3.3 MARINE BIOLOGICAL RESOURCES

The Project would occur within the Southern California Bight (SCB); which encompasses the marine waters from Point Conception at the northwest end of the Santa Barbara Channel, to a point just south of the border between the United States and Mexico. The Project area encompasses approximately 18.885 square miles (48.91 square kilometers) offshore of Huntington Beach and surrounds existing Platforms Eureka, Edith, and Ellen/Elly (Figure 1-1 Site Location Map). Water depths in the Project area range from 148 to 1,083 feet (45 to 330 meters).

This section identifies the habitats and species that may occur within the Project area and evaluates the potential for the Project to affect marine biological resources, either directly or indirectly, within the Project area and vicinity. The descriptions of marine biological resources in this section are based on existing literature, and relevant public documents.

3.3.1 Marine Habitats

3.3.1.1 Intertidal

The intertidal zone is a dynamic marine environment characterized in part by daily tidal fluctuations (leading to periods of sunlight, aerial exposure and submersion) and wave forces. Organisms residing within the intertidal zone are typified by hardy species that are capable of withstanding stresses associated with waves and daily tidal fluxes. Due to the distance of the survey area offshore, rocky and intertidal zones are not found within the direct survey area; however, are included within this discussion since intertidal zones are found within the Project region (South Coast) and are considered sensitive habitats.

California Department of Fish & Wildlife (CDFW) (2010) discusses the shoreline habitats within the South Coast Study Region and indicates that the shoreline between the Palos Verdes Peninsula to the Los Angeles/Orange County line is predominantly sandy. Rocky habitats, which support kelp, surf grass, and epifauna that could be considered sensitive, consist of both natural habitat around Palos Verdes and anthropogenic material (breakwaters and piers) associated with the Port of Los Angeles (POLA) / Port of Long Beach (POLB) and other structures. Additionally, extensive rocky shorelines that, due to the narrow shelf, support relatively small kelp beds characterize Catalina Island, are located approximately 15 miles (24 kilometers) southwest of the Project area. Due to rocky habitat being relatively uncommon within the Project region and because of the variety of habitats and species it supports, that habitat is considered sensitive (California Department of Fish and Game [CDFG], 2010). Sandy beaches are generally not considered sensitive, except, for example, when they are being utilized by grunion for spawning and/or for foraging by shorebirds.

3.3.1.2 Subtidal

Based on available data, seafloor habitats within the Project region are predominantly sedimentary. Outside of the survey area, is an approximately 8,000 feet (2,438 meters) -long, north-south trending rock feature has been identified between the 250 and 600 feet (76 and 182 meters) isobaths and as close as 3,000 feet (914 meters) west of Platform Eureka. Other hard bottom areas within the Project region include a smaller feature, identified as either a topographic depression or rocky habitat located approximately 1,000 feet (305 meters) southeast of Platform Ellen, and apparent rock outcroppings along and within the head of the western portion of the San Gabriel Submarine Canyon.

As described by Dartnell and Gardner (2009), the head of the San Gabriel Canyon system consists of an eastern and western branch and begins approximately 9.5 miles (15 kilometers) west of the current mouth of the San Gabriel River. Both of these branches excise over 0.5 miles (0.8 kilometers) into the San Pedro Shelf. The western branch, which is closest to the Project area, starts in approximately 160 feet (49 meters) of water and is over 250 feet (76 meters) deep (Dartnell and Gardner, 2009). The two channels join approximately five miles (eight kilometers) from their origin in approximately 1,400 feet (427 meters) of water. The upper (head) areas of both branches support a mixture of sedimentary rock and exposed bedrock substrate.

Although no recent surveys have been completed, general information on the biota associated with hard substrate features have found that at about the 300-feet (91-meter) isobath, the biota associated with both sedimentary and rock substrates are characterized by species not normally found in the inshore waters. Rocky substrates within the deeper water areas support some of the same macroepibiota species usually observed on inshore rocky features (i.e. solitary corals [*Paracyathus stearnsi*] and sea cucumbers) however other species of solitary corals such as Caryophillia, crinoids (*Florometra*), basket stars (*Gorgonocephalus*), and sponges (*Staurocalyptus*) become more abundant, particularly on the rock features that are not subjected to sedimentation. Rockfish, including copper rockfish (*Sebastes caurinus*), greenspotted rockfish (*S. chlorostictus*), and starry rockfish (*S. constellatus*) are also more common in these water depths around rock features. Deeper water corals (i.e., *Stylaster*) are considered sensitive species and are usually found on higher-relief rock features in water depths of 600 feet (183 meters) or more.

3.3.1.3 Platform Habitats

The four platforms within the Project area provide a diverse habitat in contrast to the relatively sedimentary seafloor. Specifically, the shell mound habitat at the base of each platform and associated epibiota within the Project area appeared to be dominated by mussels (cf *Mytilus* spp). Common shell material-associated macroepibiota at Platforms Elly-Ellen included sheep crab (*Loxorhyncus* sp.), bat stars, the sun star (Pycnopodia helianthodes), a sea cucumber, and unidentified brittle stars (Padre, 2007). Unidentified juvenile rockfish (*Sebastes* spp.) were the most commonly observed fish within this habitat. Subsequent observations between Platforms Eureka and Elly (Padre, 2012) indicates a similar macroepibiota to that documented by Padre (2007), and that the powder puff anemones (*Metridium farcimen*) were locally abundant on the jacket members and on shell debris. Other species associated with the Platforms Elly-Ellen shell mound included the convict fish (*Oxylebius pictus*) and the giant sea star (*Pisaster giganteus*).

Goddard and Love (2008) studied the macroepibiota associated with the shell mounds under 15 oil and gas platforms within the Pacific outer continental shelf (OCS) region, including those at Platforms Elly and Eureka. These previous surveys at Platforms Elly and Eureka were completed in 2005 and consisted of observations of biota within a series of quadrats within the shell debris made from the Delta submersible. That report indicates that approximately 71 percent of the shell mound habitat at Ellen is covered with shell debris; shell cover at the Platform Eureka shell mound habitat comprises approximately 76 percent. Of the seven invertebrate taxa recorded at Platform Elly, the bat star was most common; the highest density of bat stars (10 per 107 square feet [10 square meters]) within the study area were found at Platform Elly's shell mound. The survey at Platform Eureka's shell mound resulted in the identification of 12 macroinvertebrate taxa with the most abundant species being two sea stars (*A. miniata* and *Stylasterias forreri*). The powder puff or large white plumed anemone was also relatively common on Platform Eureka's shell mound (Goddard and Love, 2008).

Love (pers. comm.) stated that during his studies, fish that were commonly observed at Platform Eureka included squarespot rockfish (*Sebastes hopkinsi*), blacksmith (*Chromis punctipinnis*), widow rockfish (*S. entomelas*), and speckled rockfish (*S. ovalis*) in the mid-water depths (no depth range provided), and pinkrose (*S. simulator*), greenblotched (*S. rosenblatti*) and vermillion rockfish (*S. miniatus*) at or near the bottom (depth 700 feet [213 meters]).

Love, et al., 2010 indicated that the shell mound habitat-associated fish at Platforms Edith, Elly, and Ellen included squarespot and halfbanded rockfish (*Sebastes semicinctus*), and blackeye gobies (*Coryphopterus nicholsii*), while the shell mound habitat under Platform Eureka supported a less abundant fish community, characterized by the pinkrose rockfish.

3.3.1.4 Marine Protected Areas (MPA)

Marine Protected Areas (MPAs) are afforded protection with the CDFW under the Marine Life Protection Act (MLPA). The following designations are managed within the West Coast MPA network: State Marine Reserve (SMR), State Marine Conservation Area (SMCA), and State Marine Recreational Management Area (SMRMA). The northwest corner of the Project survey area is located approximately 5.9 miles (9.5 kilometers) from the closest MPA at Bolsa Bay (Bolsa Chica Basin) (refer to Figure 3.3-1).

