging from 0 to 100 fathoms (180 meters).

3 Subtidal Habitats and Associated Macrobenthic Biological Communities

Subtidal habitats are typically characterized as either soft or hard substrate. Depending on water depth, currents, wave energy, and other physical conditions, the soft substrate can range from coarse sands, (typically observed in high energy and/or shallow water depth environments) to fine muds (low energy/deeper water depth environments). Similarly, hard substrate can be initially divided into natural (rocky outcrop) or artificial (concrete, pilings, steel, etc.) substrate and further characterized by elevation or rise above the seafloor. The typical descriptors used for categorizing elevation of hard substrate above the seafloor are:

- Mixed bottom – a combination of coarse sand, gravel, cobble, and small boulders;
- Low relief - exposed bedrock and rocky outcropping rising approximately < 0.3 meters (<1 foot) from the seafloor;
- Moderate Relief - exposed rocky outcroppings that typically rise above the seafloor approximately 0.3-1.0 meters (1-3 feet) from the seafloor;
- High relief - exposed rocky outcropping that typically rise >1.0 meter (>3 feet) from the seafloor.

Some reports and marine scientists only characterize relief as low or high.

Many of the above cited deep-water hard substrate biological assessments have documented that with increasing elevation above the seafloor you typically observe an increase in species diversity and abundance inhabiting the hard substrate feature. These studies have demonstrated that water depth, current speeds, rate of sedimentation, composition of adjacent soft sediments, and elevation off the seafloor are all key factors in determining the composition of biota inhabiting a specific hard substrate habitat (Battelle 1991; Hardin 1994; Lissner & Shoakes 1986).

Additionally, with increasing water depth and the reduction of wave energy at the seafloor, the soft substrate community changes with depth, as sediment composition shifts from coarse sands with low organic content to fine muds with increasing organic content. This shift in sediment composition and energy also results in changes to the marine biota inhabiting the soft substrate habitat.

Contained within the Appendices of this report are tables providing taxonomic listings of invertebrate and fish species observed during the above listed fiber optic cable route reconnaissance surveys, shallower water depth surveys of hard substrate habitat done by scientists employing SCUBA in Southern California, and recent, unpublished data from one south Central California MPA, one Northern California MPA, and a third northern California adjunct location. Table 1 provides a master taxonomic list of invertebrate organisms observed in these surveys and identifies taxonomic associations with either hard or soft substrate habitat. Table 2 provides a breakout of observed invertebrate taxa by water depth range. Table 3 is a master taxonomic list of all fish and shark species reported from these surveys. Table 4 provides a breakout of all observed fish species by depth range and survey location.

It should be noted when reviewing the above tables, especially Tables 2 and 4 that quite frequently little to no hard bottom habitat may be present along a surveyed route within a specific depth range. As a result, no species would be reported occurring for that depth range and does not indicate that specific species do not occur in that location, rather since no suitable habitat was present along that cable route and within the identified depth range, no species were observed.

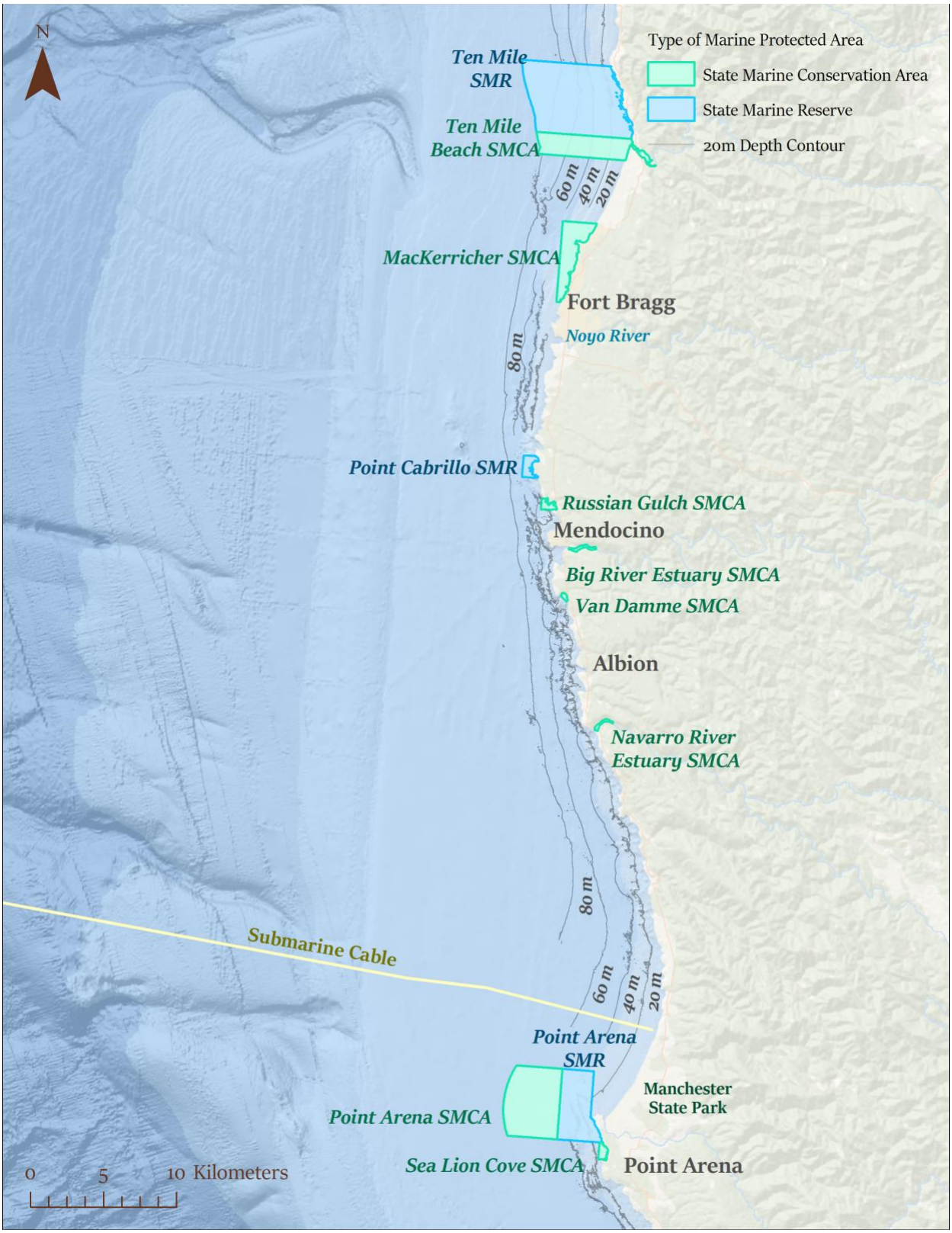

Figure 1: Coastal Region of California Offshore Manchester Beach.

3.1 Habitats and Associated Biota Observed in the 0-30 Meter Depth Range.

As mentioned above, most fiber optic cables begin their offshore routing at the point at which the cable exits an existing pipeline/outfall or horizontal bore hole in 12-25 meters of water depth, preferably in soft substrate habitat. Although hard substrate does occur in these shallower depths, the cable routes are routinely carefully selected to avoid them, especially in the very shallowest water depths. As a result, most of the fiber optic cable route reconnaissance surveys reviewed for this paper begin at depths greater than 25 meters. Survey work on shallow water reefs in Southern California has been conducted by Occidental College, which can be used to inform our understanding of species presence at water depths less than 30 meters. (Occidental 2007). Because scientists conducted these surveys using SCUBA equipment did these surveys, the taxonomic list for their work is more extensive than typically generated from an ROV survey. Tables 1 through 4 provide a more detailed listing of marine invertebrate and fish taxa observed during the Occidental (2007) surveys in the Southern California Bight. The following discussion of deep-water biota focuses primarily on observations made during the cable route surveys. The shallow water data provided by the Occidental (2007) report has been included to provide reference information on hard substrate communities in Southern California water depths shallower than fiber optic cable route characterizations typically assess. Also, the ROV survey data for the Point Arena MPA and near the Albion river focused solely on hard substrate habitat, whereas the ROV survey at the 10-mile MPA was primarily focused on soft substrate habitat.

3.1.1 Soft Substrate

Soft substrate habitat types typically observed in the 0-30 meters depth range included coarse sands through the surf and wave zone shifting to finer sands and muds (silts and clays) at deeper water depths.

The most common alga and invertebrate taxa observed included the ornate tube worm (*Diopatra ornata), cancer crabs (Cancer sp.),* the slender crabs *(Cancer gracilis),* the masking crab *(Loxorhynchus crispatus), octopus (Octopus rubescens and O. bimaculatus/bimaculoides*), market squid (*Loligo opalescens*), the white sea pen (Stylatula elongata), the sea cucumber (*Parastichopus californicus*), the sunflower star (*Pycnopodia helianthoides*) occasional polychaete tube worms, *Pachycerianthus* spp., assorted anemones, including the sand rose anemone (Urticina columbiana), and Actinariad anemones, the spiny sand star *Astropecten B. armatus*, the short-spined seastar *Pisaster brevispinus*, the seastar *Petalster* (*Luidia) foliolata*, the sea pansy *Renilla kollikeri*), swimming crabs (*Portunus xantusii*), an occasional hermit crabs, and sand dollars (*Dendraster excentricus*). The sea stars *Asterina miniata, Mediaster aequalis*, and the fragile sea star (*Linkia columbianus*), were occasionally observed in soft substrate located in close proximity to exposed hard substrate. In the coarser sand habitats, the invertebrate community was typically dominated by ornate tubeworms (*D. ornata*) and sand dollars (*D. excentricus*) when they were present in colonies occupying fairly narrow bands (Table 1 and Table 3). Algal populations of very small red and brown algae have been reported occasionally occurring attached to worm tubes (MBC 2001). In the deeper water depths of this depth range, where the sediments shift to finer muds, brittle stars (*Ophiura spp*.) start to occur. In Central and Northern California, Dungeness crab (*Metacarcinus magister*) frequently occur.

When hard substrate is nearby, various species of drift algae are commonly observed along the seafloor in soft bottom habitat. Observed species include giant kelp (*Macrocystis pyrifera*) and feather boa kelp (*Egregia meanzinii*). In north Central and Northern California, bull kelp (*Nereocystis luetkeana*) in north predominates along the coast and is also observed as drift algae.

3.1.2 Hard Substrate

Hard substrate habitat types typically observed in the 0-30 meters depth include mixed bottom (a combination of coarse sand, cobble, and small rocks less than 0.3 meters in height above the seafloor, low

relief substrate consisting primarily of exposed bedrock and small boulders, and occasionally high relief rocks greater than1 meter above the seafloor.

The biological community inhabiting these hard substrate habitats is typically characterized as being dominated by a dense mat of turf species (a mixture of small hydroids, bryozoans, tunicates, and sponges), occasional red and brown alga, and the white-plumed anemone (*Metridium farcimen* (=*giganteum*)). Other species that were reported present at some locations included surf grass (*Phyllospadix sp.)* in the very shallow depths of this zone, the sea anemone (*Actinaria unident*.), strawberry or club-tipped anemone (*Corynactis californica*), the swimming anemone (*Stomphia coccinea*), the fish eating anemone (*Urticina piscivora),* squid (*Loligo sp*.), the crabs *Cancer spp*. and *M. magiser*, the masking crab (*Loxorhynchus crispatus*), the bat star (*Asterina miniata*), the red sea star (*Mediaster aequalis), the* giant-spined sea star (*Pisaster giganteus*) , Pisaster sea stars, and *Henricia* spp. sea stars, brittle stars (*Ophiura spp*.), occasional sea hares (*Aplysia californica*), California sea cucumbers (*Parastichopus californicus*), slipper sea cucumbers (*Psolus chitonoides*), white branched sea cucumbers (*Cucumaria piperata*), and red and purple sea urchins (*Mesocentrotus fransiscsanus*, *Strongylocentrotus purparatus*) (Table 1 and Table 3).

3.2 Habitats and Associated Biota Observed in the 30-100 Meter Depth Range.

3.2.1 Soft Substrate

Soft substrate habitats normally observed in the 30-100 meter depth range include scattered mixed bottom and coarse sand substrate where bottom currents or wave energy continue to wash the seafloor and fine muds. The coarser sand substrates are normally only seen at the shallower depths of this depth range. The finer mud substrate is typically pockmarked with burrow holes.

The soft substrate macrofauna is dominated by several species of sea pens (*Ptilosarcus gurneyi, Stylatula elongata, Acanthoptilum spp., Virgularia spp.)*, sea whips (*Halipteris californica*) the sea slug (*Pleurobranchea californica*), the California sea cucumber (*P. californicus*), and the leafy flat star (*Petalaster (luidia) foliolata*). Also frequently observed were multiple species of crabs (*Cancer sp*. and *M. magister*), the red sea star (*M. aequalis*) and the multi-armed sea star (*Rathbunaster californica*), Cerianthid anemones, the swimming anemone (*Stomphia coccinea*), the sand rose anemone (*U. columbiana*), brittle stars (Ophiuroids) and the sunflower star (*Pycnopodia helianthoides*). The ornate tubeworm *(D. ornata*) remains a frequent inhabitant of the coarser sand sediments occurring in the shallower water depths of this depth range (Table 1 and Table 3).

3.2.2 Hard Substrate

Hard substrate habitat types observed in the 30-100 meters water depth range include mixed bottom in the shallower depths and low, moderate, and high relief in the deeper depths of this depth range.

The predominant hard substrate community appears to be dominated by turf, and the white-plumed anemone (*Metridium farcimen* (=*giganteum*)), red and purple sea urchins (*M. franciscanus and S. purpuratus*), orange and gray puffball sponges (*Tethya aurantia, Craniella arb*), rock scallops (*Crassedoma* giganteum), and acorn barnacles (*Balanus nubilus)*. Also commonly occurring were cup corals (*Paracyathus stearnsii*), assorted crabs (*Cancer spp*.) and shrimp, the red sea star (*M. aequalis*), the ochre star (*P. ochraceous*), the leather star (*Dermasterias imbricate*), the cookie star (*Ceramaster patagoicus*), *Henrica* spp. sea stars, the swimming anemone (*S. coccinea*), the fish eating anemone (*U. piscivora*), thorny sea star (*Hippasteria spinosa*), basket stars (Gorgonocephalus eucnemis), fish eating star fish (Stylasterias forreri), and brittle stars (*Ophiuroids*). Additionally, soft gorgonian corals are occasionally observed on hard substrate features, including *Lophogorgia chiliensis, Eugorgia rubens*, and

Swiftia spaudingi, along with the white branched sea cucumber *(Cucumaria piperate) (*Table 1 and Table 3).

Depending on local water conditions, hard bottom substrate in this depth range has been reported to support the California hydrocoral, *Stylaster californica* (=*Allopora californica*), other species of sea stars, the giant Pacific octopus (*E. dofleini*), the red octopus (*O. rubescens*) and market squid (*L. opalescens*).

3.3 Habitats and Associated Biota Observed in the 100-183 Meter Depth Range.

3.3.1 Soft Substrate

The soft substrate habitat predominantly observed in the 100-183 meters depth range is generally soft mud consisting of silty sand with a moderate clay component.

The macrobenthic community in this depth range is characterized by sea pens (*S. elongata, Virgularia spp.*), the leafy flat star (*P.* (*luidia*) *foliolata*), crabs (*Cancer spp.*), and assorted shrimp. Other commonly or frequently occurring taxa include the sea slug (*P. californica*), the red sea star (*M. aequalis*), several species of sea anemones (e.g. *Urticina* spp.) the multi-armed sea star (*R. californica),* the free-living polychaete (*Chloeia pinnata*), pink sea urchin (*Allocentrotus fragilis*), brittle stars (*Amphiodia sp*. and Ophiuroidea) and the sea cucumber (*P. californicus*).

3.3.2 Hard Substrate

Hard substrate habitat types observed in the 100-183 meter water depth range are the same as those present in the 30-100 meter (90-300 feet) water depths.

The macrobenthic taxa are similarly characterized with turf, cup corals, and the white-plumed anemone (*M. farcimen* (=*giganteum*)) being the most often observed. Also commonly observed were the giant basket star (*Gorgonocephalus eucnemis*), brittle stars (Ophiuroidea), various species of crabs (*Cancer spp*.) and the red sea star (*M. aequalis*). At some locations, crinoids (e.g. *Florometra serratissima*) are also commonly observed.

It is at these deeper water depths (and deeper) where the deep-water corals have been reported occasionally present along fiber optic cable routes. Based on favorable high relief, current speeds, and sedimentation rates, branching hard and soft corals have been reported including the branching white coral *Lophelia sp*. and the California hydro coral *Stylaster californicus (= Allopora californica*). *Stylaster* can also occur in shallower water depths where conditions are favorable, although frequently in a very small, stunted form (Occidental 2007).

4 Fish Communities

The distribution of fish species offshore California is influenced by depth, substrate type, temperature, and ocean currents, which when integrated often define fish habitat (Love and Yoklavich 2006). Fish communities along the north Central and southern Northern California coast have not been extensively researched and most data are based on commercial and recreational landing data. This data, combined with data from ROV reconnaissance surveys along fiber optic cable routes and in the MPAs is the basis for describing fish communities in this paper. Although many marine resources, including fishes, are typically distributed by depth and habitat type, the following description of fish communities is divided by substrate type. A master list of fish species observed during several fiber optic cable reconnaissance surveys and in three MPAs located near the Manchester Beach cable-landing site is presented in Table 3. Table 4 presents fish species observed during these surveys by depth range.

4.1 Hard Substrate

Nearshore rocky reefs in the northern portion of Central California and in the southern portion of Northern California are highly variable in terms of both abiotic and biotic reef structure, and metrics of the associated macroinvertebrate and fish species (Pondella et al. 2011). ROV surveys conducted in the study region (MARE 2017, SAIC 2000a) documented a total of 40 fish species associated with hard substrate, rocky reef habitat. Of these 40 fish taxa, 34 were observed at survey locations near Manchester Beach, California (Table 3). Of these 34 species, 20 were rockfish (*Sebastes*). The most dominant rockfish species observed from ROV surveys conducted near Manchester Beach, in terms of numerical density were Blue rockfish (*Sebastes mystinus*), Canary rockfish (*S. pinniger*), Olive and Yellow rockfish (S. *serranoides and S. flavidus*), Widow and Squarespot rockfish (S. *entomelas and S. hopkinsi)*, Quillback rockfish (S. *maliger*), Vermillion rockfish (S. *miniatus*), Copper rockfish (*S. caurinus*) and unidentified, schooling and juvenile rockfish. The dominant hard substrate associated non-rockfish species were Lingcod (*Ophiodon elongates*), painted greenling (*Oxylebius pictus*), and kelp greenling (*Hexagrammos decacargrammus*).

4.2 Soft Substrate

Soft bottom habitat is the most widespread benthic habitat along the California shelf (Dugan *et. al*. 2015, Allen 2006; Allen *et. al.* 2011). Demersal fishes occupying this habitat are relatively sedentary compared to pelagic fish species and respond more readily to changes in the benthic environment. Surveys conducted during ROV surveys in the study region documented a total of 52 fish species associated with soft substrate habitat. Of these fish species, 35 were observed in ROV surveys conducted near Manchester Beach, California.