3.3.2 Invertebrates

3.3.2.1 Plankton

The variation and patchiness of plankton within the California Current System, which includes the SCB has been documented by several researchers (i.e., Smith, 1971), and for the most recent years is summarized in (McClatchie, et al., 2009). That report suggests that overall, the conditions off Southern California in 2008 appeared to follow the cool Pacific Decadal Oscillation pattern observed since 1999, with relatively cool, salty conditions in the mixed layer and a shallow nitracline. However, these conditions did not lead to higher nutrient or phytoplankton concentrations in the upper mixed layer, nor have they led to higher zooplankton volumes. This contrasts with observations further north in regions more affected by upwelling. Using long-term data, McClatchie, et al., 2009 also indicate that off southern California, concentrations of chlorophyll a have been increasing since 1984 and zooplankton displacement volume has been decreasing since the 1950s.

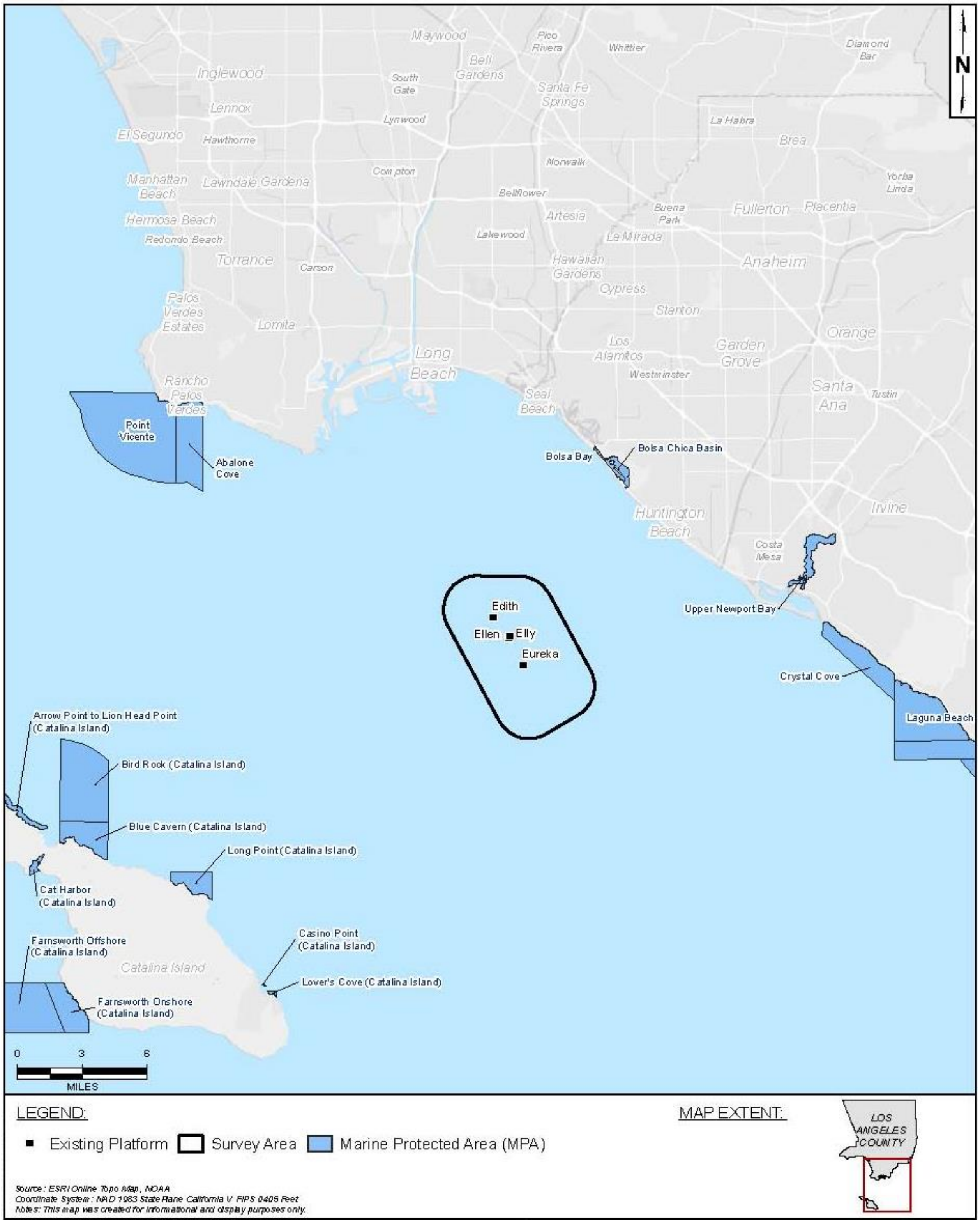

Figure 3.3-1. Marine Protected Areas

The California Cooperative Oceanic Fisheries Investigations (CalCOFI) has been collecting and analyzing plankton samples since 1949 and routinely occupies over 200 sampling stations throughout the marine waters off California. Data summaries are provided in a series of atlases and technical articles that are available on the CalCOFI website (www.calcofi.org). These data provide the most comprehensive temporal and spatial characterization of the marine plankton community within the region and the summary reports are used as the primary source of the discussions below.

The individual CalCOFI sampling stations are approximately 40 miles (64 kilometers) apart (seaward of the Project site) and are along pre-established transects. Although none of transect lines pass through the Project site, the closest are Line 86.7, which passes through and extends approximately 200 miles (321.9 kilometers) offshore of Santa Monica Bay and Line 90 which extends further offshore from approximately Dana Point (Orange County).

Despite the well-documented seasonal and annual variances in the abundance and composition of the zooplankton and ichthyoplankton within the region, some general patterns are also apparent from the CalCOFI data. Loeb, et al. (1983) indicates that within the CalCOFI sampling area (oblique net samples to 690 feet [210.3 meters] water depth), zooplankton abundance tends to decrease from north to south and from inshore to offshore, while highest abundances of ichthyoplankton were found in the nearshore regions of Southern California and Northern Baja California. The primary invertebrate zooplankton groups within the nearshore Southern California marine waters include copepods, euphausid and non-euphasid amphipods, chaetognaths, and crustacean larvae (Issacs, et al., 1969). Seasonal increases in comb jellies (ctenophores), decapod larvae, salps (larvacea and thalacea), siphonophores, and heteropods have also been documented.

Using “pooled data” from CalCOFI samples from 1951 through 1966, Smith (1971) suggests that seasonal and annual variations in plankton densities are common within the southern California marine waters. The pooled data from samples taken within “the Los Angeles Bight” area (nearshore marine waters between Point Conception and Huntington Beach) do; however, indicate that zooplankton abundances tend to increase during the spring and summer, peaking in July. Lowest zooplankton abundances were found in the autumn and winter months. Similar seasonal variations are stated in U.S. Environmental Protection Agency (EPA) (1987). The geographic “center” of highest zooplankton concentrations tends to be between 80 and 120 miles [128.7 and 193.1 kilometers] offshore (Smith, 1971).

Within the southern California sampling areas, CalCOFI data indicate that ichthyoplankton abundances were higher in the winter and early spring (January and March) and zooplankton densities were highest in mid- to late-spring (March and May). The ichthyoplankton was dominated by larval northern anchovies (*Engraulis mordax*), followed by Pacific hake (*Merluccius productus*), jack mackerel (*Trachurus symmetricus*), and Pacific sardines (*Sardinops sagax*). Loeb, et al., 1983 states that larvae of these pelagic species have a second peak in the nearshore marine waters of southern California in late fall (October/November). Diurnal zooplankton migration would be expected to result in densities varying throughout the water column with near-surface highest concentrations being found during the nighttime hours.

Moser, et al. (2001) utilized CalCOFI data to focus on the relative abundance of larvae of important sport fish species in the ichthyoplankton off southern California. That study indicates that coastal pelagic species (i.e. anchovies, sardines, and mackerel) generally dominate the ichthyoplankton within the sample area. Rocky habitat-associated species, including rockfish, sculpins, and bass contribute less than 10 percent of the CalCOFI net samples (Moser, et al., 2001). Similar results were found from nearshore plankton sampling completed by the Orange County Museum which indicated that the larvae of demersal (bottom-associated) fish accounted for 80 percent of the total taxa, that group contributed less than four percent of the total abundance. Moser, et al., 2001 suggests that the larvae of many of the more common southern California coastal fish such as queenfish (*Seriphus politus*), white seabass (*Atractoscion nobilis*), and white croaker (*Genyonemus lineatus*) settle to the bottom early in their development and are therefore not readily sampled by oblique nets. Gobies and blennies, also poorly represented in plankton tows, tend to brood their eggs in nests and the larvae spend a limited amount of time within the water column (Moser, et al., 2001).

These data suggest that ichthyoplankton concentrations during the proposed construction period (fall quarter of 2018) would be variable but would still be most likely dominated by pelagic species such as anchovies.

3.3.2.2 Seafloor Invertebrates

Macroinvertebrates and fish reported from the results of previously-completed surveys within the Project site are presented below in Table 3.3-1. The species listed in Table 3.3-1 include marine species that were reported in Padre Associates, Inc. (2007) during seafloor observations between Platforms Edith and Elly. During that 2007 survey, observed macroepibiota within the sedimentary habitats along the Project area varied with depth and proximity to the platforms. In water depths between 160 and 170 feet (49 and 52 meters), dominant macroepibiota included a seapen (*Stylatula elongata*) and unidentified urchins; fish were not abundant on the sedimentary habitat within these water depths. The epibiota in the sedimentary habitat in water depths greater than 170 feet (42 meters) was characterized by a sand star (*Luidia foliolata*), unidentified urchins, and three taxa of sea pens; *Stylatula elongata*, *Ptilosarcus gurneyi* (present only in water depths greater than 200 feet [61 meters]), and *Acanthoptilum* sp.

Table 3.3-1. Marine Invertebrates Observed at the Project Area in 2007

Common Name	Scientific Name	Common Name	Scientific Name
White sea pen	*Stylatula elongata*	Unidentified Urchins	
Pink sea pen	*Ptilosarcus gurneyi*	Sandstar	*Luidia foliolata*
Warty sea cucumber	*Parastichopus parvimensis*	Sheep crab	*Loxorhynchus grandis*
Bat star	*Asterina Miniata*	Unidentified brittle star	
Sea pen	*Acanthoptilum* sp.	Gorgonian corals	cf *Lophogorgia* sp. and *Muricea* sp.

Source: Padre Associates Inc, 2007

In addition, two important protected invertebrates, the white abalone (*Haliotus sorenseni*) and the black abalone (*Haliotis. cracherodii*) are discussed in detail below.

White Abalone. In 2001, the white abalone became the first marine invertebrate to receive Federal protection as an endangered species. The white abalone is a marine, rocky benthic, herbivorous, broadcast spawning gastropod. This species usually dwells in deep waters from 80 to over 200 feet (24 to 61 meters) from Point Conception (Southern California) southward to Baja California (NMFS, 2016a). White abalone can grow to about 10 inches long (25 centimeters), but are usually 5 - 8 inches (13 - 20 centimeters) (NMFS, 2016a). Although unlikely, white abalone has the potential to occur within the Project area.

Black Abalone. In January 2009, the black abalone was listed as endangered under the Federal ESA. In October 2011, NMFS published the critical habitat for that species (NMFS, 2016b). As a result of disease, most black abalone populations in California have declined by 90 to 99 percent since the late 1980s and have fallen below estimated population densities necessary for recruitment success. The black abalone is a shallow-living marine gastropod with a smooth, circular, and black to slate blue colored univalve shell and a muscular foot that allows the animal to clamp tightly to rocky surfaces without being dislodged by wave action. Black abalone generally inhabit coastal and offshore island intertidal habitats on exposed rocky shores from Crescent City, California, to southern Baja California, Mexico. Today the species' constricted range occurs from Point Arena, California, to Bahia Tortugas, Mexico, and it is rarely found north of San Francisco. Black abalone range vertically from the high intertidal zone to a depth of 20 feet (six meters) and are typically found in middle intertidal zones (NMFS, 2016a). Critical habitat has been proposed for the black abalone. Critical habitat includes rocky intertidal habitat to a depth of 19.7 feet (six meters) within designated coastal marine areas. The closest designated offshore marine area is Santa Catalina Island approximately 18 miles (29 kilometers to the southwest of the Project site. The closest proposed mainland marine site is an area north of Los Angeles Harbor, approximately 11 miles (17.7 kilometers) northwest of the Project site (NMFS, 2016a). Due to the distance and water depths offshore, black abalone is not expected to occur within the Project area.

3.3.3 Fish

The Southern California Coastal Water Research Project (SCCWRP) sponsored an extensive marine survey between Point Conception and the U.S./Mexican border to assess infaunal characteristics throughout the SCB. Known as "The Bight Study" (Southern California Bight Pilot Project Steering Committee, 1998), samples included several on the San Pedro Shelf. The Platform Elly-Ellen complex and Platform Eureka are located in water depths considered "middle shelf" (depths from 85 to 328 feet [26 to 100 meters]). While individual sample station data are not available, characteristic infauna for these two areas included species that were abundant in samples collected during the State of California (1965) study such as a brittle star (*Amphiodia urtica*), a polychaete worm (*Chloeia pinnata*), and a cumacean arthropod (*Eudorella* sp). Common fish reported in the Southern California Bight Pilot Project Steering Committee (1998) that were collected within the Project area water depths (considered the inner and outer shelf) included speckled sanddab (*Citharichthys stigmaeus*); roughback sculpin (*Chitonotus* *pugetensis*); rex sole (*Glyptocephalus zachirus*), blacktip poacher (*Xeneretmus latifrons*), and blackbelly eelpout (*Lycodes pacificus*).

California State Lands Commission (CSLC) (1982) summarizes the historical sampling within the then-proposed Beta Unit, regarding infauna data and trawl data from the deeper portions of the San Pedro Shelf and offshore of the Huntington Beach Generating Station. Those sources suggest that the common ichthyofauna (fish) collected within those areas included Dover and English sole (*Microstomus pacificus, Parophrys vetulus*, respectively), Pacific sanddab (*Citharichthys sordidus*), and the pink perch (*Zalembius rosaceus*).

According to Love et al., (2010), the midwater ichthyofauna at Eureka and Elly was characterized by juvenile and adult squarespot rockfish, unidentified rockfish (*Sebastes* spp), blacksmith, and widow rockfish. Dominant fish species at nearby Platform Edith included juvenile and mature blacksmith, and jack mackerel (Love, et al., 2010). That study also found that the fish species that characterized the midwater areas of Platforms Edith, Elly, and Eureka differed substantially from midwater ichthyofauna found at the other 18 southern California platforms. The demersal (bottom-associated) fish community at Platforms Elly, Ellen, and Edith is characterized by halfbanded rockfish, squarespot rockfish, unidentified rockfish, and shortbelly rockfish (*Sebastes jordani*), while Platform Eureka's demersal ichthyofauna, which was less specious and supported fewer individuals than the other three Project-area platforms, was dominated by pinkrose and greenblotched rockfish (*Sebastes simulator* and *S. rosenblatti*, respectively).

Martin and Lowe (2010) reported the results of diver-observations of the fish community at Platforms Elly, Ellen, and Eureka from 2006 through 2008. Sampling, which consisted of diver counts and video recording, was reported for three water depth ranges at Platform Ellen (16, 40, and 101 feet [5,12, and 31 meters) and two each at Platform Elly (16 and 50 feet [5 and 15 meters]) and Platform Eureka (16 and 53 feet [5 and 16 meters]). The results of the data analysis suggest that the three platforms support a similar fish community within these depths, characterized by transient pelagic species, including jack mackerel, Pacific sardine, and northern anchovy, along with resident species including blacksmith, California sheephead (*Semicossyphus pulcher*), and garibaldi (*Hypsypops rubicundus*), and a transient species, the halfmoon (*Medialuna californiensis*). Although not particularly abundant, several species of rockfish comprising most of the life stages (juveniles, sub-adults, and adults), were also found within the study area at the three platforms.

Of the three offshore platforms studies, Martin and Lowe (2010) found that Platform Elly supported the fewest fish species, lowest biomass, and lowest density. The reduced amount of structure (Platform Elly is a processing platform and thus does not have any well conductors) may contribute to these reductions compared to production Platforms Ellen and Eureka.