Fish species that are typically observed in coastal soft bottom habitats are predominantly flatfishes such as sanddabs (*Citharichthys* spp.), Petrale sole (*Eopsetta jordani*), English sole (*Parophrys vetulus*), Dover sole (*Microstomus pacificus*), Pacific hake (*Merluccius productus*), and unidentified flatfish. Dominant round fish include eelpouts (Zoarcideae), and the Shortspine and Longspine combfish (*Zaniolepsis frenata and Z. latispinnus*), depending on water depth.

Pelagic fish species observed in the open waters near Manchester Beach, California include assorted smelts (Osmeridae), assorted perches (Embiotocidae), skates (*Raja spp*.) and occasional sharks (Table 3). Additionally, juvenile rockfish and some species of rockfish will be observed swimming in the water column above soft substrate habitat.

4.3 Magnusson-Stevens Act Managed Fish Species

This Essential Fish Habitat (EFH) assessment is in accordance with the 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act. The proposed fiber optic cable landing site in Manchester Beach are located in an area designated as EFH for four Fishery Management Plans (FMPs): Pacific Coast Groundfish (PFMC 2016a), Coastal Pelagic Species (CPS) (PFMC 2018a), Pacific Coast Salmon (PFMC 2016b), and Highly Migratory Species (HMS) (PFMC 2011).

The CPS live in the water column, not near the sea floor, and are usually found from the surface to over 1,000 m deep (PFMC 2018a). There are 6 species of coastal pelagics managed under the CPS FMP, including Jack mackerel (*Traxchurus symmetricus*), krill (Euphausiids), Pacific mackerel (*Scomber japonicas*), Pacific sardine, market squid (*Loligo opalescens*), and Northern anchovy (Table 5). Additionally, euphausiid krill are also managed under this FMP and are important to baleen whales as a primary food source.

Of the 85-groundfish species managed under the Pacific Groundfish FMP, 76 are found in diverse habitats at various stages in their life histories throughout the region of north Central California and southern Northern California (proposed landing sites and offshore route). Another 14 species are considered uncommon in occurrence in this region (Table 5).

Some species are broadly dispersed during specific life stages, especially those with pelagic eggs and larvae, while other species may have limited distributions (i.e., adult rockfishes in nearshore habitats) with strong affinities to a particular location or substrate type. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" (e.g., seamounts, offshore banks, canyons) are designated Habitat Areas of Particular Concern (HAPCs) for groundfish managed species.

Fish species managed under the Pacific Groundfish FMP known to inhabit these same California waters include 13 species of flatfishes, 39 species of rockfish (*Sebastes* spp. and *Scorpaena guttata*), 2 species of thornyheads (*Sebastolobus* spp), 6 species of roundfishes, cabezon, kelp greenling, lingcod, Pacific cod, Pacific hake, and sablefish (Table 5). There are also nine species of skates, sharks, and chimeras managed under this plan (Table 5).

The Pacific Coast Salmon FMP outlines spatially explicit EFH for chinook (*Oncorhynchus tshawytscha*), Coho (*Oncorhynchus kisutch*), and Puget Sound pink (*Oncorhynchus gorbuscha*) salmon. While inland spawning habitat is considered to be the most critical to these species, all three salmonids occur as both juvenile and adults in marine offshore waters of the West Coast of the United States. Their marine EFH extends from the inland extreme high tide line offshore to the 200-mile Exclusive Economic Zone for the states of Washington, Oregon, and California north of Point Conception. Chinook are more commonly found off the coast of California, but Coho and Puget Sound pink can also be present (Table 5).

EFH for HMS includes all marine waters from the shoreline to 200 nm (370 km) offshore, and no HAPCs have been adopted for HMS in the Study Area. There are 5 species of shark managed under the HMS management plan, including bigeye thresher shark (*Alopias superciliosus*), blue shark (*Prionace glauca*), common thresher shark (*Alopias vulpinus*), pelagic thresher shark (*Alopias pelagicus*), and shortfin mako shark (*Isurus oxyrinchus*). In addition, there are 5 species of tunas managed under this plan and include albacore tuna (*Thunnus alalunga*), bigeye tuna (*T. obesus*), Northern bluefin tuna (*T. orientalis*), skipjack tuna (*Katsuwonus pelamis*), and yellowfin tuna (*T. albacares*) (Table 3). Striped marlin (*Tetrapturus audax*) is the only species of billfish managed under the HMS management plan; while broadbill swordfish (*Xiphias gladius*) is the only species of swordfish and dorado (mahi mahi) (*Coryphaena hippurus*) is the only species of dolphin fish managed under this plan (Table 5).

4.4 Commercial and Recreational Fishing

The coastal waters of north Central California are extensively used for both commercial and recreational fishing. Although more than 100 species or species groups are commercially landed at Fort Bragg, which covers all of north Central California commercial fish landings, between 2013 and 2017, 20 species or fish groupings, have accounted for 99% of the landings, based on tonnage (Table 6). Those taxa that account individually for more than 1% of the total landings between 2013 and 2017 include Red sea urchins (*M. franciscanus)*, Dover sole (*M. pacificus)*, Sablefish (*Anoplopoma fimbria)*, Dungeness crab (*M. magister)*, Chinook salmon (*Oncorhynchus tshawytscha)*, Longspine thornyhead (*S. altivelis)*, Petrale sole (*E. jordani)*, Shortspine thornyhead (*S. alascanus)*, assorted rockfish (*Sebastes spp.),* Longnose skate (*R. rhina)*, Hagfish (Myxini), Market squid (*Doryteuthis opalescens)*, and Lingcod (*Ophiodon elongates)*. Commercial fishing methods employed include trolling, trawling, diving, and trapping.

Recreational fishing, conducted from rocky shore and sandy beaches, docks, private boats, and commercial party boats, landed approximately 134 fish taxa between 2013 and 2017 (Table 7). However,

30 of these taxa accounted for more than 90% of the landings in tonnage or in individual numbers of fish landed. The dominant fish taxa caught by recreational fisherman include Lingcod (*O. elongates*), assorted rays (Rajidae), assorted species of rockfish (S. Spp.), Barred surfperch (*Amphistichus argenteus*), Dungeness crab (M. magister), Striped bass (*Morone saxatilis*), California Halibut (*Paralichthys californicus)*, Jacksmelt (*Atherinopsis californiensis*), Cabezon (*Scorpaenichthys marmoratus*), Pacific mackerel (*Trachurus symmetricus*), Pacific sanddab (*C. sordidus*) , Rock crabs (*C. productus*), Red abalone (*Haliotis rufescens*), Night smelt (*Spirinchus starksi*), American shad (*Alosa sapidissima*), and Striped kelpfish (*Gibbonsia metzi*) (Table 7). Another sought after recreational fish includes Chinook salmon (*Oncorhynchus tshawytscha*), although the total recreational landings within Mendocino County appear fairly low when compared to other species (Table 7).

5 Marine Mammals & Sea Turtles

5.1 Marine Mammals

More than 11 species of marine mammals are reported occurring in the coastal waters of California offshore Manchester Beach, all of which are protected under the Marine Mammal Protection Act (MMPA). These include 7 species of cetaceans (whales, dolphins, and porpoises) and three species of pinnipeds (seals and sea lions) (Carretta et al. 2013; Leatherwood and Reeves 1983; Reeves et al. 1992). Six species of cetaceans are federally listed as endangered, while two species of pinnipeds are listed as threatened under the Federal Endangered Species Act (FESA). Marine mammals commonly observed in the waters offshore Manchester Beach, in less then 200 meters of water depth, include California sea lions (*Zalophus californianus*), Pacific harbor seals (*Phoca vitulina*), gray whales (*Eschrichtius robustus*), humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*, Northern right whale (Callrhinus ursinus), Dall's porpoise (Phonocoenoides dalli), Risso's dolphins (*Grampus griseus*) and occasionally, killer whales (*Orcinus orca*) (NOAA 2018a).

5.1 Sea Turtles

Five species of marine sea turtles are known to inhabit coastal and offshore waters of California. These include Loggerheads (*Caretta caretta*), Green (*Chelonia mydas*), Leatherback (*Dermochelys coriacea*), Pacific Hawksbill (*Eretmochelys imbricata*), and the Olive Ridley (*Lepidochelys olivacea*) (California Herps 2018). Of these five species, only the Green and Leatherback turtles have been reported occurring in the waters of north Central and southern Northern California (California Herps 2018). The Loggerhead, Pacific Hawskbill and Olive Ridley are only known to occur in Southern California south of Point Conception, although a sighting of an Olive Ridley near Tomales Bay was reported in 2002 (California Herps 2018). All of these species typically occur farther offshore than the nearshore coastal waters adjacent to Point Arena and Manchester Beach.

The Leatherback, Green, and Pacific Hawksbill sea turtles are Federally listed as endangered throughout their ranges and the Olive Ridley and Loggerhead are Federally listed as Threatened. Critical habitat for the Leatherback sea turtle has been established from Point Arena in Northern California south to Point Arguello, in Southern California (NOAA 2018 b). The potential for occurrence of Green or Leatherback sea turtles in the nearshore coastal waters adjacent to Point Arena and Manchester Beach are very low.

6 Species of Special Concern

Inhabiting California's coastal subtidal region are several species of special concern, which includes species protected under the Federal Endangered Species Act (FESA); the California Endangered Species Act (CESA); the Marine Mammal Protection Act (MMPA); the California Fish and Game Code; the National Oceanic and Atmospheric Administration (NOAA) species of concern lists; the U.S. Fish and Wildlife Service; the California Department of Fish and Wildlife (CDFW); or State or Federal agencies, such as the California Coastal Commission (CCC) that designate species as having a scientific, recreational, ecological, or commercial importance. Table 8 provides a listing of all Species of Special Concern that have any potential to be present offshore Manchester Beach. Under FESA, CESA, and the Marine Mammal Protection Act, the marine mammals and sea turtles discussed in Section 5 (Marine Mammals and Sea Turtles) are all considered species of special concern. Similarly, there are FESA/CESA protected and Magnusson-Stevens Act (MSA) managed fish species that are considered species of special concern and are similarly discussed in Section 4 (Fish Communities) above. Finally, there are marine birds that are FESA, CESA, or protected under the Federal Migratory Bird Act, that are not part of this study which is focused on marine aquatic resources.

The following discussion is primarily focused on marine invertebrates and alga that inhabit the coastal subtidal waters of north central and southern Northern California out to approximately 1,800 meters water depth. Special status marine mammals, sea turtles, and fish are discussed in greater detail in Section 5.

6.1 FESA/CESA Protected Invertebrate Species

Black Abalone (*Haliotis cracherodii*)

The black abalone is a large marine gastropod mollusk found in rocky intertidal and very shallow subtidal habitats. It is listed as endangered under the FESA. They reach maturity at about 3 years old and Northern California populations primarily eat bull kelp and other algae (NOAA 2015a). During low tides, these marine gastropods can typically be found wedged into crevices of intertidal and shallow subtidal rocks. Black abalone range from Point Arena, CA to Bahia Tortugas and Isla Guadalupe, Mexico (NOAA 2015a). Black abalone experienced significant declines in abundance offshore California and have gone locally extinct in most locations south of Point Conception, CA. The primary factors leading to the decline are overfishing and withering syndrome, which struck black abalone at the northern Channel Islands in 1985 (NOAA 2015a). The disease appears to be more prevalent in the southern portion of black abalone range (south of Point Conception, CA) where water temperatures are relatively warmer. Die-offs also seem to occur in habitats where water temperatures are elevated by thermal discharge of power plants. Scientists estimate the abundance of black abalone prior to overexploitation and withering syndrome at over 3 million (NOAA 2015a). Increasing distance among potentially spawning males and females exacerbates reproductive failure as population density decrease.

6.2 Soft Substrate Species

Sand dollars (*D. excentricus*) frequently form dense beds in the shallow subtidal zone of open sandy beaches in water depths between 5 and 10 meters, typically just offshore of the wave zone. As would be expected, they move locations frequently and are easily subject to physical disturbance. Most cable landings go beneath the seafloor at water depths ranging between 10 and 25 meters, connecting with the horizontal bore hole or existing pipeline to connect to the onshore segment of the cable. As such, it is unlikely that sand dollar beds would be affected by fiber-optic cable installations.

6.3 Hard Substrate (Sessile) Invertebrate Species

In general, hard substrate habitat occurrence offshore California, when compared to the extent of soft substrate habitat, is relatively limited. As indicated in the discussion above, the occurrence of high-relief hard substrate typically results in the presence of species that may be considered more susceptible to impacts from mechanical disturbance, such as cable installation. The most susceptible species to these types of impacts are usually large (e.g., more than 0.3 m in height), slow growing (i.e., a few to several centimeters per year), and relatively delicate/brittle or soft/friable in body form (e.g., branching corals and erect sponges, respectively) (Lissner *et al*. 1991; Hardin *et al*. 1994).

These species are of special concern because their natural history characteristics result in recolonization and recovery following natural or human-related disturbance that requires years to accomplish, especially species with limited dispersal abilities and slow growth.

Large erect sponges (Demospongiae) are typically represented by few families, ranging in color from tan to yellow, orange, red, and blue (SAIC-SLO 1999). Many of these species are expected to be slow growing, and similar to *Stylaster californicus* (formerly *Allopora californica*) in requiring several years to achieve sizes of 30 cm or more (e.g., Lissner *et. al.* 1991; Hardin *et. al.* 1994).

Another hard substrate species commonly present in the southern regions of Northern California is the red abalone (*Haliotis rufescens*). Red abalone inhabit intertidal and shallow subtidal rocky substrate between Bahia Tartugas, Baja California to Oregon. Although red abalone predominantly inhabit rocky hard substrate, they are known to move across sand or gravel regions between isolated rocky substrate features. Red abalone inhabit water depths ranging between the intertidal zone to approximately 180 m (590 ft) deep, but are most common between 6 and 40 m (20 and 131 ft) water depth (CDFG 2001).
Red abalone are broadcast spawners and aggregate in clusters for reproduction. Young abalone, including post larva and juveniles, forage on bacteria, diatoms and single celled algae. Adult abalone forage on brown algae and when food is scarce, feed on benthic diatom films.

Mortality of red abalone is typically due to predators, anthropogenic impacts, environmental conditions and disease (CDFG 2005). Although neither currently protected under Federal or State endangered species regulations, nor identified as a species of special concern, red abalone is a major recreational fishery in Northern California and recent declines in abundance numbers and the recent closure of the fishery elevates this species to a status of special concern by the State of California.

All species of abalone were part of a commercial and recreational fishery offshore California until 1997 when California Department of Fish and Game closed the commercial fishery due to crashing abalone populations. A red abalone recreational fishery was left open north of San Francisco, however this was reduced in size with an indefinite closure of the Fort Ross area after a high mortality event as a result of a red tide (The Press Democrat 2014). The California Department of Fish and Wildlife (CDFW) closed the red abalone recreational fishery at the end of 2017. The CDFW cite low stock abundances, starving abalone, and high mortalities as reason for the closure and is developing the Red Abalone Fisheries Management Plan that will identify what conditions need to be met for reopening the fishery (CDFW 2018b).

6.4 Deep-Sea Corals

Deep-sea or cold-water corals are a diverse group of organisms with thousands of species found worldwide. Many of these corals provide habitats for a myriad of marine species. Deep-sea corals occur primarily on hard bottom substrate on the continental shelf and slope, offshore canyons, and on oceanic island slopes and seamounts. Deep sea corals are considered Habitats of Particular Concern (HAPC) for groundfish and other managed fish species under the MSA.

Deep-sea coral ecosystems are typically long lived, slow growing, and fragile, which makes them especially vulnerable to physical disturbance and damage. Along the west coast of North America, 101 species of corals have been identified, consisting of 18 species of stony corals, 7 species of black corals, 36 species of gorgonian or soft corals, 8 species of true soft corals, 27 species of pannatulaceans or sea pens, and 5 species of stylastid corals. Many of these species and taxa are designated as "structure-forming," meaning they are known to provide vertical structure above the seafloor that can be utilized by other invertebrates or fish (NOAA 2010; Whitmire and Clarke 2007).

The most common stony corals observed offshore California are the solitary cup corals (e.g., *Balanophyllia elegans*, *Paracyathus stearsii*) and branching corals (e.g., *Lophelia pertusa, Oculina profunda, Madrepora oculata*, *Dendrophyllia oldroydae, Astrangia haimei, Labyrinthocyathus quaylei* and *Coenocyathus bowersi*). Black corals, which are represented by only seven species, are considered vary abundant along the Pacific coast, with *Antipathes sp*. and *Bathypathes sp*. exhibiting coast wide distributions, while the other five species appear to be limited to seamounts (Whitmire and Clarke 2007). Gorgonians are the most populous group of corals off the Pacific coast. *Eugorgia rubens* (purple gorgonian) and *Adelogorgia phyllostera* (orange gorgonian) are commonly observed in the nearshore coastal waters, whereas *Paragorgia arborea* (bubblegum coral), although found in high abundance region-wide, inhabits water depths greater than 200 meters. Gorgonian and black corals have branching tree-like forms and can occur singly or form thickets. These three-dimensional features and vertical structures provide habitat for numerous fish and invertebrate species and enhance the biological diversity of many deep-sea ecosystems.

Included with deep-sea corals are sea pens (order Pennatulacea), which occur over soft-bottom substrates and are the most abundant coral taxon in the region. Some sea pens are quite mobile and can move from one location to another. *Stylatula sp*., *Anthoptilum grandiflorum* and *Umbellula sp*. are the most common taxa, all of which are found coast wide. Although groves of pennatulaceans have been shown to support higher densities of some fish species over adjacent areas, they are not considered to be structure forming (Brodeur 2001).

Lace corals or stylasterid corals have been observed colonizing moderate to high-relief rocky habitats from the intertidal zone down to shelf water depths. Only five species from three genera are known to occur along the Pacific west coast with *Stylatula californicus* (*Allopora californica*) being the only species known to occur in California. Note that Cairns (1983) synonymized *A. californica* to *Stylaster californicus*. Because of, widespread and historic use and immediate name recognition of "*Allopora*" by most marine scientists, this discussion uses the original name (*Allopora*) to avoid confusion.

S. californicus has a calcareous skeleton and forms upright pink to dark blue branching colonies. This species is characterized by very slow growth (e.g., 5 to 10 years to reach sexual maturity, possibly more than 20 years to grow to a height of 30 cm) (Thompson, *et al*. 1993; Gotshall 1994). *Allopora* has no planktonic larval stage and fertilization between adult colonies more than 10 meters apart is limited.

In recent years, NOAA has developed an increased interest in these ecosystems and especially the potential for impacts from bottom contact fishing activities (NOAA 2014). Deep-sea coral are being evaluated for designation as EFH within the Pacific Coast Groundfish FMP, and likely will be designated once the 5-year review is complete.

Unfortunately, there is limited information concerning known occurrences of deep-sea coral offshore Southern California. This is due in part to the difficulty and expense of locating and surveying deep-sea hard substrate habitat. Much of what the scientific community knows about their presence is as a direct result of manned submersible and ROV surveys of fiber optic cable routes or oil and gas exploration sites.