Species composition at the three platforms was relatively stable throughout the survey period, showing no statistically-significant annual variance. Some seasonal (winter-spring vs. summer-fall seasons) variation in composition and densities was, however, noted with both entities being higher during the summer-fall samplings. Of the "resident" fish species, only the blacksmith had more young-of-the-year (age class 0) at the offshore Platforms (Elly, Ellen, and Eureka); the other resident taxa were characterized by older individuals. The deeper portions of the platforms tended to support fewer individuals, but a more diverse (more species) community comprise of larger individual fish.

Using tagging and acoustic monitoring surveys, Mireles (unpublished) reports the results of a 1.5-year study on the fidelity of four fish taxa, cabezon, California sheephead, and two species of rockfish, at Platforms Edith, Elly, Ellen, and Eureka. The general findings of this study were that there are seasonal and diurnal variations of activity by these species and that they remain at the platform at which they were initially captured and tagged, thus displaying a high fidelity to a specific site. All four species tended to orient to the horizontal supports of the platforms and studies cited in Mireles (unpublished) documented spawning (nests and egg protection) of cabezon and sheephead on the deeper portions of Platform Eureka.

Table 3.2-2 lists fish species that were observed at Platform Edith during previous biological surveys (Love and Nishimoto, 2012.). The list has been divided into observations by habitat; shell mounds, platform bottom, and midwater, to specify where, in relation to the platform, species were actually observed. That survey found that halfbanded rockfish (adults and young of the year [YOY]), unidentified rockfish YOY, Cabazon, and kelp rockfish were the most abundant species at the base of the platform, and that halfbanded rockfish (adults and YOY), and unidentified rockfish (adults and YOY) dominated the fish community within the shell mound habitat. Within the mid-water depths, blacksmith, sheephead, unidentified YOY rockfish, garibaldi, shortbelly rockfish were the most abundant species, (Love and Nishimoto, 2012).

Table 3.3-2. Fish Species that were Observed at Platform Edith

Common Name	Scientific Name	Common Name	Scientific Name
Shell Mounds			
Blackeye goby	Rhinogobiops nicholsii	Painted greenling	Oxylebius pictus
Blackeye goby	Rhinogobiops nicholsii	Pile perch	Rhacochilus vacca
White seaperch	Phanerodon furcatus	Cabezon	Scorpaenicthys marmoratus
Halfbanded	Sebastes semicinctus	Lincod YOY	Ophiodon elongatus
Halfbanded YOY	Sebastes semicinctus	California sheephead	Semicossyphus pulcher
Lincod	Ophiodon elongatus	Spotted scorpionfish	Scorpaena guttata
Wolf-eel	Anarrhichthys ocellatus	Pink seaperch	Zalembius rosaceus
Unidentified fishes	--	Unidentified surfperch	--
Unidentified rockfish	--	--	--
Platform Bottom			
Kelp rockfish	*Sebastes atrovirens*	Spotted scorpionfish	--
Lincod	*Ophiodon elongatus*	Blackeye goby	*Rhinogobiops nicholsii*
Brown rockfish	*Sebastes auriculatus*	Painted greenling	*Oxylebius pictus*
Pile perch	*Rhacochilus vacca*	Cabezon	*Scorpaenicthys marmoratus*
Wolf-eel	*Anarrhichthys ocellatus*	Squarespot rockfish	*Sebastes hopkinsi*
California sheephead	*Semicossyphus pulcher*	Copper rockfish	*Sebastes caurinus*
Halfbanded rockfish	*Sebastes semicinctus*	Unidentified surfperch	--

Common Name	Scientific Name	Common Name	Scientific Name
Halfbanded rockfish YOY	*Sebastes semicinctus*	Unidentified rockfishes YOY	--
Unidentified Rockfish	--	Unidentified fishes	--
Platform Midwater			
Blacksmith	*Chromis punctipinnis*	Squarespot rockfish	*Sebastes hopkinsi*
Cabezon	*Scorpaenicthys marmoratus*	California sheephead	*Semicossyphus pulcher*
Garibaldi	*Hypsypops rubicundus*	Kelp rockfish	*Sebastes atrovirens*
Painted greenling	*Oxylebius pictus*	Painted greenling YOY	*Oxylebius pictus*
Gopher rockfish	*Sebastes carnatus*	Shortbelly rockfish	*Sebastes jordani*
Lincod	*Ophiodon elongatus*	Brown rockfish	*Sebastes auriculatus*
Unidentified YOY rockfish	--	Unidentified fishes	--

Source: Love and Nishimoto, 2012

There is only one listed fish species, Southern California steelhead (*Oncorhynchus mykiss*) that could occur in the vicinity of the Project area and is described in detail below. Three additional species, the cowcod (*Sebastes levis*), bocaccio (*Sebastes paucispinus*), and Green Sturgeon (*Acipenser medirostris*) could occur in the vicinity of the Project and are listed as National Oceanic and Atmospheric Administration (NOAA) Species of Concern are discussed below.

3.3.3.1 Southern California Steelhead

The Southern California Evolutionary Significant Unit (ESU) steelhead was listed as Endangered by NOAA Fisheries (formerly the National Marine Fisheries Service or NMFS) in October 1997. It was listed as a California Species of Special Concern in 1995. Critical habitat for this ESU is the coastal river basins from the Santa Maria River (southern San Luis Obispo County) to Malibu Creek (Los Angeles County); however, NOAA Fisheries is considering extending the southern boundary to San Mateo Creek (northern San Diego County). Portions of the San Mateo and Santa Margarita creeks (San Diego County) have been designated critical habitat for this species (NMFS, 2016c).

Southern steelhead are anadromous and spawn from December to May with the major run between January and March. The adults require gravel bottom areas of relatively swift water streams for spawning and juvenile steelhead utilize deeper pools with undercut banks and boulders prior to entering the ocean (62 FR 43938). Juvenile southern steelhead trout remain in the freshwater for one to four years and one to five years in the marine waters (Stocker et al., 2002). Although unlikely, southern steelhead has the potential to occur within the Project area.

3.3.3.2 Cowcod

Cowcod is listed as a NOAA species of concern. Cowcod is a rockfish species that occurs from Ranger Bank and Guadalupe Island in Baja California to approximately Usal, California, occurring at depths from 60 to 1,200 feet (18 to 366 meters). They prefer high-relief rocky habitat, and oil platforms have become important habitat for the species (NMFS, 2016c). The Project is not located within a cowcod conservation area. However, cowcod habitat does occur within the Project area, and cowcod may be present during Project activities.

3.3.3.3 Bocaccio

Bocaccio Southern Distinct Population Segment (DPS) is listed as a NOAA species of concern. Bocaccio occurs from Punta Blanca in Baja California to Kruzof Island and Kodiak Island, Alaska. They can occur from shallow water to over 1,000 feet (305 meters) deep. Bocaccio can occur over rocky-reefs and soft bottom, but there is strong site fidelity to rocky bottoms and outcroppings. Juveniles and subadults are more common in shallow water, and adults are associated with rocky reefs, kelp canopies, and artificial structures, such as piers and oil platforms (NMFS, 2016c). Bocaccio habitat does occur within the Project area, and this species may be present during Project activities.

3.3.3.4 Green Sturgeon

In April 2006, the Southern green sturgeon DPS was listed as a Threatened species (NMFS,2016c). Critical habitat was designated in 2009 (NMFS, 2009a). For coastal marine critical habitat, the lateral extent to the west is defined by the 60 fathom (110 meters) depth bathymetry contour relative to the line of mean lower low water (MLLW) and shoreward to the area that is inundated by MLLW, or to the COLREGS demarcation lines delineating the boundary between estuarine and marine habitats. The green sturgeon is a widely distributed, ocean-oriented sturgeon found in nearshore marine waters from Baja Mexico to Alaska. The green sturgeon is an anadromous species, living in oceanic waters, bays, and estuaries when not spawning. Green sturgeon are known to forage in estuaries and bays ranging from San Francisco Bay to British Columbia (NMFS, 2016c). There is no breeding habitat in the Project area. Green sturgeon habitat does occur within the Project area, and this species may be present during Project activities.

3.3.3.5 Fish Harvested Commercially

Several fish species found within the Project area are targeted commercially (refer to Table 3.3-3). For a complete description of the commercial fisheries, including species targeted and gear used within the Project area, refer to Section 3.8 - Commercial and Recreational Fishing.

Table 3.3-3. 2015 Top 10 Targeted Commercial Species

Rockfish (*Sebastes* spp)	Northern anchovy (*Engraulis mordax*)
Bonito (*Sarda chiliensis*)	Hagfishes (*Myxini* sp)
Pacific mackerel (*Scomber japonicus*)	Jack mackerel (*Trachurus symmetricus*)
Pacific sardine (*Sardinops sagax*)	Yellowfin tuna (*Thunnus albacares*)
Red Sea Urchin (*Mesocentrotus franciscanus*)	Market squid (*Loligo opalescens*)

Source: CDFW, 2015

3.3.3.6 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) defined essential fish habitat (EFH) as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” According to the NMFS, EFH can include sediment, hard bottom, underwater structures, and associated biological communities (Pacific Fishery Management Council [PFMC], 2005). Section 303, subdivision (a)(7) of the MSA requires fishery management councils to identify EFH. EFH that is judged to be particularly important to the long-term productivity of populations of one or more managed species, or to be particularly vulnerable to degradation, should be identified as habitat areas of particular concern. Refer to Appendix D - Essential Fish Habitat Assessment for a detailed analysis of EFH within the Project region.

3.3.4 Marine Turtles

All marine turtles in U.S. waters are listed under the Federal ESA. Table 3.3-4 lists the species that could be encountered within the Project area and their occurrences and distribution throughout southern California. It is important to note, where seasonal differences occur, individuals may also be found within the area during the “off” season. Also, depending on the species, the numbers of abundant animals present in their “off” season may be greater than the numbers of less common animals in their “on” season. Table 3.3-5 provides the most recent abundance estimate for California Marine turtles.

Table 3.3-4. California Marine Turtle Species and Periods of Occurrence within Southern California (California/Mexico Border to Point Conception)

Family Common Name	Month of Occurrence(1)											
	J	F	M	A	M	J	J	A	S	O	N	D
REPTILES												
Cryptodira												
Olive ridley turtle (T)												
Green turtle (T)												
Leatherback turtle (E)												
Loggerhead turtle (T)												

Rare with uniform distribution | Not expected to occur due to seasonal distribution | More likely to occur due to seasonal distribution | Present Year Round

(E) Federally listed endangered species.
(T) Federally listed threatened species.
(1) Where seasonal differences occur, individuals may also be found in the “off” season. Also, depending on the species, the numbers of abundant animals present in their “off” season may be greater than the numbers of less common animals in their “on” season.

Table 3.3-5. Abundance Estimates for Marine Turtles of Southern California

Common Name ***Scientific Name***	**Population Estimate**	**Current Population Trend**
REPTILES		
Cryptodira		
Olive Ridley turtle***** *Lepidochelys olivacea*	1.1 million (Eastern Tropical Pacific Distinct Population Segment [DPS])	Stable
Green turtle***** *Chelonia mydas*	20,112 (Eastern Pacific DPS)	Stable
Loggerhead turtle *Caretta*	7,138 (California)	Decreasing
Leatherback turtle *Dermochelys coriacea*	361 (California)	Decreasing

Source: NMFS, 2016 d

* Estimates are based on known data of the population of nesting females for eastern Pacific Distinct Population Segments.

3.3.4.1 Olive Ridley Sea Turtle

The olive ridley sea turtle is listed as a Federally threatened species. The olive ridley sea turtle is distributed circum-globally and is regarded as the most abundant sea turtle in the world. Within the east Pacific, the normal range of Pacific Ridley sea turtles is from Southern California to Northern Chile (NMFS, 2016d). The olive ridley sea turtle is omnivorous, feeding on fish, crabs, shellfish, jellyfish, sea grasses and algae. Major nesting beaches are located on the Pacific coasts of Mexico and Costa Rica (NMFS, 2016d). According to the Marine Turtle Specialist Group of the International Union for Conservation of Nature (IUCN), there has been a 50 percent reduction in overall population size since the 1960's. Although unlikely due to being at the northern extent of their range, olive ridley sea turtles have the potential to occur within the Project area.

3.3.4.2 Green Sea Turtle

The green sea turtle is listed as a Federally threatened species. Green sea turtles generally occur worldwide in waters with temperatures above 20 degrees Celcius (68 degrees Fahrenheit). Green sea turtles are omnivores, feeding primarily on algae and sea grasses (NMFS, 2016d). In the eastern North Pacific, green turtles have been sighted from Baja California to southern Alaska, but most commonly occur from San Diego south. There are no known nesting sites along the west coast of the U.S., and the only known nesting location in the continental U.S. is on the east coast of Florida. However, green sea turtles are sighted year-round in marine waters off of the California coast, with the highest concentrations occurring during July through September. Green sea turtles may be present during Project activities.

3.3.4.3 Leatherback Sea Turtle

The leatherback sea turtle is listed as a federally endangered species. Leatherback sea turtles are the most common sea turtle off the west coast of the U.S. Leatherback sea turtles have been sighted as far north as Alaska and as far south as Chile. Their extensive latitudinal range is due to their ability to maintain warmer body temperatures in colder waters. Off the U.S. west coast, leatherback sea turtles are most abundant during the summer and fall months (NMFS, 2016d). It has been noticed that their appearance off the U.S. west coast is "two pronged" with sightings occurring in northern California, Oregon, Washington, and Southern California, with few sighting occurring along the intermediate coastline. In central California waters, leatherback sea turtles are most common in years when water temperatures are above normal (NMFS, 2016d).

Critical habitat for leatherback sea turtles was proposed in 2010, and a final ruling was issued in the Federal Register on January 2012 for the eastern Pacific Ocean population. Critical habitat within California extends to a depth of 80 meters (262.5 feet) from the ocean surface and out to the 3,000 meters (98,423 feet) isobath between Point Arguello and Point Arena. The Project area is not within designated critical habitat. Leatherback sea turtles may be present during Project activities.

3.3.4.4 Loggerhead Sea Turtle

The loggerhead sea turtle is listed as a Federally threatened species. Loggerhead sea turtles primarily occur in subtropical to temperate waters and are generally found over the continental shelf. Loggerhead sea turtles are omnivorous and feed on a wide variety of marine life including shellfish, jellyfish, squid, sea urchins, fish, and algae. The eastern Pacific population of loggerhead turtles breed on beaches in Central and South America. Southern California is considered to be the northern limit of loggerhead sea turtle distribution. In the eastern Pacific, loggerheads have been reported as far north as Alaska and as far south as Chile. On the western U.S. coast, occasional sightings are reported from the coasts of Washington and Oregon, but most records are juveniles off the coast of California (NMFS, 2016d). In the U.S., nesting occurs only in Florida and the worldwide population appears to be decreasing (NMFS, 2016d). Although unlikely due to being at the northern extent of their range, loggerhead sea turtles have the potential to occur within the Project area.

3.3.5 Marine Birds

Generally, at-sea marine bird densities are highest in May north of Point Conception and are highest in January from Point Conception south. However, this is based on the large springtime seabird breeding populations on the Northern Channel Islands and on the abundance of overwintering birds within that area. Generally, birds that are the most common in the winter months in the Project region include the California Gull (*Larus californicus*), Western Gull (*Larus occidentalis*), Western Grebe (*Aechmophorus occidentalis*), Cassin’s Auklet (*Ptychoramphus aleuticus*), and Surf Scoter (*Melanitta perspicillata*). Sooty Shearwater (*Puffinus griseus*), Short-tailed Shearwater (*Puffinus tenuirostris*), Western Gull, Pigeon Guillemot (*Cepphus columba*), cormorants, and California Brown Pelicans (*Pelecanus occidentalis*) were most abundant in spring, summer, and fall (Mason et al., 2007; Kaplan et al., 2010). The increase in over-wintering birds that congregate along the shoreline within the project region contribute to the overall higher abundance in January.