Christmas tree coral (*Antipathes dendrochristos*), a species of black coral that occurs in the Southern California Bight, has been documented around Piggy Bank and on Hidden Reef north of Santa Catalina Island; there are also a few documented occurrences around San Nicolas Island (Huff *et. al.* 2013). Huff et al. (2013) mapped ocean currents, primary productivity (chlorophyll), and temperature against known locations of Christmas tree coral to develop a predictive model for the SCB. These environmental correlates predict bands of low occurrence, interspersed with isolated pockets of high occurrence, in the project area. Specific locations of coral within these bands of low occurrence and pockets of high occurrence depend on the availability of hard bottom substrate. Guinotte and Davies (2014) developed a habitat suitability model for multiple species of deep-sea coral for the U.S. West Coast. They reported bands of suitable habitat associated with specific bathometric features in the project area. Both studies show suitable deep-sea coral habitat in places that would be crossed by the proposed cable routes. Specific locations where the proposed cable routes may encounter deep-sea coral are the following:

- Bottom slopes south of the Channel Islands and around Piggy Bank;
- High relief bottom between Santa Barbara Island and the Channel Islands;
- High relief bottom between San Nicolas Island and the Channel Islands.

6.5 Kelp and Sea Grasses (Submerged Aquatic Vegetation)

Bull kelp (*Nereocystis luetkeana)* is a species of larger brown algae that occurs from Point Conception, California to Unmask Island, Alaska. This alga is found in the near shore area from 3-20m and attaches with holdfasts to hard substrate including bedrocks, reefs and boulder fields (Springer et al. 2007). Bull kelp is an essential part of the ecosystem provides protection for various marine life as well as foraging grounds for fish, mammals and seabirds (Springer et al. 2007). Large persistent kelp beds occur offshore of Pt. Arena and extend to the southward. North of Pt. Arena there is a gap between the kelp beds due to sandy environments.

There are two species of surfgrass that occur offshore California including *Phylospadix scouleri* and *Phylospadix torreyi*. Surfgrasses are flowering marine plants found throughout shallow coastal environments in low tidal areas (MARINe 2018). No known surfgrass beds are known to occur offshore Manchester Beach, California or in nearby areas.

7 Potential Effects of Fiber Optic Cable Installation and Operation on Intertidal and Subtidal Marine Communities

The installation, maintenance, and ultimate abandonment/removal of a subsea fiber optic cable located in the coastal waters of California could result in disturbances to both soft and hard substrate habitats and would differ according to installation methods, which vary with water depth and substrate type. In shallow water soft-sediment areas, divers or ROVs are typically used to bury the cable using a water jet to create a channel in which the cable is laid, and the cable channel is allowed to self-bury. In deeper soft-bottom areas, a cable installation plow is employed that digs a 1-meter deep trench in the seafloor, places the cable into the trench, and then refills the trench with the excavated sediment.

In the event a proposed cable route contains hard substrate features, the final selected routing of the cable is such that to the maximum extent feasible, all hard substrate, especially high relief outcrops, is avoided, especially in water depths less than 33 meters (100 ft.). If placement along mixed bottom or low to moderate relief habitat is unavoidable, the cable is typically laid onto the seafloor and either a ROV or divers are used to properly position the cable around isolated exposed outcrops or high relief features and in general, locate the cable so that minimum contact with more sensitive hard bottom habitat occurs.

In addition to direct physical disturbance of marine habitats by cable placement or burial during installation, other potential effects include:

- Increased water turbidity during cable burial in soft seafloor sediments with a cable plow or by ROV or diver trenching activities,
- Potential release of drilling fluids during the boring of the fiber optic cable landfall conduits,
- Underwater noise from marine construction work vessels and activities, and
- Accidental release of hydrocarbon containing fuel oils and lubricants by work vessels engaged in cable installation and landfall conduit horizontal directions drilling (HDD) activities

Numerous fiber optic cables have been installed in California coastal waters over the past several decades, with landfalls in Southern California (San Diego, Hermosa Beach, Manhattan Beach, Los Angeles, and Santa Barbara), Central California (Montana de Oro, Grover Beach, Estero Bay, and Moss Landing), and Northern California (Manchester Beach). As more cables have been installed along the California coast, pre and post ROV surveys have been performed that provide some anecdotal information on the longevity and severity of potential effects to marine habitats and biota. Additionally, CEQA documents prepared for these projects discuss in detail the potential impacts to marine biota from the installation, operation and removal/abandonment of fiber optic cables. Mitigation measures outlined in these documents can be assessed for their efficacy in preventing or minimizing the identified potential effects to marine resources. Potential effects will undoubtedly vary between each project depending on the specifics of each project, its route, location along the coast, and technical approach for installation. The following discussion on potential effects of fiber optic cable installation provides a brief synopsis of potential marine effects to marine biological resources from fiber optic cable installation and operation and outlines operational actions that can be employed to prevent significant impact to marine ecosystems.

7.1 Soft-bottom Habitat & Associated Biota

Any effects to soft-sediment biota during cable installation, operation, or abandonment can be expected to be minimal and short-term. The use of a cable plow to create a temporary furrow along the seafloor into which the fiber optic cable is placed and immediately buried can be expected to result in a temporary disturbance of benthic infauna (animals living in the sediments of the seafloor) and epifauna (animals living on the surface of the seafloor). It is estimated that the actual area of disturbance is less than 8 meters wide, the size of the plow itself, with the most severe effects being limited to the 1-m wide trench. Most mobile invertebrates and fish can be expected to avoid the plow and return to the area shortly after the plow has left. Any benthic infauna inhabiting the upper biotic sediment layers disturbed by the plow and then replaced into the furrow on top of the cable can be assumed will be smothered and killed. The loss will be minimal and temporary, based on the extremely small area of the seafloor affected relative to the surrounding area. Recolonization will occur both by migration from adjoining, undisturbed seafloor areas and by natural recruitment. This recolonization can be expected to begin immediately after disturbance.

Studies of offshore sand mining operations in the Gulf of Mexico and Atlantic Ocean have shown that recovery of benthic infauna to comparable productivity levels following burial or complete removal with the mined sand typically occurs within a few years following the disturbance (Hammer *et al.* 1993; Van Dolah *et. al*. 1992). The key factors to the speed of recovery were (1) when the impact occurred relative to seasonal periods of spawning and recruitment, and (2) the proximity of undisturbed sediment to the disturbed/impacted area. Because the disturbance to benthic infauna during cable installation does not involve sediment removal and the distance between disturbed and undisturbed sediment is typically less than 0.5 meters, recovery to pre-disturbance conditions is expected to be relatively quick. During the 2007 ROV survey of the AAG S-5 cable route, several other buried telecommunications cables were crossed

and any apparent disturbance observed. No detectable differences in benthic macrofauna were noticeable at these locations. At one cable crossing a slight depression in the seafloor was detected (AMS 2008).

Possible effects to sessile, less mobile epibenthic organisms would include temporary burial by relocated sediment during cable plow operation and possible crushing and/or dislodgement. Similar to the benthic infauna, recovery can be expected to occur, typically within a year. Because of the relatively small area of disturbance, no effect to the general productivity of the area should be expected.

In any coarse sand, shallow water areas of a cable route where divers or ROVs are typically used to bury the cable, the disturbance can be expected to be similar to the deeper finer sediment areas of the route where a cable plow is used. In the very nearshore areas of the route, in water depths less than 30 meters, the seafloor and associated biota experience frequent and regular disturbance from wave action. As a result of this high energy, constantly changing environment, the associated biological community has adapted to frequent exposure and burial. The infaunal community is typically limited in species diversity and consists primarily of filter feeders (e.g. tube worms, sand dollars, sand anemones) and detrital feeders (e.g. shrimp and crabs). These taxa tend to be highly mobile and as a result, any effects to the habitat and associated biota can be expected to be insignificant and undetectable within a few days or months of cable installation.

During plow and trenching activities, temporary spikes in near-seafloor turbidity may occur. Increased turbidity is typically restricted to the water immediately above and adjacent to the seafloor where the plowing or trenching is occurring. Depending on water depth and natural wave or current energy generated through the water column, any generated turbidity plumes can be expected to dissipate quickly and any resuspended sediments resettled to the seafloor. During ROV surveys of cable routes, seafloor sediments are frequently disturbed by the ROV thrusters and generate similar turbidity plumes (AMS 2008, AMS 2016). These turbidity clouds quickly dissipate and the resuspended sediments resettled within minutes following the disturbance. Similar quick settlement can be expected from cable trenching and ploughing activities.

Similar to increases in turbidity from cable trenching and plowing activities, HDD boring of landfall conduits can also result in the accidental release of bentonite drilling fluid to nearshore subtidal habitats resulting in temporarily altered sediment composition and increased turbidity. Bentonite is a marine clay that is used for lubricating the borehead cutting tool and transporting borehole cuttings back to shore. During the HDD boring process, it is possible that some bentonite drilling fluid could be released to the seafloor. The HDD boring process typically terminates the landfall conduit installation at water depths between 12-17 meters (40 and 55 ft.). In general, the offshore termination point along the cable route is selected to occur in soft sediment habitat. Throughout most of California, the seafloor sediments occurring at these water depths are composed of sand with some minor silt and clay components. Coastal seafloor sediments at these water depths are also typically exposed to wind and wave surge as well as regular resuspension of seafloor sediments, resulting in naturally occurring increased turbidity near the seafloor.

The accidental release of small volumes of bentonite drilling fluid into this environment is not expected to result in any detectable effects on marine biota that may be present in the area of release or result in any permanent changes to soft substrate habitat. Any released bentonite clay would be expected to be quickly resuspended by wind and wave generated surge present at these shallow water depths and transported with similar sized sediment particles suspended in coastal waters to natural depositional areas along the coast. Any potential increased turbidity resulting from the accidental release of bentonite drilling fluid would also be expected to be either non-detectable against existing background turbidity conditions at the release site or be expected to quickly dissipate similar to any increased turbidity caused by cable trenching or ploughing.

The greatest potential for substantive effects to marine habitats and associated marine biota from the accidental release of bentonite drilling fluids during HDD boring activities is if a large volume of fluid is released. The release of large volumes of bentonite could result in the short-term burial and smothering of benthic epifauna and infauna, clog fish gills (Robertson-Bryan 2006), and cause longer-term increased turbidity in the area of the release. Early detection of any accidental release of bentonite drilling fluid, and the immediate cessation of HDD drilling activities until operational steps can be taken to stop the release of drilling fluid, are key to limiting the potential effect of HDD drilling on marine habitats and biological resources. Preparation and implementation of an HDD Monitoring Plan that details procedures for preventing the accidental release of drilling fluid during HDD work, as well as operational and release response procedures in case of a drilling fluid release can prevent the inadvertent discharge of large volumes of bentonite drilling fluid to the marine environment. A key and critical component of an HDD Monitoring Program is the inclusion of Rhodamine WT dye into the drilling fluid, paired with a continuous monitoring program to detect its presence in the ocean water above the HDD borehole route during active HDD boring activities. Since 2000, a total of 28 fiber optic cable landings using HDD boring technology and implementing HDD monitoring programs have occurred with only two minor detections of bentonite drilling fluid. In both cases, the boreholes were close to the surface and about to exit the seafloor. The early detection of the accidental release by the monitoring program, the immediate cessation of HDD boring activities, and in both cases the conversion to fresh water for lubrication, as outlined in the HDD monitoring and response plan, resulted in no continued detectable presence of bentonite on the seafloor or effects to marine taxa.

The use and operation of marine construction equipment and vessels always poses some risk of an accidental release of hydrocarbon materials, such as fuel oil or diesel fuel, lubricants, hydraulic fluids, etc. However, the accidental release of hydrocarbon-based products into the marine environment has the potential to impact all marine habitats and taxa, depending on the potential quantity released. Accidental releases could expose soft substrate associated marine biota, including fish, to oil or hazardous materials, through oiling, destruction or degradation of habitat, food sources, and nursery grounds, or through chronic toxicity.

Vessels operate under strict State and Federal regulatory requirements that include measures to prevent and respond to an unforeseen accidental release of hydrocarbon materials. These vessel-specific spill prevention and response plans include procedures to prevent, contain, report, recover, and remove any accidental hydrocarbon releases onboard the vessel or in the ocean. Additionally, the preparation of a project specific spill prevention and response plan that includes specific requirements for prevention of hydrocarbon materials present at work sites and onboard work vessels from reaching coastal waters, stockpiling onboard and onsite recovery and clean-up equipment and materials, and training requirements for project personnel, routinely prevent the occurrence of accidental releases, as well as minimize the potential exposure to marine ecosystems.

7.2 Hard-substrate Habitat

Impacts from cable installation can potentially be the greatest in hard substrate habitat within the cable route. The biota associated with hard substrate habitat is predominantly sessile, slow growing, and susceptible to crushing, dislodgement, and other physical disturbances. High-relief (> 1 meter in height) hard substrate areas, because of their higher species diversity, species abundances, and the potential presence of organisms that are sensitive to physical disturbances, such as erect turf species, hard and soft hydrocorals, branching and erect sponges, etc., are generally considered to be more sensitive to impacts than low-relief (< 1 meter) hard bottom habitat (Lissner *et al*. 1991). Low-relief hard bottom habitat is often subject to higher turbidity and cycles of frequent burial by sand and exposure typically resulting in

lower species diversity and abundances. These harsher physical conditions result in an associated biological community that is often more ephemeral and dominated by organisms that are more tolerant of high turbidity, sand scouring, or able to grow fast enough to avoid complete burial. Typical taxa observed in recent ROV habitat and macrobenthic taxa surveys for fiber optic cable routes in California include some cup corals, puffball and other similar sponges, gorgonian corals, and some species of anemones, such as *Stomphia* and *Urticina*.

The predominant species inhabiting moderate to higher relief hard substrate in water depths <200 meters (650 feet) include a turf community (mixtures of small hydroids, bryozoans, tunicates, and sponges), cup corals (*Paracyathus* and *Balanophyllia*), seastars (*Asterina* and *Henricia*), brittlestars (*Amphipholis*), various encrusting sponges, tunicates, bryozoans, red algae (at depths to about 30 m), rockfishes (*Sebastes spp.),* lingcod (*Ophiodon elongatus*), and painted greenling (*Oxylibius pictus*). Additionally, on hard bottom moderate to high relief features in water depths >100 meters (300 feet) the feather star or crinoid, *Florometra serratissima,* and the large plumose anemone *Metridium* are frequently observed. All of these taxa are capable of withstanding periodic physical impacts. Other species, such as the California hydrocoral, *Stylaster californicus (=Allopora californica),* the branching coral *Lophelia*, the colonial anemone, *Corynactis californica,* and large erect sponges are typically more sensitive to physical impact and turbidity/burial and may require longer time periods to recover. *Metridium* and *Corynactis* are common species on moderate and high relief substrate, whereas *Stylaster (Allopora) and Lophelia* are only infrequently reported being observed in past cable route surveys.

The potential for post-lay disturbance effects is highly dependent on where the cable is located within a hard substrate area and how securely the cable is anchored to the seafloor in order to avoid possible suspension across hard bottom features or movement on the hard bottom substrate. Suspensions often result in continued movement of the cable in response to currents in shallow depths (< 30 meters), causing abrasion of hard substrate. Based on observations made during past cable route and post-lay surveys in California coastal waters, the impacts to associated biota from post-lay movement appear to be minimal with careful placement of the cable. AMS (2007) reported during their survey of the AT&T Asia-America Gateway (AAG) S-5 cable, that ran parallel to previously laid fiber optic cables in low relief hard substrate, that they could not detect any noticeable impacts associated with previously laid cables in the area. In one survey, large erect sponges were observed growing on or over exposed cables (SAIC, 2000a), and another survey reported small-localized movements up to 10 cm in width being observed (SAIC-SLO 1999). Recovery of disturbed areas by immigration, asexual propagation or larval recruitment should begin occurring within months of the disturbance, although a study performed in the Pt. Arguello area suggests that the small areas of hard bottom habitat that might be disturbed by cable laying operations could take years to recover (Hardin *et. al.* 1993). These authors reported estimated mean time for recovery to background densities of 23 years for *Paracyathus stearnsi* and 19 years for *Lophogorgia chilensis* in areas disturbed by dragging anchors during pipe laying operations.

Increased turbidity from cable trenching or ploughing activities, or the accidental release of bentonite drilling fluid, can also be expected to pose a greater negative effect on hard bottom habitats and associated marine taxa. As discussed above, marine taxa, such as colonial and branching corals, large erect sponges, anemones, hydrocorals, and in shallower waters, brown, red and green algae, are generally more sensitive to increased turbidity and sediment deposition than solitary cup corals and turf species. Project induced turbidity, sedimentation, and bentonite drilling fluid releases can result in increased burial of low, moderate, and high relief hard substrate and attached taxa, clogging of fish gills and feeding surfaces, and temporary loss of foraging habitat. These impacts can be expected to be greater for moderate to high relief habitat and associated biota because of their greater sensitivity to sedimentation and the greater time it takes to recover from impacts (Hardin, *et. al.* 1993). Terminating cable trenching and HDD borehole cable conduits in areas of soft sediment that are away from hard bottom habitat and associated biota, as well as the development and implementation of an HDD Monitoring Plan, can be

expected to prevent and minimize potential exposure of hard substrate habitat and biota to accidental bentonite drilling fluid releases and increased turbidity from cable trenching and burial.

Potential exposure of hard substrate habitat and associated marine communities, including fish, marine mammals, and sea turtles to hydrocarbon materials is typically worse than that posed for soft substrate communities because of the time it takes these communities to establish themselves and the typically slower growing rate of many of the sessile taxa inhabiting hard substrate, such as sponges and corals. As for soft substrate communities, the implementation of spill prevention, training, and response procedures can be expected to prevent the occurrence of accidental hydrocarbon releases or limit the volume of released material should they occur.

7.3 Fishes

Most of the environmental assessments prepared for underwater fiber optic cables indicate that temporary displacement of some fishes from the immediate vicinity (e.g., tens of feet) of the cable route would occur during short-term passage of cable installation equipment (CSLC 2000a; CSLC 2000b; CSLC 2005; City of Hermosa Beach 2014). The impacts described in these documents were considered temporary (i.e., hours) and localized (occurring over a very discrete area), and therefore less than significant. Extensive alteration or destruction of habitat or communities lasting more than 1 year is unlikely due to the small size of the cable, the very localized corridor represented by the route, and burial of the cable along most of the inshore route to a depth of 1,200 meters (3,937 ft.) of the route. Any disturbances to the bottom from installation methods are expected to return to pre-installation conditions in a relatively short amount of time (less than a year) which is typically verified during a post-installation survey.

Fish could be exposed to temporary and isolated increased underwater noise from cable laying activities and from work vessels involved in HDD boring and cable installation activities. Studies in the North Sea assessing cable trenching and ploughing projects for offshore wind farms reported underwater noise levels of 178 db re 1 µp at a distance of 1 meter (Nedwell et al 2003). Similarly, peak underwater noise levels for cable laying ships has been reported to range between 170-180 db (re 1 µp at a distance of 1 m) (Hale 2018) and 160-180 db at a distance of 1 m for small work boats (CalTrans 2015), depending on the vessel size and design. Peak nearshore background underwater noise levels have been reported averaging between 128-138 db (re 1 µp at a distance of 1 m) (Farbre and Wilson 1997). Therefore, the generation of underwater noise by fiber optic cable installation are below established acute impact levels of 183 dB and 187 dB for fish less than and greater than 2 grams in mass, respectively, and only slightly higher than the 150 dB level established for behavioral disturbance (CalTrans 2015). Additionally, it can be anticipated that project generated underwater noise levels will reach subleathel levels for fish in approximately 32-64 m (95-210 ft.) and background underwater noise levels in 128-160 m (420-840 ft.) from the source, based on an assumed dB drop of 5-6 db per doubling of distance from the noise source (McKenna et.al 2012). Given the low magnitude of underwater noise generated by most cable laying activities relative to established thresholds for acute effects to fish and the short duration and small distance underwater noise generated by cable laying activities will exceed background conditions, no substantive effects to fish should be anticipated.