Over 2.5 million seabirds may pass through or reside in the SCB at any one time. Based on aerial and ship surveys, average seabird densities in the open water areas near the Project area may be between 20 and 200 birds per square mile (Mineral Management Service, 1993, cited in U.S. Navy, 2000).

The Pacific Flyway is a major migratory route for all bird species that travel from the northwestern U.S., Canada, and Alaska to southern California and Central America. The Pacific Flyway actually consists of at least two relatively distinct pathways: the mainland route, which is primary route that parallels the coast approximately 50 to 100 miles (80.5 to 160.9 kilometers) inland and the oceanic route, which is used predominantly by seabirds during their transequatorial migration between the North and South Pacific. A portion of the Pacific Flyway is located off the coast of California, but the exact location can vary depending on weather. Waterbirds tend to fly at elevations between 100 and 200 feet (60.9 meters) above the ocean (Aspen, 2008). However, weather conditions, such as wind and fog, can greatly influence flight altitude.

Because of species diversity in central and southern California, the timing of seasonal migrations can vary; however, the majority of southward migration to wintering areas occurs from late September to late December. The fall migration generally occurs over a longer period of time compared to the spring migration presumably because of the variability in the length of time of species egg incubation, and nesting and fledging times of birds that breed in the region. Spring migration normally occurs from February through the beginning of June, and the fall migration route of coastal seabirds is usually further offshore than that used by the spring migrants (Aspen, 2008). According to Spear and Ainley (1999), the variation in the number of migrants is directly correlated to the sea-surface temperature.

The seasonal distribution and abundance of coastal birds is summarized in Table 3.3-6. "x" in the table below indicates when the species could be observed within or near the Project site. A highlighted "**X**" indicates the season when the species is likely to occur at the highest abundance within or near the Project site (Aspen, 2008; Briggs et al. 1987; Mason et al. 2007, Mcgrath and Feenstra, 2007; Sibley, 2003).

The Channel Islands provide breeding grounds for many seabirds within the SCB. Specifically, the northern Channel Islands and Santa Barbara Island provide breeding grounds for 13 species of seabirds (U.S. Navy, 2008; Mason et al. 2007; NOAA, 2000). Because of the extensive mainland development and disturbance, breeding grounds for seabirds have been isolated to the islands (CDFG, 1976). See Table 3.3-6 for active breeding areas in southern California.

Several bird species that have the potential to occur within the Project area have been afforded protected status by the State and/or Federal government due to declining populations and/or habitats. The following special-status marine bird species could be found within the vicinity of the proposed activities.

3.3.5.1 Xantus's Murrelet

The Xantus's murrelet is listed as California Threatened species, and a USFWS Bird of Conservation Concern. This small black and white seabird nests on fewer than 10 islands in southern California and Baja Mexico. The estimated remaining global population of 5,600 birds is concentrated during the breeding season in four major colonies all in the Channel Islands and Baja California. The species typically nests in crevices, caves, under large rocks, on steep cliffs and canyons of offshore islands. The nesting period extends from February through July, but may vary depending on food supplies (Audubon Society Watchlist, 2007). Briggs et al. (1987) observed bird concentrations around Santa Barbara Islands and off San Diego in the breeding months (March to May) with birds off San Diego presumably from the nearby Coronado Islands, Mexico. According to Mason et al. (2007), during the month of May 1999 to 2001, greatest densities were near Santa Barbara and Anacapa Islands and north of Point Conception along the coast.

This species could be found in the Project vicinity year-round; however, with a northerly migration from southern breeding islands, the greatest possibility for them to occur in the Project is in early summer or during the winter months prior to the breeding season. This species' at-sea abundance was highest in May and very few birds were observed during January and September. Depending on prey abundance, Xantus's may be found in the vicinity of the Project site in the breeding season as breeding adults from Santa Barbara Island have been known to travel great distances for food. Based on the current Project schedule (Fall), Xantus's murrelet could occur within the vicinity of the Project site during Project activities.

3.3.5.2 California Brown Pelican

The California brown pelican was formerly listed as Federal and California Endangered species, and California Fully-Protected, but has been taken off of the Federal and California endangered species list due to recovered population numbers. The California brown pelican is no longer California Fully-Protected species. This species forages within estuarine, subtidal, and pelagic waters and feeds almost entirely on fish that are caught by diving from a distance of 20 to 40 feet (6.1 to 12.2 meters) above the water surface. They are common along the southern California Coast from June to October and can be regularly seen feeding within the offshore and nearshore portions of the Project site.

This species annually breeds on Anacapa and Santa Barbara islands, and irregularly breeds on Santa Cruz and San Miguel islands. This species breeds from March to early August, and builds nests of sticks on the ground. Following the breeding season, individuals leave the breeding colonies and disperse along the California and Mexico coastlines, with some small numbers visiting the Salton Sea and Colorado River reservoirs (Zeiner, et al., 1990). Based on documented seasonal distribution, this species is most likely to occur within the vicinity of the Project site from summer through fall.

Table 3.3-6. Marine/Coastal Bird Species Likelihood of Occurrence Within or Near the Project Area

FAMILY Common Name	Scientific Name	Status[1]	Season				Activity		
			Winter	Spring	Summer	Fall	Wintering	Breeding	Migrant
ANATIDAE (Swans, Geese, and Ducks)									
Brant	*Branta bernicla*	M, CSC	X	X		X	X		X
Surf Scoter	*Melanitta perspicillata*	M	**X**	X		X	X		X
White-winged Scoter	*Melanitta fusca*	M	X	X		X	X		
Black Scoter	*Melanitta americana*	M	X	X		X	X		
Red-breasted Merganser	*Mergus serrator*	M	**X**	X		X	X		
GAVIIDAE (Loons)									
Red-throated Loon	*Gavia stellata*	M	**X**	X		X	X		X
Common Loon	*Gavia immer*	M	**X**	X		X	X		X
Pacific Loon	*Gavia pacifica*	M	**X**	X		X	X		X
PODICIPEDIDAE (Grebes)									
Horned Grebe	*Podiceps auritus*	M	X	X		X	X		X
Clark's/western Grebe	*Aechmophorus clarkii/occidentalis*	M	X	X	X	X	X		X
DIOMEDEIDAE (Albatrosses)									
Laysan Albatross	*Phoebastria immutabilis*	M	X	X					X
Black-footed Albatross	*Phoebastria nigripes*	M, BCC		X	X				X
Short-tailed Albatross	*Phoebastria albatrus*	M, FE	X			X			X
PROCELLARIIDAE (Shearwaters and Fulmars)									
Northern Fulmar	*Fulmarus glacialis*	M	**X**	X		X	X		
Cook's Petrel	*Pterodroma cookii*	M		X	X				X
Pink-footed Shearwater	*Puffinus creatopus*	M, BCC	X	X	**X**	X	X		X
Flesh-footed Shearwater	*Puffinus carneipes*	M		X		X			X
Buller's Shearwater	*Puffinus bulleri*	M			X	X			X
Sooty Shearwater	*Puffinus griseus*	M		**X**	**X**	**X**			X
Short-tailed Shearwater	*Puffinus tenuirostris*	M	X			**X**	X		X
Black-vented Shearwater	*Puffinus opisthomelas*	M, BCC	**X**	X		X	X		

FAMILY Common Name	Scientific Name	Status[1]	Season				Activity		
			Winter	Spring	Summer	Fall	Wintering	Breeding	Migrant
HYDROBATIDAE (Storm Petrels)									
Fork-tailed Storm-Petrel	*Oceanodroma furcata*	M, CSC	X	X		X	X		X
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	M		X	**X**	X		X	
Ashy Storm-Petrel	*Oceanodroma homochroa*	M, CSC, BCC		X	X	X		X	
Black Storm-Petrel	*Oceanodroma melania*	M, CSC		X	**X**	X		X	
Least Storm-Petrel	*Oceanodroma microsoma*	M			X	X			X
PHAETHONTIDAE (Tropicbirds)									
Red-billed Tropicbird	*Phaethon aethereus*	M		X	**X**	X			X
FREGATIDAE (Frigatebirds)									
Magnificent Frigatebird	*Fregata magnificens*	M			X	X			X
SULIDAE (Boobies and Gannets)									
Brown Booby	*Sula leucogaster*	M			X	X			X
PHALACROCORACIDAE (Cormorants)									
Brandt's Cormorant	*Phalacrocorax penicillatus*	M	**X**	**X**	X	X	X	X	X
Double-crested Cormorant	*Phalacrocorax auritus*	M, TW	X	**X**	X	X	X	X	X
Pelagic Cormorant	*Phalacrocorax pelagicus*	M	X	X	X	X	X	X	X
PELECANIDAE (Pelicans)									
American White Pelican	*Pelecanus erythrorhynchos*	M, CSC		**X**		X	X		X
Brown Pelican	*Pelecanus occidentalis*	M, FDL, CP	X	**X**	X	X	X	X	X
SCOLOPACIDAE (Sandpipers and Relatives)									
Red-necked Phalarope	*Phalaropus lobatus*	M		X	X	X			X
Red Phalarope	*Phalaropus fulicarius*	M	X	X	X	X	X		X
LARIDAE (Gulls and Terns)									
Black-legged Kittiwake	*Rissa tridactyla*	M	**X**	X		X	X		X
Sabine's Gull	*Xema sabini*	M		X	X	X			X
Bonaparte's Gull	*Chroicocephalus philadelphia*	M	X	X		X	X		X
Heermann's Gull	*Larus heermanni*	M	X		X	**X**	X		X
Mew Gull	*Larus canus*	M	X	X		X	X		X
Ring-billed Gull	*Larus delawarensis*	M	**X**	X	X	X	X		X
Western Gull	*Larus occidentalis*	M	**X**	**X**	**X**	**X**	X	X	
California Gull	*Larus californicus*	M, TW	**X**	X	X	**X**	X		X

FAMILY Common Name	Scientific Name	Status[1]	Season				Activity		
			Winter	Spring	Summer	Fall	Wintering	Breeding	Migrant
Herring Gull	*Larus argentatus*	M	X	X		X	X		X
Thayer's Gull	*Larus thayeri*	M	X	X		X	X		X
Glaucous-winged Gull	*Larus glaucescens*	M	X	X		X	X		X
California Least Tern	*Sternula antillarum*	M, FP, FE, SE		X	X			X	
Caspian Tern	*Hydroprogne caspia*	M	X	X	X	X	X	X	X
Black Tern	*Chlidonias niger*	M, CSC		X	X	X			X
Common Tern	*Sterna hirundo*	M		X	X	X			X
Arctic Tern	*Sterna paradisaea*	M		X	X	X			X
Forster's Tern	*Sterna forsteri*	M	X	X	X	X	X	X	X
Royal Tern	*Thalasseus maximus*	M	X	X		X	X		X
Elegant Tern	*Thalasseus elegans*	M, TW, BCC		X	X	X		X	X
Black Skimmer	*Rynchops niger*	M, CSC, BCC	X	X	**X**	X	X		X
STERCORARIIDAE (Skuas and Jaegers)									
South Polar Skua	*Stercorarius maccormicki*	M		X	X	X			X
Pomarine Jaeger	*Stercorarius pomarinus*	M	X	X	**X**	X	X		X
Parasitic Jaeger	*Stercorarius parasiticus*	M	X	X		X	X		X
Long-tailed Jaeger	*Stercorarius longicaudus*	M		X	X	**X**			X
ALCIDAE (Auks, Murres, and Puffins)									
Common Murre	*Uria aalge*	M	X	X	X	X	X	X	X
Pigeon Guillemot	*Cepphus columba*	M		**X**	**X**	X		X	
Marbled Murrelet	*Brachyramphus marmoratus*	M, SE, FT	X			X	X		
Xantus's Murrelet	*Synthliboramphus hypoleucus*	M, FC, ST, BCC	X	**X**	X			X	
Craveri's Murrelet	*Synthliboramphus craveri*	M			X	X			X
Cassin's Auklet	*Ptychoramphus aleuticus*	M, BCC, CSC	**X**	**X**	X	X	X	X	X
Rhinoceros Auklet	*Cerorhinca monocerata*	M, TW	**X**	X	X	X	X	X	X
Tufted Puffin	*Fratercula cirrhata*	M, CSC		X	X			X	X

Status[1]

M = Protected under the Federal Migratory Bird Treaty Act (MBTA)
FE = Federally Endangered
FT = Federally Threatened
FDL = Federally Delisted
SE = California State Endangered
ST = California State Threatened
CSC = California Species of Special Concern
FP = California Fully Protected Species
BCC = USFWS Birds of Conservation Concern
TW = California Designated Taxa to Watch

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3.3.5.3 Ashy Storm-Petrel

The ashy storm-petrel is a California Species of Special Concern. The ashy storm-petrel is a small smoke-gray seabird with a forked tail that is only found on the islands off California and in the adjacent waters of the continental slope. This species nest in cavities on offshore islands and moves to and from colonies at night. Ashy storm-petrels do not travel significantly far from their colonies after breeding, and many birds remain offshore from their breeding grounds. However, many individuals can make short seasonal migrations. The breeding season for this species is spread out over most of the year (Shuford and Gardali, [eds] 2008). This species breeds on six of the eight major California Channel Islands (does not breed on Santa Rosa and San Nicolas islands). According to Mason et al. (2007), this species was found around most of the Channel Islands with the greatest abundance at Santa Catalina after October; annual and season variations were, however, noted in that study. Based on the normal distribution and abundance, this species could occur within the Project site year-round but has the highest potential of occurrence during the winter months.

3.3.5.4 Black Storm-Petrel

The black storm-petrel is a California Species of Special Concern. This is the largest California storm-petrel, and has a dark rump, pointed wings, and a notched tail. The black storm-petrel can be found closer to shore than other storm-petrels and it feeds on squid, small fish, and crustaceans that occur near the surface. Black storm-petrels nest in desert habitat on small rocky islands or the talus slopes of non-mountainous larger islands that are not large enough to support predatory mammals year-round. Black storm-petrels arrive at their nesting colonies in mid-April and breeding occurs from May through October (Shuford and Gardali [eds], 2008). In the SCB, storm-petrels breed on Santa Barbara, Sutil, and Coronado islands, and possibly on Prince Rock (approximately 0.5 miles [0.8 kilometers] north of San Miguel Island) and San Clemente Island. According to range maps from Mason et al. (2007) the black storm-petrel has been observed throughout the year offshore southern California. However, there were few sightings in the vicinity of the Project site, with the highest density occurring in September.

3.3.5.5 California Least Tern

The California least tern is a Federally listed and California-listed Endangered species and is a California Fully Protected species. The California least tern is a migratory species that usually arrives in California breeding territories in late April. This species forages for small epipelagic fish (anchovy, atherinids, and shiner surfperch) within estuaries, lagoons and nearshore waters. Least terns are present at nesting colonies from April through August. Preferred nesting habitat for this species is open or sparsely-vegetated, sandy or gravelly shores, located near shallow-water feeding areas that are relatively free of human or predatory disturbance. This species abandons nesting areas readily if disturbed. Courtship typically occurs at beaches near the nesting colonies (Zeiner et al., 1990). Fall migration begins the last week of July and first week of August (USFWS, 2006a). This species is not expected to occur in the vicinity of the Project site; however, individuals could be present in the POLA/POLB area through which the Project vessels transit to and from the Project site.

3.3.5.6 Marbled Murrelet

The marbled murrelet is a Federal Threatened and a California Endangered species that occurs in Washington, Oregon, and California. It is a small sea bird that spends most of its life in the nearshore marine environment, but nests and roosts inland in low-elevation old growth forests, or other forests with remnant large trees. It is generally confined to the marine fog belt near the coast. Nesting generally occurs in the marine fog belt within 25 miles (40.2 kilometers) of the coast in coast redwood, Douglas fir, western red cedar, western hemlock, and Sitka spruce. The species nests from Washington to central California (Monterey Bay area). This bird is rare in southern California and is only found in the non-breeding season (late fall, winter, and early spring) in Orange County. The marbled murrelet would only occur as a fall/winter migrant within or near the area of Project site.