As discussed above for invertebrate taxa, the accidental release of any hydrocarbon materials has the potential to impact any fish that happen to be present in the area effected by the release and happen to swim through any surface slicks generated by the accidental release. The preparation and implementation of a spill prevention, training, and response procedures plan can be expected to prevent the occurrence of accidental hydrocarbon releases from cable installation and maintenance activities, as well as limit the volume of any released material and therein the potential effects on marine taxa, should they occur.

7.4 Marine Mammals & Sea Turtles

No significant effects to marine mammals or sea turtles are anticipated from cable installation at the landing sites or along the offshore cable route. Many of the potential impacts such as disruption of migration route or increased noise during installation are considered temporary, lasting only hours (along the sea route installation) to a few days (at the cable landfall location) in any one location, and would not cause disruptions substantially different from normal ship traffic (e.g., noise) through the area (SAIC 2000b). In addition, ship strikes of whales and sea turtles have become of growing concern for several species, with ship strikes to the highly endangered North Atlantic right whale receiving the most attention off the U.S. east coast (Calambokidis 2011) and leatherback turtles offshore California. In 2007, four blue whales off the coast of California were found dead with direct or indirect indications of having been struck by ships. These four were all found in the vicinity of the Santa Barbara Channel and Los Angeles-Long Beach Harbors. Ship strikes of marine mammals during cable installation is highly unlikely since the speed of the ship during cable laying activities is slower (~0.5 to 1.5 knots while plowing) than migrating whales or sea lions. The potential for ship strikes to sea turtles is greater than for marine mammals, especially when they surface to breathe. Although some avoidance of a cable lay ship can be anticipated as a result of disturbance and noise generated by cable installation operations, some potential for collision remains. Active avoidance of potential collisions with both marine mammals and sea turtles remains the best appraoch to preventing negative interactions between cable lay vessels and marine mammals and sea turtles. The preparation and implementation of a marine mammal monitoring and avoidance plan that is implemented during all cable laying operations will prevent the potential for either marine mammals or sea turtles to come close enough to cable lay operations that any strike can occur. These plans typically require marine mammal observers being present on the cable installation ship, in addition to procedures for ceasing all operations if a marine mammal or sea turtle comes within a prescribed “safety zone” distance of the vessel.

The long-term presence of the fiber optic cable along the seafloor also would not significantly impede migration since it would be buried along most of the nearshore route where whales transit the coast during migrations and represent a very low profile (e.g., 1 to several inches) in hard bottom areas as a result of careful installation and post-lay inspection/adjustment of the cable in these areas. Also, as discussed in CSLC (2000a), cable slack would be stabilized at a level within the range of 2 to 3 percent in areas where the cable cannot be buried to ensure that the cable conforms to the slopes and peaks of the seabed so that it is not suspended substantially (e.g., more than 1 foot) above the bottom. This would prevent any spans from developing that could potentially entangle marine mammals (e.g., whales). Of the eleven known commercial fiber optic cable landings in coastal California waters installed since 2000, no known or reported entanglements between whales and fiber optic cables have occurred.

Exposure to underwater noise from cable installation activities and work vessels, like with fish, poses some potential for acute and sublethal effects to marine mammals and sea turtles. As discussed above for fish, these operations can generate underwater noise levels ranging between 160-180 dB. NOAA (2018d) established cumulative sound exposure levels (SEL) for marine mammals. These cumulative SEL levels are 183 dB for baleen whales, 185 dB for dolphins, toothed whales and true seals, 155 dB for porpoises, and 203 dB for sealions, fur seals, and otters. With the exception of the sound exposure limits for porpoises, all of the other NOAA established underwater thresholds are greater than the underwater noise generated by cable installation equipment and vessels. As discussed above for underwear noise effects on fish, assuming a 5-6 dB decrease in noise level for every doubling of the distance from the noise source, cable installation underwater noise should decrease to levels <155 dB in approximately 16-32 m (52-105 ft.) from the source. As presented in Table 8, only Dahl’s porpoise is expected to occur in the coastal waters offshore Manchester Beach. If present during cable installation activities, the porpoises would need to be closer than 32 m (105 ft.) to the cable lay ship or work vessel to be impacted by the generated underwater noise. Although they can be expected to avoid the immediate area of the generated underwater

noise if traveling or foraging in the area offshore Manchester Beach during cable lay activities, the implementation of a marine mammal monitoring program and the presence of marine mammal observer onboard during cable installation activities and procedures for the cessation of cable installation activities in the event any marine mammals, including porpoises, come within an established safety zone, can be expected to prevent any exposure of porpoises and other marine mammals and sea turtles to underwater noise levels of sufficient magnitude to result in any deleterious effects.

As discussed above for fish and invertebrate taxa, the accidental release of any hydrocarbon materials has the potential to impact marine mammals and sea turtles that happen to be present in the area effected by the release and happen to swim through any surface slicks generated by the accidental release. The preparation and implementation of a spill prevention, training, and response procedures plan can be expected to prevent the occurrence of accidental hydrocarbon releases from cable installation and maintenance activities, as well as limit the volume of any released material and therein the potential effects on marine taxa, should they occur.

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9 Appendices

Table 1: Master Macrobenthic Invertebrate and Alga Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters.

Table 2: Macrobenthic Invertebrates and Alga Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters by Depth.

Table 3: Master Fish Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters.

Table4: Fish Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters by Depth.

Table 5: Magnuson-Stevens Act Managed Fish Species Occurring in North Central and Southern Northern California Coastal Waters Near Point Arena.

Table 6: California Annual Commercial Landings (in Thousand Pounds) at Fort Bragg, California.

Table 7: Mendocino County, California Annual Recreational Fish & Invertebrate Landings.

Table 8: Special-Status Marine species and their potential to occur within the study area.

Table 1: ***Master Macrobenthic Invertebrate and Alga Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters.***

Phylum	Scientific Name	Common Name	Global West (SAIC 2000a)			S. Cal. Bight (Pondella et. al. 2009)	Morro Bay (SAIC200a; AMS 2008; SAIC-SLO 1999)			Monterey Bay (MBARI 2004)		Point Arena MPA	Albion	Ten Mile MPA
			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
Angiosperm	**Flowering Plant**													
	Phyllospadix sp.	Surf grass					X							
Chlorophyta	**Green Algae**													
	Ulva spp. drift	Sea lettuce, drift					X							
Phaeophyta	**Brown Algae**													
	Egregia meanzinii drift	Feather boa kelp drift				X	X	X	X					
	Macrocystis pyrifera drift	Giant kelp, drift				X	X	X	X					
	Nereocystis californica drift	Bull kelp, drift					X	X	X					
Rhodophyta	**Red Algae**													
	Callophyllus sp.	Beautiful leaf algae					X							
	Corallincea Unident., drift	Coralline algae, drift					X	X	X					
	Mastocarpus papillatus	Turkish towel				X								
	Rhodymenia sp.	Red membrane algae					X							
	Rhodophyta, unident.	Red algae unidentified												
Ochrophyta	*Cystoseira osmundacea*	Chain-bladder kelp				X								
	Desmarestia ligulata	Acid kelp				X								
	Eisenia arborea	Southern sea palm				X								

Phylum	Scientific Name	Common Name	Global West (SAIC 2000a)			S. Cal. Bight (Pondella et. al. 2009)	Morro Bay (SAIC200a; AMS 2008; SAIC-SLO 1999)			Monterey Bay (MBARI 2004)		Point Arena MPA	Albion	Ten Mile MPA
			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Laminaria farlowii	oarweed				X								
Ochrophyta	*Laminaria setchellii*	Southern stiff striped kelp				X								
	Pterygopgora californica	Pom pom kelp				X								
	Sargassum sp.	wireweed				X								
	Undaria pinnatifida	Wakame				X								
Porifera	**Sponges**									**X**				
	Craniella arb	Gray puffball sponge	X	X		X						X		
	Polymastia pachymastia	Aggravated vase sponge					X							
	Spheciospongia confoederata	Grey moon sponge					X							
		Sponge, foliose white					X	X					X	
		Sponge, large white					X							
		Sponge, white					X	X						
		Sponge, white encrusting					X	X						
		Sponge, white/gray saucer					X	X						
		Sponge, grey					X	X						
		Sponge, orange					X							
		Sponge, salmon encrusting					X	X						
		Sponge, tan bulbous					X					X		

Phylum	Scientific Name	Common Name	Global West (SAIC 2000a)			S. Cal. Bight (Pondella et. al. 2009)	Morro Bay (SAIC200a; AMS 2008; SAIC-SLO 1999)			Monterey Bay (MBARI 2004)		Point Arena MPA	Albion	Ten Mile MPA
			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
		Sponge, tan globose					X							
		Sponge, yellow					X	X				X		
	Tethya aurantia	Orange puff ball sponge				X	X	X				X	X	
	Toxadocia spp.	White finger sponge				X	X							
	Hydroids, Sea Anemones, Sea Pens, Corals													
	Acanthoptilum sp.	Sea Pen	X	X				X	X		X			
	Actinaria unident.	Sea anemone	X							X		X	X	X
	Actinostola	Anemone	X											
	Adelogorgia phyllostera	Orange gorgonian					X		X					
	Amphianthus	Sea anemone	X											
	Anthopleura artemsia?	Moonglow anemone							X					
Cnidaria	Anthopleura elegantissima	Aggregating anemone				X								
	Anthopleura sola	Solitary anemone				X								
	Anthopleura xanthogrammica	Giant green anemone				X								
	Balanophyllia elegans	Orange cup coral		X			X							
	Caryophillia sp.?	White cup coral	X	X			X							
	Cerianthidae, unident.	Cerianthid anemone						X	X		X	X		
	Corallimorphus sp. 1	Colonial anthizoan									X			
Cnidaria	*Corynactis californica*	Strawberry or club-tipped anemone	X				X			X				

Phylum	Scientific Name	Common Name	Global West (SAIC 2000a)			S. Cal. Bight (Pondella et. al. 2009)	Morro Bay (SAIC200a; AMS 2008; SAIC-SLO 1999)			Monterey Bay (MBARI 2004)		Point Arena MPA	Albion	Ten Mile MPA
			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Cup coral	Brown or orange cup corals				X								
	Cyathoceras foxi	Cup corals												
	Desmophyllum	Cup corals	X											
	Eugorgia rubens	Purple gorgonian				X								
	Gorgonocephalus eucnemis	Giant basket star	X	X						X		X	X	X
	Orgonacea Unident.											X		
	Halipteris californica	Short sea whip										X	X	X
	Hydrozoa	Corals				X								
	Lophelia sp.	Branching white coral	X				X							
	Lophogorgia chiliensis	Red gorgonian (sea whip)	X	X		X	X							
	Metridium farcimen (giganteum)	White-plumed anemone	X	X			X	X	X	X		X	X	X
	Metridium senile	Frilled anemone											X	X
	Muricea californica	Golden gorgonian				X								
	Muricea fruticoas	Brown gorgonian				X								
	Paracyathus stearnsi	Brown cup coral	X	X			X	X		X				
	Parazoanthus sp.	Parasitic aggregating												
	Pachycerianthus sp.	Tube anemone					X	X						
	Pachycerianthus fimbratus	Tube-dwelling anemone				X								
	Pennatulacea sp.	Sea pen									X			
	Polyorchis pencillatus	Bell medusa				X								
Cnidaria	*Ptilosarcus gurneyi*	Orange or fleshy							X		X	X	X	X

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
		sea pen												
	Scyphozoans Unident.	Sea Jellies											X	X
	Scytalium sp.	Sea pen						X	X					
	Stomphia coccinea	Swimming anemone	X				X		X					
	Stompia spp.	Swimming anemone									X			
	Stylaster californicus (formerly Allopora californica)	California hydrocoral	X			X	X		X			X	X	
	Stylatula elongata	White sea pen						X	X		X	X	X	X
	Stylatula sp.	Sea pen			X			X	X					
	Swiftia spauldingi	Short red gorgonian										X	X	X
	Urticina columbiana	Sand-rose anemone					X	X				X	X	X
	Urticina crassicornis	Painted anemeone											X	
	Urticina lofotensis	White-spotted rose anemone				X								
	Urticina mcpeaki	McPeak's urticina												
	Urticina piscivora	Fish eating anemone; White spotted rose anemone				X	X	X				X	X	

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Urticina sp.	Anemone, unident.							X		X	X		
	Virgularia californica	Sea pen							X					
	Virgularia sp	Sea pen						X	X			X		
	Virgularidae unident.	Sea pen						X	X				X	X
		Plumed hydroid, unident.					X		X					
		Branched hydroid, unident.					X							
	Zoanthidae Unident.											X		
Annelida	**Segmented Worms**													
	Arcidae unident.				X									
	Amphinomidae	Polychaete worm							X					
	Chloeia pinnata?	Free living polycahete			X				X					
	Cossura	Polychaete			X									
	Diopatra ornata	Ornate tube worm							X		X			
		Serpulid worm casing					X							
		Tube Worm, unident.							X					
	Lumbrineris	polychaete			X									
	Maldanidae	polychaete mound worms			X									
	Mediomastus	Polychaete worm			X									
	Nephtys	Catworm			X									
Annelida	*Paraprionospio*	polychaete			X									
	Pectenaria	Fanworm			X									

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Prionospio				X									
	Sabellidae unident.	Feather duster worms									X			
	Spiophanes				X									
	Tharyx				X									
Mollusca	**Bivalves, Snails, Octopus, Squid, Sea Hares, Nudibranchs**													
	Anisodoris sp.	Yellow nudibranch					X							
	Aplysia californica	California sea hare				X								
	Astrea gibberosa	Red turban snail					X							
	Axinopsida				X									
	Bivalve Mollusk	Clam like bivalve					X							
Mollusca	Bivalve siphon										X			
	Cadlina leuteomarginata	Yellow-edged cadlina				X								
	Calliostoma annulatum	Purple-ring top snail					X							
	Ceratostoma foliatum	Leafy hornmouth				X								
	Chaceia ovoidea	Wart-necked piddock				X								
Mollusca	*Chromadorid sp.*	Chromid sea slug					X							
	Crassedoma giganteum	Rock scallop				X						X	X	
	Cyclocardia sp.	Mollusk			X									
	Cypraea spadicea	Chestnut cowry				X								
	Dendrodoris sp.	Dendrodorid nudibranch				X								
	Diaulula sandiegensis	San Diego dorid				X								

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Dirona albolineata	White-lined dirona				X								
	Doris montereyensis	Monterey dorid				X								
	Enteroctopus dofleini	Giant Pacific octopus										X	X	
	Flabellinopsis iodinea	Spanish shawl nudibranch				X	X							
	Gastropoda	Marine snail									X			
	Haliotis corrugata	Pink abalone				X								
	Haliotis fulgens	Green abalone				X								
	Haliotisrufescens	Red abalone				X								
	Kelletia undosum	Kellet's whelk				X								
	Lithopoma undosum	Turban snail				X								
	Loligo sp.	squid					X							
	Loligo opalescens	Market squid										X		X
	Megathura crenulata	Giant keyhole limpet				X								
	Mexichromis porterae	Porter's chromodorid				X								
	Mitrella	Sea snail			X									
	Norrisia norrisi	Norris's topsnail				X								
	Nudibranch, dorid white	Sea slug					X				X			
	Octopoda	Octopus			X						X		X	
	Octopus bimaculoides	Two-spot octopus				X								
	Octopus rubescens	Red octopus							X			X	X	X

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Opistobranch Unident.	Nudibranch										X		X
	Parapholas californica	Scaleside piddock				X								
	Parvilucina californica				X									X
	Peltodoris nobilis	Sea lemon				X							X	
	Pleurobranchaea californica	Sea slug			X				X		X	X		X
	Tochuina teraquetrar	Orange peel nudibranch										X		
	Tritonia diomedea	Pink Tritonia												X
Arthropoda	**Shrimp, Crabs, Isopods**													
	Amphipods				X									
	Barnacle	Unidentified barnacle				X								
	Balanus nubilus	Giant acorn barnacle										X		
	Cancer antennarius	Brown rock crab				X								
	Cancer gracilis	Slender crab						X	X					
	Cancer spp.	Crab			X	X	X	X	X		X			
	Cancer productus	Red rock crab											X	
	Euphilomedes				X									
	Galatheidae	Squat lobster	X	X										
	Hemisquilla ensigera	Manta shrimp												
	Hinnites giganteus	Rock scallop					X							
	Loxorhynchus crispatus	Masking crab	X	X		X	X					X		
	Lopholithodes mandtii	Puget Sound king crab										X	X	
	Metacarcinus magister	Dungeness crab										X		X

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Munida quadrispina	Squat lobster					X							
	Paguristes sp.	Hermit crab						X	X					
	Pandalus danae	Coon stripe shrimp					X							
	Pandalus gurneyi	Coon striped shrimp				X								
	Panulirus interruptus	California spiny lobster				X								
	Pandalus platyceros	California spot prawn									X			
	Pandalis jordani ?	Pacific ocean shrimp					X	X	X					
	Pandalid shrimp	Shrimp					X	X	X					
	Photis	Amphipod			X									
	Pugettia producta	Northern kelp crap				X								
	Pugettia richii	Cryptic kelp crab				X								
	Sicyonia	Prawn			X									
Bryozoans		Bryozoan, unident.	X	X										
		Bryozoa, tan					X							
		Bryozoa, tan branching												
		Bryozoa, white branching												
		Bryozoa, pink encrusting												
		Bryozoa, orange encrusting												
		Bryozoa, orange												

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
		branching												
	Membranipora sp.	White encrusting bryozoan on drift kelp						X						
		White ectoproct?												
	Cellaria sp	Stick-figure bryozoan					X							
Echinodermata	**Sea Stars, Brittle Stars**													
	Allocentrotus fragilis	Pink sea urchin			X									
	Amphiodia sp.	Brittle star			X				X					
	Amphipholis sp.	Brittle star	X		X				X					
	Asterina miniata	Bat star	X	X		X			X			X	X	
	Astometis sertulifera	Fragile rainbow star				X								
	Asteroidea unident.	Sea star									X			
	Astropecten verrilli and/or A. *armatus*	Spiny sand star			X	X			X					
	Brisaster	Sea urchin			X									
	Brisingidae	Sea star			X						X			
	Centrostephanus coronatus	Black sea urchin				X								
	Ceramaster patagonicus	Cookie cutter sea star				X	X						X	
	Cucumaria miniata	Orange sea cucumber										X	X	
	Cucumaria piperata	Salt-and-pepper sea cucumber				X						X		
	Dedraster ecentricus	Sand dollar						X						

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Dermasterias imbricata	Leather star				X	X					X	X	
	Echinoderm, juvenile unident.	Juvenile sea star					X							
	Echinoderm, unident.	Unidentified sea star										X	X	X
	Florometra serratissima	Crinoid		X			X							
	Henricia sp.	Sea star	X	X		X	X					X	X	
	Hippasteria sp.	Sea star		X							X			
	Hippasteria spinosa	Spiny red star										X	X	
	Holothuroidea sp.	Sea cucumber									X			
	Linckia columbianus	Fragile star				X								
	Luidia foliolata	Sand star										X	X	X
	Lytechinus anamesus	White urchin			X	X								
	Mediaster aequalis	Red sea star	X	X			X				X	X	X	
	Mesocentrotus franciscanus	Red sea urchin										X	X	
	Ophiocantha diplasia	Brittle star	X	X					X					
	Ophionereis sp.	Brittle star	X	X					X					
	Ophiura sp.	Brittle star						X	X					
	Ophiuroids, unident	Brittle star						X	X					
	Ophioplocus esmarki	Smooth brittle star				X								
	Orthasterias koehleri	Rainbow sea star				X	X						X	
	Parastichopus californicus	Sea cucumber				X			X		X	X	X	
	Parastichopus leukothele	Sea cucumber									X			

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Parastichopus parvimensis	Purple sea cucumber				X								
	Parastichopus sp.	Sea cucumber		X							X			
	Peridontaster		X											
	Petalaster (luidia) foliolata	Leafy flat star			X				X		X			
	Pisaster brevispinus	Pink sea star	X			X	X	X	X			X		
	Pisaster sp.	Sea star					X	X	X					
	Pisaster giganteus	Giant-spined sea star				X	X							
	Poraniopsis inflata	Thorny sea star										X	X	
	Psolus chitonoides	Slipper sea cucumber										X	X	
	Pisaster ochraceus	Ochre star				X						X		
	Pteraster sp.	Sea star									X			
	Pteraster tesselatus	Cushion star										X	X	
	Pteraster tesselatus arcuatus	Fat sea star							X					
	Pycnopodia helianthoides	Sunflower star				X			X		X			
	Rathbunaster californica	Multi-armed sea star	X	X					X		X		X	
	Solaster sp	Solaster sun star complex										X		
	Solaster dawsonii	Morning sun star							X					
	Strongylocentrotus fragilis	Fragile pink urchin											X	
	Strongylocentrotus franciscanus	Red sea urchin				X								

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			Habitat			Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
			Hard Substrate-high relief	Hard Substrate-low relief	Soft Substrate	Hard Substrate	Hard Substrate	Mixed Bottom	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
	Strongylocentrotus purpuratus	Purple sea urchin				X						X		
	Stylasterias forreri	Fish-eating star				X					X	X	X	
Urorchordata	**Tunicates**		X	X										
	Archidistoma psammion	Compound ascidian					X							
	Ascidia paratropa	Glassy tunicate					X							
	Boltenia villosa	Spiny-headed tunicate					X							
	Cystodytes sp.	Lobed tunicate					X					X		
	Polyclinum planum	Elephant ear tunicate					X							
	Styela montereyensis	Stalked tunicate				X	X							
	Laqueus californianus	Lampshell								X				
Hemichordata	*Balanoglassus sp.*					X								
	Enteropneusia					X								
Salpida	Salpida Unident.	Salps												X

Table 2: Macrobenthic Invertebrates and Alga Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters by Depth.

Scientific Name	Common Name	Global West (SAIC 2000a)		S. Cal. Bight (Pondella *et. al.* 2009)	Morro Bay (SAIC 2000a; AMS 2008)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Protobacteria															
Beggiatoa spp.	White filamentous bacteria														
Angiosperm															
Phyllospadix sp.	Surf grass, drift				X	X	X								
Phaeophyta															
Egregia meanzinii	Feather boa kelp, drift			X	X	X	X								
Macrocystis pyrifera	Giant kelp, drift			X	X	X	X	X							
Nereocystis californica	Bull kelp, drift				X	X									
Phaeophyta, unident.	Unidentified brown algae														
Rhodophyta															
Chondracanthus exasperatus															
Mastocarpus papillatus	Turkish towel			X											
	Encrusting coralline algae				X	X	X								
Cystoseira osmundacea	Chain-bladder kelp			X											
Desmarestia ligulata	Acid kelp			X											
Desmarestia ligulata, drift	Drift acid kelp														
Eisenia arborea	Southern sea palm			X											
Laminaria farlowii	Oarweed			X											
Laminaria setchellii	Southern stiff striped kelp			X											
Pterygopgora californica	Pom pom kelp			X											
Rhodophyta, unident.	Red algae unidentified														
Sargassum sp.	wireweed			X											
Undaria pinnatifida	wakame			X											
Porifera															
Craniella arb	Gray puffball sponge			X									X		
Rhabdocalyptus sp.	Vase sponge														
Silicea (Porifera*) Sp. A*	Sponge-orange														

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		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Silicea (Porifera) *Sp. B*	Sponge- Yellow												X		
Silicea (Porifera) *Sp. C*	Sponge, unident.														
Silicea (Porifera) *Sp. D*	Tan globular sponge					X	X	X					X		
Tethya aurantia	Orange puff ball sponge			X		X	X						X	X	
Toxadocia spp.	White finger sponge			X										X	
	White foliose sponge														
Cnidaria															
Acanthoptilum sp.	Sea Pen					X	X	X							
Actinaria unident.	Sea anemone								X	X	X				
Actinostola	Anemone	X	X												
Adelogorgia phyllostera	Orange gorgonian							X							
Amphianthus	Sea anemone	X	X												
Anthopleura artemsia?	Moonglow anemone					X									
Anthopleura elegantissima	Aggregating anemone			X											
Anthopleura sola	Solitary anemone			X											
Anthopleura xanthogrammica	Giant green anemone			X											
Balanophyllia elegans	Orange cup coral		X			X	X	X							
Caryophillia sp.	White cup coral	X	X			X									
Cerianthidae, unident.	Cerianthid anemone					X	X			X	X		X		
Corallimorphus sp. 1	Colonial anthizoan										X				
Corynactis californica	Strawberry or club-tipped anemone	X			X				X						
Cyathoceras foxi	Cup corals														
Desmophyllum	Cup corals	X	X												
Eugorgia rubens	Purple gorgonian			X											
Gorgonocephalus eucnemis	Giant basket star		X								X		X	X	X
Gorgonacea Unident.													X		
Halipteris californica	Short sea whip												X	X	X
Hydrozoa	Corals			X											
Lophelia sp.	Branching white coral		X				X								
Lophogorgia chiliensis	Red gorgonian (sea whip)	X		X		X									

Scientific Name	Common Name	Global West (SAIC 2000a)		S. Cal. Bight (Pondella *et. al.* 2009)	Morro Bay (SAIC 2000a; AMS 2008)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Metridium farcimen (=giganteum)	White-plumed anemone	X	X			X	X	X	X	X	X	X	X	X	X
Metridium senile	Frilled anemone														X
Muricea californica	Golden gorgonian			X											
Muricea fruticoas	Brown gorgonian			X											
Paracyathus stearnsi	Brown cup coral	X			X	X	X			X					
Parazoanthus sp.	Parasitic aggregating														
Pachycerianthus sp.	Tube anemone			X		X	X	X							
Pennatulacea sp.	Sea pen														
Polyorchis pencillatus	Bell medusa			X											
Ptilosarcus gurneyi	Orange or fleshy sea pen					X				X	X	X	X	X	X
Scyphozoans Unident.	Sea jellies													X	X
Scytalium sp.	Sea pen					X	X	X							
Stomphia coccinea	Swimming anemone		X		X	X				X	X				
Stompia spp.	Swimming anemone									X	X				
Stylaster californicus (formerly Allopora californica)	California hydrocoral	X		X									X	X	
Stylatula elongata	White sea pen				X	X	X	X	X	X	X	X	X	X	X
Stylatula sp.	Sea pen	X			X	X	X	X							
Subselliflorae spp.	Sea whip, unidentified														
Short red gorgonian	Swiftia spauldingi												X	X	X
Urticina columbiana	Sand-rose anemone				X								X	X	X
Urticina crassicornis	Painted anemone													X	
Urticina sp.	Anemone, unident.				X	X	X	X							
Urticina lofotensis	White-spotted rose anemone			X	X										
Urticina mcpeaki	McPeak's urticina			X											
Urticina piscivora	Fish eating anemone				X								X	X	
Virgularia californica	Sea pen				X	X	X	X							
Virgularia sp	Sea pen				X	X	X	X							
Virgularidae unident.	Sea pen				X	X	X	X						X	X

Scientific Name	Common Name	Global West (SAIC 2000a)		S. Cal. Bight (Pondella *et. al.* 2009)	Morro Bay (SAIC 2000a; AMS 2008)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Zoanthidae Unident.													X		
Annelida															
Amphinomidae	Free living Polychaete							X							
Chaetopterus variopedatus	Parchment worm														
Chloeia pinnata?	Free living polychaete		X					X							
Cossura	Polychaete	X													
Diopatra ornata	Ornate tube worm				X	X				X					
	Tube Worm, unident.				X	X	X	X							
Diopatra splendidissima	Splendid diopatra														
Lumbrineris	polychaete	X	X												
Maldanidae	polychaete mound worms														
Mediomastus	Polychaete worm	X													
Nephtys	Catworm	X													
Paraprionospio	polychaete	X	X												
Pectenaria	Fanworm	X													
Phyllochaetopterus	Parchment worms														
Prionospio		X													
Protula superba	Serpulid tube worm														
Sabellidae unident.	Feather duster worms			X											
Spiophanes		X													
Tharyx			X												
	Unknown feathered tube worm					X									
Mollusca															
Aplysia californica	California sea hare			X											
Axinopsida		X													
Bivalve Mollusk	Clam like bivalve					X				X					
Cadlina leuteomarginata	Yellow-edged cadlina			X											
Calliostoma annulatum	Purple ring top snail					X									
Ceratostoma foliatum	Leafy hornmouth			X											
Chaceia ovoidea	Wart-necked piddock			X											

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		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Crassedoma giganteum	Rock scallop			X									X	X	
Cyclocardia sp.	Mollusk	X													
Cypraea spadicea	Chestnut cowry			X											
Dendrodoris sp.	Dendrodorid nudibranch			X											
Diaulula sandiegensis	San Diego dorid			X											
Dirona albolineata	White-lined dirona			X											
Doris montereyensis	Monterey dorid			X											
Enteroctopus dofleini	Giant Pacific octopus												X	X	
Flabellinopsis iodinea	Spanish shawl nudibranch			X											
Gastropoda	Marine snail				X	X				X					
Haliotis corrugata	Pink abalone			X											
Haliotis fulgens	Green abalone			X											
Haliotis rufescens	Red abalone			X											
Kelletia undosum	Kellet's whelk			X											
Lithopoma undosum	Turban snail			X											
Loligo sp.	squid				X	X	X	X							
Loligo opalescens	Market squid												X		X
Megathura crenulata	Giant keyhole limpet			X											
Mexichromis porterae	Porter's chromodorid			X											
Mitrella	Sea snail		X												
Norrisia norrisi	Norris's topsnail			X											
Nudibranch, dorid white	Sea slug									X					
Octopoda	Octopus	X								X	X			X	
Octopus bimaculoides	Two-spot octopus			X											
Octopus rubescens	Red octopus				X	X	X	X					X	X	X
Opistobranch Unident.	Nudibranch												X		X
Parapholas californica	Scaleside piddock			X											
Parvilucina		X													
Peltodoris nobilis	Sea lemon			X										X	
Peltodoris lentignosa	Freckled pale sea lemon													X	
Pleurobranchaea californica	Sea slug		X			X	X	X		X	X	X	X	X	X

Scientific Name	Common Name	Global West (SAIC 2000a)		S. Cal. Bight (Pondella *et. al.* 2009)	Morro Bay (SAIC 2000a; AMS 2008)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Tritonia diomedea	Pink Tritonia														X
Tochuina tetraquetra	Orange-peel nudibranch												X		
Ectoprocta															
	Bryozoa, orange branching					X									
	Bryozoa, orange encrusting				X	X	X								
	Bryozoa, pink encrusting				X	X	X								
	Bryozoa, unknown				X	X	X								
Cellaria sp.	Stick-figure bryozoan					X									
Arthropoda															
Balanus nubilus	Acorn barnacle												X		
Barnacle	Unidentified barnacle			X											
Cancer antennarius	Brown rock crab			X											
Cancer gracilis	Slender crab				X	X	X	X							
Cancer productus	Red rock crab													X	
Cancer spp.	Crab	X			X	X	X	X	X	X	X	X			
Euphilomedes		X													
Galatheidae	Squat lobster	X	X												
Hinnites giganteus	Rock scallop			X		X									
Lopholithodes mandtii	Puget Sound king crab												X	X	
Loxorhynchus crispatus	Masking crab			X	X								X		
Metacarcinus magister	Dungeness crab												X		X
Paguristes sp.	Hermit crab					X									
Pandalid shrimp	Shrimp					X	X	X							
Pandalis jordani?	Pacific ocean shrimp					X	X	X							
Pandalus gurneyi	Coonstriped shrimp			X											
Panulirus interruptus	California spiny lobster			X											
Photis	Amphipod	X													
Pugettia producta	Northern kelp crap			X											
Pugettia richii	Cryptic kelp crab			X											

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		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Sicyonia	Prawn	X													
Echinodermata															
Amphiodia urtica	Brittle star					X	X	X							
Amphiodia sp.	Brittle star	X	X			X	X	X							
Amphipholis sp.	Brittle star	X				X	X	X							
Asterina miniata	Bat star	X		X	X	X	X	X					X	X	
Asteroidea unident.	Sea star								X	X	X				
Astrometis sertulifera	Fragile rainbow star			X											
Astropecten verrilli and/or A. armatus	Spiny sand star	X	X	X		X									
Brisaster	Sea urchin		X												
Brisingidae	Sea star		X								X				
Centrostephanus coronatus	Black sea urchin			X											
Ceramaster patagonicus	Cookie cutter sea star			X										X	
Cucumaria miniata	Orange sea cucumber													X	
Cucumaria piperata	Salt-and-pepper sea cucumber			X									X		
Dedraster ecentricus	Sand dollar					X									
Dermasterias imbricata	Leather star			X		X							X	X	
Echinoidea, unident.	Unidentified sea urchin												X	X	X
Ecinoderm, juvenile unident.	Juvenile sea star				X	X									
Florometra serratissima	Crinoid		X												
Henricia spp.	Sea star	X		X										X	
Hippasteria sp.	Sea star	X										X	X		
Hippasteria spinosa	Spiny red star												X	X	
Holothuroidea sp.	Sea cucumber												X		
Linckia columbianus	Fragile star			X											
Luidia foliolata	Sand star												X	X	X
Lytechinus anamesus	White urchin	X		X											
Mediaster aequalis	Red sea star		X		X	X				X	X	X	X	X	
Mesocentrotus franciscanus	Red sea urchin												X	X	

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		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Ophiocantha diplasia	Brittle star	X													
Ophionereis sp.	Brittle star	X	X			X									
Ophiocantha dispasia	Brittle star					X									
Ophiocanthus sp.	Brittle star					X									
Ophiura sp.	Brittle star				X	X	X	X							
Ophiuroids	Brittle star				X	X	X	X							
Ophioplocus esmarki	Smooth brittle star			X											
Orthasterias koehleri	Rainbow sea star			X	X									X	
Parastichopus californicus	California sea cucumber			X								X	X	X	
Parastichopus leukothele	Sea cucumber											X			
Parastichopus parvimensis	Purple sea cucumber			X											
Peridontaster			X												
Parastichopus sp.	Sea cucumber	X					X					X			
Peridontaster															
Petalaster (luidia) foliolata	Leafy flat star				X	X	X	X		X	X	X			
Pisaster brevispinus	Pink sea star			X	X	X							X		
Pisaster sp.	Sea star				X	X									
Pisaster giganteus	Giant-spined sea star			X	X	X	X								
Pisaster ochraceus	Ochre star			X									X		
Poraniopsis inflata	Spiny sea star												X	X	
Psolus chitonoides	Slipper sea cucumber												X	X	
Pteraster sp.	Sea star									X					
Pteraster tesselatus	Cushion star												X	X	
Pycnopodia helianthoides	Sunflower star			X	X		X		X	X				X	
Rathbunaster californicus	Multi-armed sea star	X				X	X	X		X	X	X		X	
Solaster dawsonii	Morning sun star					X									
Solaster sp.	Solaster sun star complex												X		
Strongylocentrotus (Allocentrotus) fragilis	Pink sea urchin		X											X	
Strongylocentrotus franciscanus	Red sea urchin			X											
Strongylocentrotus purpuratus	Purple sea urchin			X									X		

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		30-150m	150-300m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Stylasterias forreri	Fish-eating star			X							X	X	X	X	
Urorchordata															
Cystodytes sp.	Lobed tunicate					X							X		
Polyclinum planum	Elephant ear tunicate					X									
Styela montereyensis	Stalked tunicate			X											
Brachiopoda															
Laqueus californianus	Lampshell											X			
Salpida															
Salpida Unident.	Salps														X

Table 3: Master Fish Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters.

Scientific Name	Common Name	Global West (SAIC 2000a)	S. CA Bight (Pondella *et. al.* 2009)	Morro Bay (SAIC 2000a; AMS, 2008; SAIC-SLO 1999)			Monterey Bay (MBARI 2004)		Point Arena MPA	Albion	Ten Mile MPA
		Habitat	Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
		Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
Alloclinus holderi	Island kelpfish		X								
Agonidae unident.	Poacher				X	X		X			
Anarrhichthys ocellatus	Wolf eel									X	
Anisotremus davidsonii	Sargo		X								
Anoplopoma fimbria	Sablefish							X			X
Argentina sialis	Pacific Argentine										
Artedius corallinus	Coralline sculpin		X								
Atherinidae, unident.	Baitfsh school										
Atherinops affinis	Topsmelt		X								
Atherinopsidae	Silverside		X								
Atherinopsis californiensis	Jack smelt		X								
Aulorhynchus flavidus	Tubesnout		X			X	X				
Balistes polylepis	Finescale triggerfish		X								
Brachyistius frenatus	Kelp perch		X								
Caulolatilus princeps	Ocean whitefish		X								
Cephaloscyllium ventriosum	Swell shark		X			X					
Cheilotrema saturnum	Black croaker		X								
Chilara taylori	Spotted cusk-eel					X					
Chilara sp.	Cusk-eel					X					
Chondrichthyes	Cartilaginous fishes							X			
Chromis punctipinnis	Blacksmith		X								
Citharichthys sp.	Sanddab sp.										X
Clupeiformes	Ray finned fishes							X			
Citharichthys sordidus	Pacific sanddab					X					
Citharichthys stigmaeus	Speckled sanddab										
Citharichthys spp	Sanddab					X					
Clinidae	kelpfish		X								

Scientific Name	Common Name	Global West (SAIC 2000a)	S. CA Bight (Pondella *et. al.* 2009)	Morro Bay (SAIC 2000a; AMS, 2008; SAIC-SLO 1999)			Monterey Bay (MBARI 2004)		Point Arena MPA	Albion	Ten Mile MPA
		Habitat	Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
		Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
Clinocottus analis	Wooly sculpin		X								
Cottidae unident.	Sculpin, cabezon			X	X	X		X	X		
Cymatogaster aggregata	Shiner perch		X								X
Embiotoca jacksoni	Black perch		X								
Embiotoca lateralis	Striped seaperch		X								
Engraulis mordax	Northern anchovy		X	X	X	X	X				
Enophrys taurina	Bull sculpin				X	X					
Eopsetta jordani	Petrale sole										X
Eopsetta exilis	Slender sole	X									
Eptatretus stouti	Pacific hagfish	X				X			X	X	
Galeorhinus galeus	Soupfin shark		X								
Gibbonsia elegans	Spotted kelpfish		X								
Gibbonsia sp.	Kelpfish		X								
Girella nigricans	Opaleye		X								
Gobiidae	Unidentified goby		X								
Genyonemus lineatus	White croaker					X	X				
Glyptocephalus zachirus	Rex sole	X						X			X
Gymnothorax mordax	California moray		X								
Halichoeres semicinctus	Rock Wrasse		X								

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		Habitat	Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
		Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
Hermosilla azurea	Zebra perch		X								
Heterodontus francisci	Horn shark		X								
Heterostichus rostratus	Giant Kelpfish		X	X							
Hexagrammos decagrammus	Kelp greenling		X						X	X	
Hydrolagus colliei	Spotted ratfish					X			X		
Hyperprosopon argenteum	Walleye surfperch		X								
Hypsurus caryi	Rainbow seaperch		X								
Hypsypops rubicundus	Garibaldi		X								
Leiocottus hirundo	Lavender sculpin		X								
Leptocottus armatus	Staghorn sculpin										X
Lethops connectens	Halfblind goby		X								
Lycodes sp.	Eelpout					X		X			
Lycodes cortezanus	Bigfin eelpout	X						X			
Lycodopsis pacifica	Blackbelly ellpout										
Lythrypnus dalli	Bluebanded goby		X								
Medialuna californiensis	halfmoon		X								
Micrometrus minimus	Dwarf surfperch		X								
Microstomus pacificus	Dover sole	X				X		X			X
Merluccius productus	North Pacific hake	X						X			X
Mola mola	Ocean sunfish									X	
Myliobatis californicia	California bat ray		X								
Ophiodon elongatus	Lingcod	X	X			X		X	X	X	X
Orthonopias triacis	Snubnose sculpin		X								
Oxyjulis californa	Senorita		X								
Oxylebius pictus	Painted Greenling		X	X					X		
Paralabrax clathratus	Kelp bass		X	X							
Paralabrax neubulifer	Barred sandbass		X								
Paralichthys californicus	California halibut		X			X					
Parophrys vetulus	English sole										X
Phanerodon atripes	Sharpnose seaperch		X								

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		Habitat	Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
		Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
Phanerodon furcatus	White seaperch		X								
Platichthys stellatus	Starry Flounder										X
Pleuronectes vetulas	English sole					X		X			
Pleuronectifores, *unident.*	Flatfish								X	X	X
Pleuronichthys coenosus	C-O sole							X			
Pleuronichthys ritteri	Spotted turbot										
Pleuronichthys verticulus	Hornyhead turbot										
Pleuronectidae Sp.	Sole					X					
Porichthys notatus	Plainfin midshipman	X									
Rathbunella alleni	Stripefin ronquil		X								
Raja binoculata	Big skate					X					X
Raja rhina	Longnose skate					X		X			
Raja sp.	Skate					X					
Raja stellulata	Starry skate									X	X
Rhacochilus toxotes	Rubberlip seaperch		X								
Rhacochilus vacca	Pile perch		X						X		
Rhinogobiops nicholsii	Blackeye goby		X								
Sarda chiliensis	Bonito		X								
Sardinops sagax	Pacific sardine		X								
Scomber japonicus	Pacific chub mackerel		X								
Scorpaena guttata	California scorpionfish		X								
Scorpaenichthys marmoratus	Cabezon		X								
Scorpaenodes xyris	Rainbow scorpionfish		X								
Sebastes atrovirens	Kelp rockfish		X								

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		Habitat	Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
		Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
Sebastes auriculatus	Brown rockfish		X						X		
Sebastes cimplex	Brown rockfish		X								
Sebastes carnatus	Gopher rockfish		X						X	X	
Sebastes caurinus	Cooper rockfish		X						X	X	
Sebastes chrysomelas	Blank-and-yellow rockfish		X								
Sebastes constellatus	Starry rockfish										
Sebastes crameri	Darkblotched rockfish							X			
Sebastes dallii	Calico rockfish		X								
Sebastes diplopora	Splitnose rockfish							X			
Sebastes entomelas	Widow rockfish								X	X	
Sebastes elongatus	Green stripped rockfish			X				X*		X	
Sebastes hopkinsi	Squarespot rockfish										X
Sebastes jordani	Shirtbelly rockfish							X	X		X
Sebastes maliger	Quillback rockfish			X					X	X	
Sebastes melanops	Black rockfish								X		
Sebastes melanostomus	Blackgill rockfish	X									
Sebastes miniatus	Vermillion rockfish		X						X	X	
Sebastes mystinus	Blue rockfish		X						X	X	
Sebastes nebulosus	China rockfish								X	X	
Sebastes paucispinus	Bocaccio		X							X	
Sebastes pinniger	Canary rockfish								X	X	
Sebastes pinniger	Orange rockfish										
Sebastes rastrelliger	Grass rockfish		X								
Sebastes rosaeeus	Rosy rockfish			X						X	
Sebastes ruberrimus	Yelloweye rockfish										
Sebastes rubrivinctus	Flag rockfish									X	
Sebastes saxicola	Stripetail rockfish							X			
Sebastes semicinctus	Half banded rockfish			X					X	X	
Sebastes serriceps	Tree fish		X	X							
Sebastes serrinoides	Olive rockfish		X	X	X	X					

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		Habitat	Habitat	Habitat			Habitat		Habitat	Habitat	Habitat
		Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft Substrate	Hard Substrate	Hard Substrate	Soft Bottom
Sebastes serrinoides/flavidus	Olive/yellowtail rockfish		X								
Sebastes umbrosus	Honeycomb rockfish		X								
Sebastes spp. (juveniles)	Rockfish (juveniles)			X	X	X			X	X	X
Sebastes spp. (adult)	Rockfish (adult)		X	X		X		X	X	X	X
Sebastes wilsoni	Pygmy rockfish									X	
Sebastolobus alascanus	Shortspine thornyhead	X									
Semicossyphus pulcher	California sheephead		X								
Seriphus politus	Queenfish										
Sphyraena argentea	Pacific barracuda		X								
Squalus acanthias	Dogfish shark										
Squatina californica	Pacific angel shark		X			X					
Stereolepis gigas	Giant sea bass		X								
Subgenus Sebastomus	Sebastomus rockfish								X	X	
Symphurus atricauda	California tonguefish					X					
Synodus luciocepsis	California lizardfish							X			
Torpedinidae	Torpedo ray							X			
Torpedo californica	Pacific electric ray					X					
Trachurus symmetricus	Jack mackerel		X								
Triakis semifasciata	Leopard shark		X								
Urobatis halleri	Round stingray		X								
Xeneretmus leiops	Smootheye poacher	X									
Xenistius californiensis	salema		X								
Xystreurys lioepsis	Fantail sole										
Zalembius rosaceus	Pink surfperch			X				X	X		
Zaniolepi frenata	Shortspine combfish										
Zaniolepis latipinnus	Longspine combfish					X					
Zaniolepi spp.	Combfish										
Zapteryx exasperata	Banded guitarfish					X					
Zoarcidae unident.	Eelpout							X			

Table 4: Fish Taxonomic List for Seafloor Habitats and Associated Biological Communities in North Central and Southern Northern California Coastal Waters by Depth.

Scientific Name	Common Name	South. CA Pondella *et. al.* 2009)	Global West (SAIC 2000a)		Morro Bay (SAIC 2000a; AMS 2008; SAIC, 1999)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Agonidae unident.	Poacher					X	X					X			
Alloclinus holderi	Island kelpfish	X													
Anarrhichthys ocellatus	Wolf eel														X
Anisotremus davidsonii	Sargo	X													X
Anoplopoma fimbria	Sablefish										X	X			X
Artedius corallinus	Coralline sculpin	X													
Atherinops affinis	Topsmelt	X													
Atherinopsidae	Silverside	X													
Atherinopsis californiensis	Jack smelt	X													
Aulorhynchus flavidus	Tubesnout	X			X			X							
Balistes polylepis	Finescale triggerfish	X													
Caulolatilus princeps	Ocean whitefish	X													
Cephaloscyllium ventriosum	Swell shark	X			X										
Cheilotrema saturnum	Black croaker	X													
Chilara taylori	Spotted cusk-eel				X	X	X	X							
Chilara sp	Cusk-eel				X	X	X	X							
Chromis punctipinnis	blacksmith	X													
Citharichthys sordidus	Pacific sanddab					X	X	X							
Citharichthys spp	Sanddab					X	X	X	X	X	X	X			
Clinidae	Kelpfish	X													
Clinocottus analis	Wooly sculpin	X													
Cottidae unident.	Sculpin					X	X	X		X	X	X			
Cymatogaster aggregata	Shiner perch	X													X

Scientific Name	Common Name	South. CA Pondella *et. al.* 2009)	Global West (SAIC 2000a)		Morro Bay (SAIC 2000a; AMS 2008; SAIC, 1999)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Embiotoca jacksoni	Black perch	X													
Embiotoca lateralis	Striped seaperch	X													
Engraulis mordax	Northern anchovy	X			X	X	X	X							
Enophrys taurina	Bull sculpin					X									
Eopsetta jordani	Petrale sole														X
Eptatretus stoutii	Pacific hagfish					X	X	X					X	X	
Galeorhinus galeus	Soupfin shark	X													
Genyonemus lineatus	White croaker					X									
Gibbonsia elegans	Spotted kelpfish	X													
Gibbonsia sp.	Kelpfish	X													
Girella nigricans	Opaleye	X													
Glyptocephalus zachirus	Rex sole			X								X			X
Gobiidae	Unidentified goby	X													
Gymnothorax mordax	California moray	X													
Hydrolagus colliei	Spotted ratfish					X							X		
Halichoeres semicinctus	Rock Wrasse	X													
Hermosilla azurea	Sebraperch	X													
Heterodontus francisci	Horn shark	X													
Heterostichus rostratus	Giant Kelpfish	X													
Hexagrammos decagrammus	Kelp greenling	X											X	X	

Scientific Name	Common Name	South. CA Pondella *et. al.* 2009)	Global West (SAIC 2000a)		Morro Bay (SAIC 2000a; AMS 2008; SAIC, 1999)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Hyperprosopon argenteum	Walleye surfperch	X													
Hypsurus caryi	Rainbow seaperch	X													
Hypsypops rubicundus	Garibaldi	X													
Leiocottus hirundo	Lavender sculpin	X													
Leptocottus armatus	Staghorn sculpin														X
Lethops connectens	Halfblind goby	X													
Lycodes sp.	Eelpout					X	X	X				X			
Lycodes cortezanus	Bigfin eelpout			X								X			
Lycodes pacifica	Blackbelly ellpout														
Lythrypnus dalli	Bluebanded goby	X													
Medialuna californiensis	Halfmoon	X													
Merluccius productus	North Pacific hake			X											X
Micrometrus minimus	Dwarf surfperch	X													
Microstomus pacificus	Dover sole			X		X	X					X			X
Mola mola	Ocean sunfish													X	
Myliobatis californicia	California bat ray	X													
Ophiodon elongatus	Lingcod	X		X		X						X	X	X	X
Orthonopias triacis	Snubnose sculpin	X													
Oxyjulis californa	Senorita	X													
Oxylebius pictus	Painted Greenling	X											X		
Paralabrax clathratus	Kelp bass	X			X	X									
Paralabrax neubulifer	Barred sandbass	X													
Paralichthys californicus	California halibut	X				X	X	X							

Scientific Name	Common Name	South. CA Pondella *et. al.* 2009)	Global West (SAIC 2000a)		Morro Bay (SAIC 2000a; AMS 2008; SAIC, 1999)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Parophrys vetulus	English sole														
Phanerodon atripes	Sharpnose seaperch	X				X	X					X			X
Phanerodon furcatus	White seaperch	X													
Platichthys stellatus	Starry flounder														X
Pleuronectidae unident.	Sole					X	X	X							
Pleuronichthys coenosus	C-O sole														
Pleuronichthys ritteri	Spotted turbot														
Pleuronichthys verticalis	Horneyhead turbot														
Porichthys notatus	Plainfin midshipman			X											
Raja binoculata	Big skate					X									X
Raja rhina	Longnose skate						X			X	X	X			
Raja sp.	Skate					X	X			X					
Raja stellulata	Starry skate												X		
Rathbunella alleni	Stripefin ronquil	X													
Rhacochilus toxotes	Rubberlip seaperch	X													
Rhacochilus vacca	Pile perch	X											X		
Rhinogobiops nicholsii	Blackeye goby	X													
Sarda chiliensis	Bonito	X													
Sardinops sagax	Pacific sardine	X													
Scomber japonicus	Pacific chub mackerel	X													
Scorpaena guttata	California scorpionfish	X													
Scorpaenichthys marmoratus	Cabezon	X											X		
Scorpaenodes xyris	Rainbow scorpionfish	X													
Sebastes atrovirens	Kelp rockfish	X													
Sebastes auriculatus	Brown rockfish	X													
Sebastes cimplex	Brown rockfish	X											X		
Sebastes carnatus	Gopher rockfish	X											X	X	

Scientific Name	Common Name	South. CA Pondella *et. al.* 2009)	Global West (SAIC 2000a)		Morro Bay (SAIC 2000a; AMS 2008; SAIC, 1999)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Sebastes caurinus	Cooper rockfish	X											X	X	
Sebastes crameri	Darkblotched rockfish											X			
Sebastes chrysomelas	Blank-and-yellow rockfish	X													
Sebastes constellatus	Starry rockfish													X	
Sebastes dallii	Calico rockfish	X													
Sebastes diplopora	Splitnose rockfish											X			
Sebastes elongatus	Green stripped rockfish											X		X	
Sebastes entomelas	Widow rockfish												X	X	
Sebastes hopkinsi	Squarespot rockfish												X		
Sebastes jordani	Shirtbelly rockfish										X	X	X		X
Sebastes maliger	Quillback rockfish												X	X	
Sebastes melanops	Black rockfish												X	X	
Sebastes melanostomus	Blackgill rockfish			X											
Sebastes miniatus	Vermillion rockfish	X											X	X	
Sebastes mystinus	Blue rockfish	X											X	X	
Sebastes nebulosus	China rockfish												X	X	
Sebastes paucispinus	Bocaccio	X												X	
Sebastes pinniger	Canary rockfish												X	X	
Sebastes rastrelliger	Grass rockfish	X													
Sebastes rosaceus	Rosy rockfish				X	X								X	
Sebastes ruberrimus	Yelloweye rockfish													X	
Sebastes rubrivinctus	Flag rockfish														
Sebastes saxicola	Stripetail rockfish											X			
Sebastes semicinctus	Half banded rockfish												X	X	
Sebastes serriceps	Tree fish	X													
Sebastes serrinoides	Olive rockfish	X				X									
Sebastes serrinoides/ flavidus	Olive/yellowtail rockfish	X													
Sebastes spp. (juveniles)	Rockfish (juveniles)				X	X	X	X	X	X		X			
Sebastes spp. (adult)	Rockfish (adult)	X			X	X	X	X							
Sebastes umbrosus	Honeycomb rockfish	X													

Scientific Name	Common Name	South. CA Pondella *et. al.* 2009)	Global West (SAIC 2000a)		Morro Bay (SAIC 2000a; AMS 2008; SAIC, 1999)				Monterey Bay (MBARI 2004)				Point Arena MPA	Albion	Ten Mile MPA
		9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	30-85m	85-100m	100-300m	9-60m	9-60m	9-60m
Sebastes wilsoni	Pygmy rockfish													X	
Sebastolobus alascanus	Shortspine thornyhead			X											
Semicossyphus pulcher	Califonria sheephead	X													
Seriphus politus	Queenfish														
Sphyraena argentea	Pacific barracuda	X													
Squalus acanthias	Dogfish shark														
Squatina californica	Pacific angel shark	X				X									
Stereolepis gigas	Giant sea bass	X													
Subgenus Sebastomus	Sebastomus rockfish												X	X	
Symphurus atricauda	California tonguefish					X	X								
Synodus luciocepsis	California lizardfish									X	X				
Torpedinidae	Torpedo ray									X	X				
Torpedo californica	Pacific electric ray					X									
Trachurus symmetricus	Jack mackerel	X													
Triakis semifasciata	Leopard shark	X													
Urobatis halleri	Round stingray	X													
Xeneretmus leiops	Smootheye poacher			X											
Xenistius californiensis	Salema	X													
Xystreurys liolepis	Fantail sole														
Zalembius rosaceus	Pink surfperch					X	X			X	X	X	X		
Zanioles spp.	Combfish														
Zanioleis frenata	Shortspine combfish														
Zanioleis latipinnis	Longspine combfish						X								
Zapteryx exasperata	Banded guitarfish					X									
Zoarcidae unident.	Eelpout											X			

Table 5: Magnuson-Stevens Act Managed Fish Species Occurring in North Central and Southern Northern California Coastal Waters Near Point Arena.

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage	Probability of Occurrence at Site
Coastal Pelagic	Jack Smelt	*Atherinopsis californiensis*	E, L, J, A	Common [1]
	Northern anchovy	*Engraulis mordax*	E, L, J, A	Common [1]
	Pacific sardine	*Sardinops sagax*	E, L, J, A	Common [1]
	Pacific mackerel	*Scomber japonicus*	E, L, J, A	Common [1]
	Jack mackerel	*Trachurus symmetricus*	E, L, J, A	Common [1]
	Market squid	*Loligo opalescens*	E, L, J, A	Common [1]
	Euphausiid	*Eastern pacific sp.*	E, F, J, A	Common [1]
Pacific Groundfish	Cabezon	*Scorpaenichthys marmoratus*	E, L, J, A	Common [2]
	Kelp greenling	*Hexagrammos decagrammus*	E, L, J, A	Common [2]
	Lingcod	*Ophiodon elongatus*	E, L, J, A	Common [2]
	Pacific Cod	*Gadus macrocephalus*	E, L, J, A	Common [2]
	Pacific Whiting (Hake)	*Merluccius productus*	E, L, J, A	Common [2]
	Sablefish	*Anoplopoma fimbria*	E, L, J, A	Uncommon [2]
	Aurora rockfish	*Sebastes aurora*	E, L, J, A	Uncommon [2]
	Bank rockfish	*Sebastes rufus*	E, L, J, A	Common [2]
	Black rockfish	*Sebastes melanops*	E, L, J, A	Common [2]
	Black-and-yellow rockfish	*Sebastes chrysomelas*	E, L, J, A	Common [2]
	Blackgill rockfish	*Sebastes melanostomus*	E, L, J, A	Rare [2]
	Blue rockfish	*Sebastes melanostomus*	E, L, J, A	Common [2]
	Bocacio rockfish	*Sebastes paucispinis*	L, J, E, A	Common [2]
	Bronzespotted rockfish	*Sebastes gilli*	E, L, J, A	Rare [2]
	Brown rockfish	*Sebastes auriculatus*	E, L, J, A	Common [2]
	Calico rockfish	*Sebastes dalli*	E, I, J, A	Not Present [2]
	California scorpionfish	*Scorpaena gutatta*	E, L, J, A	Common [2]
	Canary rockfish	*Sebastes pinniger*	E, I, J, A	Common [2]
	Chilipepper rockfish	*Sebastes goodei*	E, L, J, A	Common [2]
	China rockfish	*Sebastes nebulosus*	E, L, J, A	Common [2]
	Copper rockfish	*Sebastes caurinus*	E, L, J, A	Common [2]
	Cowcod	*Sebastes levis*	E, L, J, A	Common [2]
	Darkblotched rockfish	*Sebastes crameri*	E, L, J, A	Common [2]
	Dusky rockfish	*Sebastes variabilis*	E, L, J, A	Not Present [2]
	Dark rockfish	*Sebastes ciliatus*	E, L, J, A	Not Present [2]
	Flag rockfish	*Sebastes rubrivinctus*	E, L, J, A	Common [2]
	Gopher rockfish	*Sebastes carnatus*	E, L, J, A	Common [2]
	Grass rockfish	*Sebastes rastrelliger*	E, L, J, A	Common [2]
	Greenblotched rockfish	*Sebastes rosenblatti*	E, L, J, A	Common [2]
	Greenspotted rockfish	*Sebastes chlorostictus*	E, L, J, A	Common [2]
	Greenstriped rockfish	*Sebastes elongatus*	E, L, J, A	Common [2]
	Harlequin rockfish	*Sebastes variegatus*	E, L, J, A	Not Present [2]
	Honeycomb rockfish	*Sebastes umbrosus*	E, L, J, A	Not Present [2]
	Kelp rockfish	*Sebastes atrovirens*	E, L, J, A	Common [2]
	Longspine thornyhead	*Sebastolobus altivelis*	E, L, J, A	Not Present [2]
	Mexican rockfish	*Sebastes macdonaldi*	E, L, J, A	Not Present [2]
	Olive rockfish	*Sebastes serranoides*	E, L, J, A	Common [2]
	Pacific ocean perch	*Sebastes alutus*	E, L, J, A	Common [2]
	Pink rockfish	*Sebastes eos*	E, L, J, A	Common [2]
	Quillback rockfish	*Sebastes maliger*	E, L, J, A	Common [2]

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage	Probability of Occurrence at Site
	Redbanded rockfish	*Sebastes babcocki*	E, L, J, A	Common [2]
	Redstripe rockfish	*Sebastes proriger*	E, L, J, A	Common [2]
	Rosethorn rockfish	*Sebastes helvomaculatus*	E, L, J, A	Common [2]
	Rosy rockfish	*Sebastes rosaceus*	E, L, J, A	Common [2]
	Rougheye rockfish	*Sebastes aleutianus*	E, L, J, A	Common [2]
	Sharpchin rockfish	*Sebastes zacentrus*	E, L, J, A	Common [2]
	Shortbelly rockfish	*Sebastes jordani*	E, L, J, A	Common [2]
	Shortraker rockfish	*Sebastes borealis*	E, L, J, A	Common [2]
	Shortspine thornyhead	*Sebastolobus alascanus*	E, L, J, A	Common [2]
	Silvergray rockfish	*Sebastes brevispinis*	E, L, J, A	Common [2]
	Speckled rockfish	*Sebastes ovalis*	E, L, J, A	Uncommon [2]
	Splitnose rockfish	*Sebastes diploproa*	E, L, J, A	Uncommon [2]
	Squarespot rockfish	*Sebastes hopkinsi*	E, L, J, A	Common [2]
	Starry rockfish	*Sebastes constellatus*	E, L, J, A	Not Present [2]
	Stripetail rockfish	*Sebastes saxicola*	E, L, J, A	Common [2]
	Tiger rockfish	*Sebastes nigrocinctus*	E, L, J, A	Common [2]
	Treefish rockfish	*Sebastes serriceps*	E, L, J, A	Not Present [2]
	Vermillion rockfish	*Sebastes miniatus*	E, L, J, A	Common [2]
	Widow rockfish	*Sebastes entomelas*	E, L, J, A	Common [2]
	Yelloweye rockfish	*Sebastes ruberrimus*	E, L, J, A	Common [2]
	Yellowmouth rockfish	*Sebastes reedi*	E, L, J, A	Common [2]
	Yellowtail rockfish	*Sebastes flavidus*	E, L, J, A	Common [2]
	Aleutian skate	*Bathyraja aleutica*	E, L, J, A	Rare [3]
	Big skate	*Raja binoculata*	E, L, J, A	Common [2]
	California skate	*Raja inornata*	E, L, J, A	Common [2]
	Leopard shark	*Triakis semifasciata*	E, L, J, A	Common [2]
	Longnose skate	*Raja rhina*	E, L, J, A	Common [2]
	Soupfin Shark	*Galeorhinus galeus*	E, L, J, A	Common [2]
	Spiny dogifsh	*Squalus suckleyi*	E, L, J, A	Common [2]
	Spotted ratfish	*Hydrolagus colliei*	E, L, J, A	Common [2]
	Pacific grenandier	*Coryphaenoides acrolepis*	E, L, J, A	Not Present [2]
	Giant grenadier	*Albatrossia pectoralis*	E, L, J, A	Uncommon [2]
	Finescale codling (Pacific flatnose)	*Antimora microplepis*	E, L, J, A	Uncommon [2]
	Arrowtooth flounder (turbot)	*Atheresthes stomias*	E, L, J, A	Common [2]
	Butter sole	*Isopsetta isolepis*	E, L, J, A	Common [2]
	Curlfin sole	*Pleuronichthys decurrens*	E, L, J, A	Common [2]
	Dover sole	*Microstomus pacificus*	E, L, J, A	Uncommon [2]
	English sole	*Parophrys vetulus*	E, L, J, A	Common [2]
	Flathead sole	*Hippoglossoides elassodon*	E, L, J, A	Uncommon [2]
	Pacific sanddab	*Citharichthys sordidus*	E, L, J, A	Common [2]
	Petrale sole	*Eopsetta jordani*	E, L, J, A	Common [2]
	Rex sole	*Glyptocephalus zachirus*	E, L, J, A	Common [2]
	Rock sole	*Lepidopsetta bilineata*	E, L, J, A	Uncommon [2]
	Sand sole	*Psettichthys melanostictus*	E, L, J, A	Common [2]
	Starry flounder	*Platichthys stellatus*	E, L, J, A	Common [2]
Salmon	Chinook Salmon	*Oncorhynchus tshawytscha*	J, A	Common [3]
	Coho Salmon	*Oncorhynchus kisutch*	J, A	Common [3]
	Puget Sound pink	(*Oncorhynchus gorbuscha*)	J, A	Uncommon [3]

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage	Probability of Occurrence at Site
Highly Migratory	North Pacific Albacore	*Thunnus alalunga*	A	Common [4]
	Bigeye tuna	*Thunnus obesus*	A	Common [3]
	Yellowfin tuna	*Thunnus albacares*	A	Common [3]
	Skipjack tuna	*Katsuwonus pelamis*	A	Common [3]
	Northern bluefin tuna	*Thunnus thynnus*	A	Common [3]
	Common thresher shark	*Alopias vulpinus*	A	Common [3]
	Bigeye thresher	*Alopias superciliosus*	A	Common [3]
	Pelagic thresher	*Alopias pelagicus*	A	Common [3]
	Shortfin mako shark	*Isurus oxyrinchus*	A	Common [3]
	Blue Shark	*Prionace glauca*	A	Common [3]
	Swordfish	*Xiphias gladius*	A	Common [3]
	Striped marlin	*Kajikia audax*	A	Common [3]
	Dorado	*Coryphaena hippurus*	A	Common [3]

NOTES: A = Adult J = Juvenile L = Larvae E = Egg

TABLE SOURCES: California Department of Fish and Wildlife (CDFW): Final California Commercial Landings, 2015. Table 19PUB (PDF). Poundage And Value Of Landings By Port, Santa Barbara Area During 2015, 1: Pacific Fishery Management Council. 2018. Coastal pelagic species Fisheries Management Plan as Amended through Amendment 16. Portland, Oregon. 2:Pacific Coast Groundfish Fishery Management Plan Appendix B Part 2 Groundfish Life History Descriptions. Portland Oregon. 3: Froese, R. and D. Pauly. 2017. Fishbase. World Wide Web Electronic Publication. www.fishbase.org (02/20/18), 4: Wells R.J.D., Kohin S., Teo S.L.H, Snodgrass O.E., K. Uosaki. 2013. Age and Growth of North Pacific Albacore (*Thunnus alalunga*): Implications for stock assessment. Fisheries Research 147: 55-62.

Table 6: California Annual Commercial Landings (in Thousand Pounds) at Fort Bragg, California.

Common Name	Genus Species	2017	2016	2015	2014	2013	Mean	% Total Catch
Sea urchin, red	*Mesocentrotus franciscanus*	459	547	1,272	3,596	4,234	2,022	28.1%
Sole, Dover	*Microstomus pacificus*	762	755	1,148	1,023	1,049	947	13.2%
Sablefish	*Anoplopoma fimbria*	1,034	857	1,052	810	580	867	12.1%
Crab, Dungeness	*Metacarcinus magister*	1,411	858	403	537	873	816	11.4%
Salmon, Chinook	*Oncorhynchus tshawytscha*	40	165	624	1,037	1,408	655	9.1%
Thornyhead, longspine	*Sebastolobus altivelis*	488	364	499	471	500	464	6.5%
Sole, Petrale	*Eopsetta jordani*	271	154	449	359	221	291	4.0%
Rockfish, chillipepper	*Sebastes goodei*	116	83	263	320	559	269	3.7%
Thornyhead, shortspine	*Sebastolobus alascanus*	152	114	157	153	159	147	2.0%
Skate, longnose	*Raja rhina*	35	0	110	113	95	71	1.2%
Hagfishes	*Myxini*	145	6	0	0	0	30	1.1%
Squid, market	*Doryteuthis opalescens*	0	0	142	0	0	28	1%
Rockfish, blackgill	*Sebastes melanostomus*	61	27	43	69	87	56	1%
Lingcod	*Ophiodon elongatus*	76	59	77	35	27	55	1%
Rockfish, bocaccio	*Sebastes paucispinis*	98	59	61	33	17	54	1%
Rockfish, bank	*Sebastes rufus*	43	1	69	34	46	39	0.5%
Flounder, arrowtooth	*Atheresthes stomias*	2	12	28	40	87	34	0.5%
Sole, English	*Parophrys vetulus*	11	12	40	46	37	29	0.4%
Rockfish, group slope	*Sebastes*	6	52	17	45	25	29	0.4%
Swordfish	*Xiphias gladius*	0	0	6	0	42	10	0.3%
Tuna, albacore	*Thunnus alalunga*	17	16	5	12	59	22	0.3%
Sole, rex	*Glyptocephalus zachirus*	20	11	20	11	15	15.	0.2%
Shark, spiny dogfish	*Squalus acanthias*	0	0	9	38	1	10	0.2%
Cabezon	*Scorpaenichthys marmoratus*	10	11	13	11	7	10	0.1%

Data source: CDFW Final California Commercial Landings, Table 14FB: 2013 - 2017.
Species shown account for 99% of total annual commercial landings in pounds in the Fort Bragg Area.
Fish species that individually account for < 0.1% of total catch include: Grenadier; Sea urchin, purple; Skate, unspecified; Sanddab; Shark, thresher; Rockfish, splitnose; Rockfish, darkblotched; Sea cucumber, giant red; Rockfish, aurora; Skate, big; Rockfish, gopher; Rockfish, widow; Rockfish, black and yellow; Greenling, kelp; Rockfish, vermilion; Rockfish, canary; Thornyheads; Rockfish, China; Rockfish, copper; Whitefish, ocean; Rockfish, black; Whiting, Pacific; Rockfish, grass; Smelt, night; Trawled fish, unspecified; Sardine, juvenile; Surfperch, redtail; Shark, unspecified; Sea cucumber, warty; Tuna, bluefin; Rockfish, quillback; Octopus unspecified; Rockfish, brown; Rockfish, yellowtail; Opah; Rockfish, blue; Rockfish, group shelf; Crab, claws; Rockfish, redbanded; Mackerel, jack; Shad, American; Rockfish, stripetail; Shark, soupfin; Sole, slender; Rockfish, shortbelly; Rockfish, cowcod; Rockfish, rougheye; Rockfish, rosethorn; Squid, jumbo; Mackerel, Pacific; Rockfish, group rosefish; Louvar; Surfperch, calico; Sole, rock; Sanddab, Pacific; Shark, shortfin mako; Halibut, Pacific; Sole,

Common Name	Genus Species	2017	2016	2015	2014	2013	Mean	% Total Catch
unspecified; Rockfish, greenstriped; Turbot, curlfin; Rockfish, group bolina; Ratfish, spotted; Rockfish, unspecified; Rockfish, greenspotted; Rockfish, olive; Rockfish, shortraker; Skate, California; Smelt, surf; Sole, curlfin; Flounder, starry; Sea stars; Rockfish, rosy; Rockfish, flag; Rockfish, group red; Sole, butter; Halibut, California; Salmon, Roe (Chinook, Coho); Surfperch, rainbow; Tomcod, Pacific; Rockfish, yelloweye; Surfperch, striped; Surfperch, barred; Yellowtail; Rockfish, greenblotched; Rockfish, black/blue; Sole, sand; Surfperch, walleye; Mackerel, unspecified; Turbot; Rockfish, starry; Cod, Pacific; Prickleback, monkeyface (eel); Surfperch, unspecified; Rockfish, Pacific ocean perch; Shark, leopard; Sculpin, staghorn; Flounder, unspecified; Rockfish, pink; Rockfish, group nearshore; Rockfish, group small; Rockfish, squarespot; Eel Order.								

Table 7: Mendocino County, California Annual Recreational Fish & Invertebrate Landings.

Fish Species		Recreational Catch (Thousand Pounds)						
Common Name	**Genus Species**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Catch (by weight)**
Lingcod	Ophiodon elongatus	932	1,100	1,458	1,132	801	1,085	21.92%
Stingray Gemus	Myliobatoidei		564	-	-	-	564	11.40%
Rockfish, black	Sebastes melanops	199	354	485	741	793	514	10.39%
Rockfish, blue	Sebastes mystinus	317	258	334	245	222	275	5.56%
Rockfish, vermilion	Sebastes miniatus	384	252	271	170	134	242	4.90%
Surfperch, barred	Amphistichus argenteus	226	257	302	152	113	210	4.24%
Rockfish, brown	Sebastes auriculatus	141	170	187	224	144	173	3.50%
Crab, Dungeness	Metacarcinus magister	-	-	-	49	265	156	3.16%
Rockfish, copper	Sebastes caurinus	289	139	138	81	51	140	2.82%
Rockfish, yellowtail	Sebastes flavidus	155	64	198	126	118	132	2.67%
Bass, striped	Morone saxatilis	120	122	225	151	32	130	2.62%
Halibut, California	Paralichthys californicus	198	121	103	153	65	128	2.59%
Rockfish Genus	Sebastes	-	-	48	274	318	213	4.31%
Jacksmelt	Atherinopsis californiensis	182	110	87	54	6	100	2.02%
Rockfish, gopher	Sebastes carnatus	81	125	104	103	71.88	97	1.96%
Surfperch, redtail	Amphistichus rhodoterus	169	109	76	49	45	90	1.81%
Cabezon	Scorpaenichthys marmoratus	65	89	115	97	69	87	1.76%
Rockfish, olive	Sebastes serranoides	55	67	81	37	16	51	1.03%
Mackerel, Pacific	Trachurus symmetricus	4	31	157	20	5	43	0.87%
Sanddab, Pacific	Citharichthys sordidus	25	26	31	90	27	40	0.80%
Crab, red rock	Cancer productus				18	62	40	0.80%
		Number of Individuals Retained (Weight not available)						
		2017	2016	2015	2014	2013	Mean	% Catch (by count)
Abalone, red	Haliotis rufescens				3,137	4,222	3,680	65.78%
Smelt night	Spirinchus starksi	1,158		113			636	11.36%
Shad, American	Alosa sapidissima	1,982	0	129	126		559	10.00%
Crab, brown rock	Romaleon antennarium				154	609	382	6.82%
Kelpfish, striped	Gibbonsia metzi		160				160	2.86%

Fish Species		Recreational Catch (Thousand Pounds)						
Common Name	**Genus Species**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Catch (by weight)**
Sculpin smoothhead	Artedius lateralis					42	42	0.75%
Goby family	Gobiidae	35	48		0		28	0.49%
Guitarfish, banded	Guitarfish, banded				23		23	0.41%
Flounder, righteye family	Plueronectidae	57	0		0		19	0.34%

Data Source: PSMFC RecFIN, Mendocino County 2013 – 2017.
Fish Species that individually account for < 0.1% of total catch include: Rockfish, bocaccio; Surfperch, striped; Shark, leopard; Ray, bat; Greenling, kelp; Rockfish, canary; Rockfish, China; Surfperch, calico; Herring, Pacific; Rockfish, black and yellow; Rockfish, kelp; Rockfish, grass; Sturgeon, white; Rockfish, starry; Rockfish, quillback; Bonito, Pacific; Seabass, white; Croaker, white; Mackerel, jack; Squid Class; Surfperch, walleye; Surfperch, silver; Surfperch, black; Prickleback, monkeyface (eel); Rockfish, widow; Skate and Ray Order; Shark, dogfish family; Rockfish, rosy; Rockfish, greenspotted; Anchovy, northern; Sardine, Pacific; Surfperch, pile; Surfperch, family; Flounder, starry; Greenling, rock; Skate, big; Treefish; Surfperch, rubberlip; Sole, Petrale; Surfperch, shiner; Shark, unidentified; Shark, sevengill; Topsmelt; Surfperch, white; Shark, brown smoothhound; Sandbass Genus; Sole, rock; Lizardfish, California; Guitarfish, shovelnose; Eel, wolf; Rockfish, flag; Sheephead, California; Surfperch, rainbow; Silverside family; Sole, sand; Sturgeon, green; Rockfish, yelloweye; Halfmoon; Smouthhound Family; Cancer Genus; Rockfish, tiger; Sculpin, Pacific staghorn; Whitefish, ocean; Surfperch, sharpnose; Shark, soupfin; Flounder, arrowtooth; Rockfish, speckled; Barracuda, California; Flatfish Order; Opaleye; Skate, California; Sablefish; Blacksmith; Bass, kelp; Sculpin Family; Shark, gray smoothhound; Lizardfish Family; Thronback; Yellowtail; Irish lord, red; Rockfish, stripetail; Sculpin, buffalo; Rockfish, squarespot; Smelt, surf; Rockfish, chillipepper; Hake, Pacific; Rockfish, greenstriped; Rockfish, calico; Goby, yellowfin; Turbot, diamond; Lancetfish, longnose; Prickleback, family; Rockfish, honeycomb; Triggerfish, finescale; Flounder, lefteye family; Cowcod; Butterfish (Pacific pompano); Kelpfish, giant; Sole, Dover; Rockfish, greenblotched; Rockfish, bank; Sole, butter; Surfperch, spotfin; Sole, English; Senorita; Sanddab, longfin; Skate, longnose; Sanddab, speckled; Greenling, painted; Sand Lance, Pacific; Sole, curlfin; Sculpin, bull; Surfperch, dwarf perch; Midshipman, plainfin

TABLE 8: SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Mammals					
Baird's Beaked Whale	*Berardius bairdii*	FD	Inhabit deep offshore waters in the North Pacific and are common along steep underwater geologic structures, like submarine canyons, seamounts, and continental slopes.	Seasonal-sightings from late spring to early fall Very Rare	Sightings occur in deeper waters than the study area, mainly along continental shelf edges or in deep submarine canyons where they forage. National Marine Fisheries records indicate less than a dozen individuals have been washed up along the west coast of the US.
Blainville's Beaked Whale	*Mesoplodon densirostris*	P	Found mainly over the continental shelf and into open ocean waters. Occupy tropical to temperate waters worldwide. Groups have been regularly observed off Oahu, Hawaii and in the Bahamas in 500-1000m waters.	Rare	Unlikely to be observed in the study area.
Blue Whale	*Balaenoptera musculus*	FE, FD	Blue whales are found worldwide but often occur near the edges of physical features where krill tend to concentrate. These whales begin to migrate south during November.	Seasonal from June through November Common	Relatively common offshore the CA coast, on waters 90- 370 km from the shore.
Bottlenose Dolphin	*Tursiops truncatus*	FD	Found in temperate and tropical waters around the world. Have both coastal and offshore populations. These are the most common dolphins in the Southern CA Bight, including offshore.	Year-round Common	Since 2010 bottlenose dolphins have been reoccurring in San Francisco. It possible they could occur in the study area during times when waters are warmer than usual.
Bryde's Whale	*Balaenoptera edeni*	P	Found highly productive tropical, subtropical, and warm temperate waters worldwide. More commonly found further from shore.	Rare	Unlikely to be observed in the study area.
California Sea Lion	*Zalophus californianus*	P	Reside in the Eastern North Pacific Ocean in coastal waters. Commonly observed in the Southern Californian Bight and throughout the California coast.	Seasonal Common	Commonly observed
Common Dolphin – Long-beaked	*Delphinus capensis*	P	Found from Baja California northward to central CA. Found in shallow, warmer temperate waters relatively close to shore.	Year-round Common	The common dolphin is the most abundant cetacean found in the coastal waters of California, but numbers begin to decrease northward from the central coast, and the maximum northward extent is Point Arena.

TABLE 8: (CONTINUED) SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Mammals (continued)					
Common Dolphin – Short-beaked	*Delphinus delphis*	P	A more pelagic species than the long-beaked common dolphin, can be found up to 300 nm from shore. Majority of populations are observed off California coast, especially in the warm water months.	Year-round Common	Generally found offshore of the study area.
Cuvier's Beaked Whale	*Ziphius cavirostris*	P	Found in temperate, tropical, and subtropical waters. Associated in deep pelagic waters (usually greater than 1,000m deep) of the continental shelf and slope, and near underwater geologic features. Seasonality and migration patterns are unknown.	Sightings in fall and winter Rare	Generally occur in the deeper waters west of the study area.
Dall's Porpoise	*Phocoenoides dalli*	P	Distributed throughout the North Pacific Ocean. Mainly in pelagic waters deeper than 180m, but can be found both offshore and inshore.	Winter and early spring Rare	Most frequently observed offshore, but have been documented around San Francisco Bay
Dwarf Sperm Whale	*Kogia simus*	P	Occur over the continental slope and open ocean. Prefer warm tropical, subtropical, and temperate waters worldwide.	Rare	Not likely to be observed within the study area. Records of dwarf sperm whales are rare and it is unknown whether low numbers are a consequence of their cryptic behavior or if they are not regular in habitants of offshore CA waters.
False Killer Whale	*Pseudorca crassidens*	P	Occur over the continental slope and into open ocean waters of tropical and warm temperate waters worldwide.	Sightings in summer and early fall Rare	Not likely to occur in the study area as they prefer warmer waters than those found in northern CA.
Fin Whale	*Balaenoptera physalus*	FE, FD	Fin Whales occupy the deep, offshore waters of all major oceans, but are less common in the tropics.	Seasonal	Relatively common in CA waters between March and October, but due to their occurrence farther offshore in deep water, it is not likely they would be seen in the study area.
Ginkgo-toothed Whale	*Mesoplodon ginkgodens*	P	Found mainly over the continental shelf and into open ocean warm waters of the Pacific and Indian Oceans.	Rare	Not found in the study area.
Gray Whale	*Eschrichtus robustus*	FDL, P	Predominantly occur within the nearshore coastal waters of the North Pacific Ocean, from Gulf of Alaska to Baja Peninsula.	Seasonal December through May Common	Occur in coastal waters during late fall-winter southward migration and again late winter to early summer during their northward migration. Can be as close as a few hundred yards of shore, but more common 3-12 miles offshore.

TABLE 8: (CONTINUED) SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Mammals (continued)					
Guadalupe (Southern) Fur Seal	*Arctocephalus townsendi*	CT, FT, FD	Reside in tropical waters of Southern California and Mexico. Breed in rocky coastal habitats and caves mainly along the eastern coast of Guadalupe Island, approximately 200 Kilometers west of Baja California. There is a small population on San Miguel Island in the Channel Islands	Seasonal Very Rare	Unlikely to occur as far north as Point Area in northern CA.
Harbor Porpoise	*Phocoena phocoena*	P	Continental slope to oceanic waters, mainly in northern temperate, subarctic coastal, and offshore waters. Commonly found in bays, estuaries, harbors, and fjords less than 200m deep.	Year-round Uncommon	Likely to occur in the study area between 0-200 m depth.
Harbor Seal	*Phoca vitulina*	P	Found as far north as British Columbia, Canada and as far south as Baja California, Mexico. Most commonly observed pinniped along CA coastline. Use the offshore waters for foraging and beaches for resting. Occur on offshore rocks, on sand and mudflats in estuaries and bays, and on some isolated beaches.	Year-round Common	Common throughout the California coast. Harbor seals favor near shore coastal waters.
Hubb's Beaked Whale	*Mesoplodon carlhubbsi*	P	Endemic to the North Pacific Ocean. Species is not well known but assumed to occur mainly over the continental shelf and into open ocean waters.	Rare	May occur in waters offshore of Point Arena, but the species is very rare.
Humpback Whale	*Megaptera novaeangeliae*	FE, FD	Found in all major oceans. Central California population of humpback whales migrates from their winter calving and mating areas off Mexico to their summer and fall feeding areas off coastal California. Humpback whales occur from late April to early December.	Seasonal- May through November Common	Frequently observed migrating along the CA coast between April and November, typically 20 to 90 km offshore. These whales are more common inshore near the submarine Monterey canyon.
Killer Whale	*Orcinus orca*	P	Found throughout all oceans. Most abundant in colder waters but can be somewhat abundant in temperate water. Presence and occurrence can be common but unpredictable in coastal California.	Seasonal Uncommon	Most common during April, May, and June as they feed on northbound migrating gray whales. Generally observed in the deeper waters offshore of the study area.
North Pacific Right Whale	*Eubalaena japonica*	FE, FD	Found in the North Pacific Ocean. Seasonally migratory; inhabit colder waters for feeding, and then migrate to warmer waters for breeding and calving. Although they may move far out to sea during their feeding seasons, right whales give birth in coastal areas.	Very Rare	Unlikely to be present in the study area.

TABLE 8: (CONTINUED) SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Mammals (continued)					
Northern Elephant Seal	*Mirounga angustirostris*	P	Found from Alaska to Mexico. They are sighted regularly over shelf, shelf-break, and slope habitats and they are also present in deep ocean habitats seaward of the 2000 m isobaths. Rookeries are located to the north the study area.	Year-round Uncommon	Northern elephant seals are widely distributed in Monterey Bay National Marine Sanctuary and are likely found northward in the study area.
Northern Fur Seal	*Callorhinus ursinus*	FD	Spend 300 or more days per year foraging in the open ocean of the North Pacific. Use rocky beaches for reproduction. Usually come ashore in California only when debilitated, however, few individuals observed on Ano Nuevo Island.	Year-round Very Rare	Usually 18-28 km from shore in California, however, they have been observed within 5 km of Point Pinos to the south of the study area.
Northern Right Whale Dolphin	*Lissodelphis borealis*	P	Endemic to deep, cold temperate of the North Pacific Ocean. Also occur over the continental shelf and slope where waters are less than 66°F.	Year-round Rare	Considered very rare within CA waters. Not likely to occur near in the study area.
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	P	Occupy temperate waters of the North Pacific. Found from the continental shelf to the deep ocean.	Year-round Common	Likely to occur around Point Arena
Perrin's Beaked Whale	*Mesoplodon perrini*	P	Believed to occupy continental shelves and open ocean waters, but not well documented.	Rare	This whale is known from less than half a dozen strandings between San Diego and Monterey. It is highly unlikely that it will be observed within the study area, but the species' complete distribution is unknown.
Pygmy Sperm Whale	*Kogia breviceps*	P	Occur over the continental slope and open ocean. Prefer tropical, subtropical, and temperate waters of the Pacific Ocean. They are mostly found offshore of Peru.	Rare	Unlikely to occur in the study area. Strandings have been documented off Mexico, and once in New Zealand and Monterey Bay. Overall the species is rare and would occur south of the study area.
Risso's Dolphin	*Grampus griseus*	P	Distributed throughout all major oceans. Generally found in waters greater than 1,000m in depth and seaward of the continental shelf and slopes.	Year-round Rare	They generally occur in deeper waters offshore of the study area.
Rough-toothed Dolphin	*Steno bredanensis*	P	Found in all tropical and subtropical oceans. Continental shelf to open ocean waters. Prefer the depths of tropical and warmer temperate waters.	Sighting in summer and early fall Rare	Unlikely to occur in the relatively cold waters surrounding the study area.
Sei Whale	*Balaenoptera borealis*	FE, FD	Cosmopolitan distribution and occur in subtropical, temperature, and subpolar waters around the world. Usually observed in deeper waters of oceanic areas far from the coastline.	Seasonal-spring and summer Very Rare	Sei whales are uncommon in CA waters, especially within the project area because they primarily occupy the open ocean.

TABLE 8: (CONTINUED) SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Mammals (continued)					
Short-finned Pilot Whale	*Globicephala macrorhynchus*	P	Found in warmer tropical and temperate waters. Commonly seen along the coast close to the continental shelf, Forage in areas with high densities of squid.	Year-round Very Rare	Generally found in deeper water than that in the study area and in warmer waters.
Southern Sea Otter	*Enhydra lutris nereis*	FT, P	A top carnivore in its coastal range and a keystone species of the nearshore coastal zone. Frequent inhabitor in kelp forests.	Year-round Uncommon	Southern sea otters occupy the nearshore waters of California from San Mateo County south to Santa Barbara County. They are unlikely to be found as far north as Point Arena.
Sperm Whale	*Physeter macrocephalus*	FE, FD	Occur in the open ocean far from land and are uncommon in waters less than 300m deep. Live at the surface of the ocean but dive deeply to catch giant squid.	Most probable late spring and late fall Rare	Sperm whales are present offshore CA year-round, peak in abundance late spring and late summer, but are rarely seen because they occupy deep water far offshore.
Spotted Dolphin	*Stenella attenuata*	P	Typically found far away from the coast in tropical and subtropical waters worldwide but can also occupy waters over the continental shelf. Spend majority of day in waters 90-300m deep then dive to depth at night to search for prey.	Sightings in summer and early fall Rare	The eastern Pacific Ocean population is typically observed far from the coast and south of the study area.
Steller (Northern) Sea Lion	*Eumetopias jubatus*	FT, P	Distributed around the coasts along the North Pacific Ocean rim. Common in coastal waters and onshore for resting. A small population breeds on Año Nuevo Island, north of Monterey Bay.	Seasonal Occasional	Documented as relatively common in the immediate coastal area north of Point Arena.
Striped Dolphin	*Stenella coeruleoalba*	P	Continental shelf to open ocean waters worldwide, often found in areas of upwelling and around convergence zones. Prefer highly productive tropical to warm temperate waters.	Sightings in summer and early fall Rare	Unlikely to occur near the study area. Observations are typically far offshore.
Marine Turtles					
Green Sea Turtle	*Chelonia mydas*	FE	Distributed globally. Primarily use three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas.	Seasonal Rare	In the eastern Pacific, green turtles have been sighted from Baja California to southern Alaska but most commonly occur from San Diego south.

TABLE 8: (CONTINUED) SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Turtles (continued)					
Leatherback Sea Turtle	*Dermochelys coriacea*	FE	Distributed globally. Regularly seen off the western coast of the US in the pelagic with the greatest densities found off central CA.	Seasonal Occasional	Leatherback sea turtles are most commonly seen between July and October, when the surface water temperature warms to 15-16° C and large jellyfish, the primary prey of the turtles, are seasonally abundant offshore.
Loggerhead Sea Turtle	*Caretta caretta*	FT	Distributed throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Occupy three different ecosystems during their lives: the terrestrial zone, the oceanic zone, and the neritic or nearshore coastal area.	Seasonal Very Rare	In the U.S., most recorded sightings are of juveniles off the coast of California but occasional sightings are reported along the coasts of Washington and Oregon.
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	FT	Mainly a "pelagic" sea turtle in tropical/temperate regions of the Pacific, South Atlantic, and Indian Oceans but has been known to inhabit coastal areas, including bays and estuaries.	Seasonal Very Rare	In the eastern Pacific, the range of the Olive Ridley turtle extends from southern California to northern Chile.
Sharks and Fish					
Basking Shark	*Cetorhinus maximus*	CSC	This species movements and migrations are poorly understood. Usually sighted from British Columbia to Baja California in the winter and spring months; where they go once they leave coastal areas is unknown.	Seasonal Very Rare	Basking shark populations were severely depleted by commercial fisheries of the 1950s, and they have never fully recovered due to slow growth and low fecundity.
Chinook Salmon	*Oncorhynchus tshawytscha*	CE, FE	Found from the Bering Strait to Southern California. Freshwater streams up to the first two years of life, then they migrate to estuarine areas as smolts and eventually the ocean to mature and feed. These salmon prefer deeper and larger streams than those used by other Pacific species.	Seasonal	Potentially present in larger streams and rivers throughout northern CA, such as the Garcia River. Historically, these salmon ranged as far south as the Ventura River, but populations have drastically declined and individuals that do reach the ocean do not appear to extend very far south of San Francisco Bay.
Coho Salmon	*Oncorhynchus kisutch*	FT	Spawn in small streams with gravel substrates, and spend first half of life cycle in streams and small freshwater tributaries. The later half of life cycle is spent foraging in estuarine and marine waters.	Seasonal	Spawn in streams and rivers throughout northern CA including the Garcia River, south of Point Arena. Adults may occur in coastal waters near streams and rivers.
Cowcod	*Sebastes levis*	CSC	Found from central Oregon to Baja California, Mexico. Juveniles recruit to fine sediment habitat. They have been observed at depths between 40 and 100m. Young cowcod move to deeper habitat within their first year.	Seasonal Common	Documented catch has declined drastically since the mid 1980's. May be present near seafloor.

TABLE 8: (CONTINUED) SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Sharks and Fish (continued)					
Steelhead Trout	*Onchorhynchus mykiss*	FT, CSC	Can be found along the entire Pacific Coast. Resident forms are usually called rainbow, or redband, trout. Those that are anadromous can spend up to 7 years in fresh water prior to smoltification, and then spend up to 3 years in salt water prior to first spawning.	Seasonal	Spawn in streams and rivers throughout northern CA including the Garcia River, south of Point Arena. Adults may occur in coastal waters near streams and rivers.
Tidewater Goby	*Eucycloglobius newberryi*	FE	Despite the common name, this goby inhabits lagoons formed by streams running into the sea. The lagoons are blocked from the Pacific Ocean by sandbars, admitting salt water only during particular seasons, and so their water is brackish and cool. The tidewater goby prefers salinities of less than 10 parts per thousand (ppt) (less than a third of the salinity found in the ocean) and is thus more often found in the upper parts of the lagoons, near their inflow.	Seasonal	Unlikely to occur within the study area because it is very rare. Has been documented as being seasonally present in Elkhorn Slough, Bennet Slough, and Salinas River, all of which are outside of the study area.
Green Sturgeon (Southern DPS)	Acipenser medirostris	FT, CSC	Marine and estuarine environments, Sacramento River; All of San Francisco Bay-Delta, Humboldt bay, offshore waters to 60 fathoms from Monterey Bay t the US-Canada boarder.	Very rare Unknown	Unknown
White sharks	*Carcharodon carcharias*	CSC	In California, important white shark habitat occurs around Monterey Bay and Greater Farallones, national marine sanctuaries. White shark populations are impacted by purposeful and incidental capture by fisheries, marine pollution, and coastal habitat degradation	Year-round	Present in coastal waters throughout the State.
Gastropods					
Black Abalone	*Haliotis cracherodii*	FE	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter	Year-round Very Rare	Point Arena is the northern most point of black abalone distribution along the entire California coast, although they are rare north of San Francisco.
Green Abalone	*Haliotis fulgens*	FSC	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Year-round Not Present	Unlikely to occur within the study area. They are mainly distributed from Point Conception to Bahia Magdalena in Baja California, Mexico.

TABLE 8 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Occurrence in Study Area
Gastropods (continued)					
Pink Abalone	*Haliotis corrugate*	FSC	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Year-round Not Present	Unlikely to occur within the study area. They are mainly distributed from Point Conception to Bahia Magdalena in Baja California, Mexico.
White Abalone	*Haliotis sorenseni*	FE	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Year-round Not Present	Unlikely to occur within the study area. They are mainly distributed from Point Conception to Bahia Magdalena in Baja California, Mexico.

NOTES:
FESA = Federal Endangered Species Act
MMPA = Marine Mammal Protection Act
CESA = California Endangered Species Act

STATUS CODES:

Federal: National Oceanographic and Atmospheric Administration (NOAA); MMPA
FD = Depleted Population
P = Federally Protected

Potential for Species Occurrence Rankings:
Not Expected - Suitable foraging or spawning habitat is not known to be present or rare, and the species has not been or is rarely documented to occur
Low - Suitable foraging or spawning habitat is present, but the species has either not been documented to be present or if present, the presence is uncommon and infrequent
Moderate - Suitable foraging or spawning habitat is present and the species is somewhat common or common for part of the year
High - Suitable foraging or spawning habitat is present and the species is common throughout the year and/or in substantial numbers

Federal: U.S. Fish and Wildlife Service (USFWS), NOAA National Marine Fisheries Service (NMFS); FESA
FDL = Delisted
FE = Listed as "endangered" (in danger of extinction) under FESA
FT = Listed as "threatened" (likely to become Endangered within the foreseeable future) under FESA
FC = Candidate to become a proposed species
FSC = Former "federal species of concern". The USFWS no longer lists Species of Concern but recommends that species considered to be at potential risk by a number of organizations and agencies be addressed during project environmental review. *NMFS still lists "Species of Concern".

State: California Department of Fish and Game (CDFG); CESA
CE = Listed as "endangered" under the CESA
CT = Listed as "threatened" under the CESA
CSC = CDFW designated "species of special concern"

Sources: Allen et. al 2010, Allen 2014, AMS 2015, CDFW 2001, CSLC et al 2007, Miller and Shanks 2004, NOAA 2011b, NOAA 2014, NOAA 2014a, NOAA 2016, NOAA 2018a, 2018b, 2018c, PFMC 2016, PFMC 2016a, PFMC 2016b, SAIC 2000, CDFW 2017, UC 2017,