3.3.5.7 Pink-Footed Shearwater

The pink-footed shearwater is designated as a "Bird of Conservation Concern" by USFWS. The pink-footed shearwater is endemic to Chile, and is known to breed on only three known islands. After chicks fledge (from approximately April to May), the parents migrate northward to spend the non-breeding season in waters off the coasts of Peru and North America, specifically southern California. This species feeds primarily on fish and squid in offshore waters over the continental shelf but also in pelagic waters. This shearwater catches its prey from short dives of less than 10 feet [3 meters]; however, it has the ability to dive up to 60 feet (18.3 meters) in depth (Pink-footed shearwater, 2010). According to at-sea range maps from Mason et al. (2007) the pink-footed shearwater has been observed in southern California in the months of January, May, and September and therefore could also occur in the vicinity of the Project site during those months. It was most abundant during the summer or early fall months.

3.3.5.8 Black-Vented Shearwater

The black-vented shearwater is designated as a "Bird of Conservation Concern" by USFWS. This species is pelagic, occurring in the Pacific Ocean and the Gulf of California. The black-vented shearwater is nocturnal when visiting land and breeds on desert islands along the west coast of Baja California, Mexico. It will nest within burrows in sandy substrate or it will drop a single egg in natural rock crevices. This shearwater feeds by plunging from just above the sea surface or submerges from afloat and dives to depths of greater than 60 feet (18.3 meters) to catch schooling fish and squid. This species is considered a coastal bird, usually found within 12 miles (19.3 kilometers) from shore. This species visits southern California during the non-breeding season. According to at-sea range maps from Mason et al. (2007) the black-vented shearwater has been observed in the months of January and September in the vicinity of the Project site and in southern California. Although it was observed, the species was seen at low densities.

3.3.5.9 Tufted Puffin

The tufted puffin is designated as a California Species of Special Concern. Tufted puffins can be found throughout the northern Pacific Ocean and they have recently recolonized southern California where they had not nested since the early 1900s. The largest tufted puffin populations occur along the west coast of the Olympic Peninsula, Washington, but their status there is not well known. They nest in burrows at the edges of cliffs, on grassy slopes, or in natural crevices in rocks. Migratory patterns are not well known, but tufted puffins are less likely to be seen nearshore in winter than in the breeding season. They are probably the most pelagic of the alcids during their non-breeding season, with many birds wintering 60 to 120 miles (96.5 to 193.1 kilometers) offshore. This species was discovered breeding on Prince Island (northern Channel Islands) in 1991. This species could be in the area of Project site year-round; however, it is more likely to occur in the non-breeding season late spring and summer (Shuford and Gardali [eds], 2008).

3.3.5.10 Cassin's Auklet

The Cassin's auklet is designated as a "Bird of Conservation Concern" by USFWS and a "California Species of Special Concern". Cassin's auklets are widely distributed in the Pacific Ocean, breeding from the Aleutian Islands, Alaska, to central Baja California, Mexico. When its prey (small crustaceans, squid, and fish) is abundant, these birds often gather in large flocks, using their short, stubby wings to "swim" after prey. The breeding season varies from late fall through winter in Baja California, but in early to mid-summer in Alaska. In May, birds were concentrated in northwest Santa Barbara Channel and north of Point Conception, reflecting a northward dispersal of SCB breeders (Adams et al. 2004). In September, most Cassin's auklets were observed north of Point Conception. They were widely distributed across the SCB in January, primarily west of San Nicolas Island. According to at-sea range maps from Mason et al. (2007), Cassin's auklets have been observed in the vicinity of the Project site during the months of January, May, and September. However, occurrences appeared rare in that portion of the species range.

3.3.5.11 Short-Tailed Albatross

The short-tailed albatross is a Federal endangered species. This species is a large pelagic bird with long narrow wings adapted for soaring just above the water surface. As of 2008, 80 to 85 percent of the known breeding short-tailed albatross use a single colony, Tsubamezaki, on Torishima Island. The remaining population nests on other islands surrounding Japan. During the non-breeding season, short-tailed albatross range along the Pacific Rim from southern Japan to northern California, primarily along continental shelf margins. Nests consist of a divot on the ground lined with sand and vegetation with eggs hatch in late December and January. The diet of this species is not well studied; however, research suggests at sea during the non-breeding season that squid, crustaceans, and fish are important prey (USFWS, 2008). This species is not expected to occur in the vicinity of the Project site; however, it could be in California in the non-breeding season of fall and early winter.

3.3.5.12 Black-Footed Albatross

The black-footed albatross is designated as a "Bird of Conservation Concern" by USFWS. This albatross is the most abundant albatross along the eastern Pacific coast and occurs off California throughout the year. It nests on the northern Hawaiian Islands, on the U.S. Minor Outlying Islands (Midway, Wake, etc.), and on three outlying islands of Japan and can be seen on those breeding grounds in winter and spring. After breeding, individuals fly to Alaska, California, Taiwan, and the Bering Sea. This species breeds on beaches and slopes with little or no vegetation. This albatross feeds mainly on squid and on the eggs of flying-fish, although it often follows ships and trawlers, picking up debris left in their wake. According to Mason et al. (2007), the black-footed albatross has been observed in the months of May and September in southern California during the months of May and September, with highest densities in September.

3.3.5.13 Double-Crested Cormorant

The double-crested cormorant is no longer a California Species of Special Concern; however, it is currently listed by California as a Taxa to Watch. This species formerly bred on coastal cliffs and offshore islands along the coast from Marin County south to La Jolla, San Diego County, and in the interior in northeastern California, the Sacramento Valley, the San Joaquin Valley, and the Salton Sea. However coastal breeding populations counted in 2008 were in decline from previous estimates in 2001-2003 (USGS, 2010). This species nests in colonies in nests built in trees and shrubs and on the ground of rocky cliffs and islands. Prey consists of fish and marine invertebrates from the water's surface. Based on the current Project schedule (Fall) this species will most likely be present in the vicinity of the Project site during the Project activities.

3.3.5.14 Elegant Tern

The elegant tern is no longer a California Species of Special Concern; however, it is currently listed by California as a Taxa to Watch. This species may be found at coastal areas from Humboldt County south to Baja California, Mexico. It congregates on beaches and tidal flats when not feeding, and forages primarily within shallow ocean waters beyond the surf zone. Primary prey consists of fish. This species was initially a rare and irregular post-nesting visitor to California, but numbers have been increasing since the 1950's, and large flocks can now be seen. Breeding primarily occurs in Mexico and in extreme southern California. During 1959, a colony was established at San Diego Bay and this colony has persisted, and may have facilitated the species' range extension into the central coast of California (Zeiner, et al., 1990). Based on the current Project schedule (Fall), elegant tern could occur within the vicinity of the Project site during Project activities.

3.3.5.15 California Gull

The California gull is no longer a California Species of Special Concern; however, it is currently listed by California as a Taxa to Watch. This species is an abundant visitor to coastal and interior lowlands during the non-breeding season (mid-August to mid-April), and may be found in a variety of local habitats including: sandy beaches mudflats, rocky intertidal, pelagic areas, fresh and saline emergent wetlands, lakes, rivers, cropland, landfills, and open lawns within urban areas. This omnivorous species feeds on garbage, carrion, earthworms, insects (adults and larvae), brine shrimp, and young birds. This species nests in colonies at alkali and freshwater lacustrine habitats east of the Sierra Nevada and Cascades and the San Francisco Bay Area (Zeiner et al., 1990). Based on the current Project schedule (Fall), California gull could occur within the vicinity of the Project site during Project activities.

3.3.5.16 Rhinoceros Auklet

The rhinoceros auklet is currently listed by California as a Taxa to Watch. This species breeds from the Aleutian Islands, Alaska to San Miguel Island (northern Channel Islands). The rhinoceros auklet has a bright orange-yellow bill with a whitish horn, which is a diagnostic feature of the species. They often feed close to shore, especially where tidal currents near islands create upwellings and concentrations of food. This species breeds in burrows within grass, shrubs or trees, as long as there is enough soil for the birds to burrow. This species can be present off the coast of southern/central California in ocean waters year-round; however, it was most abundance in the region of the Project in the non-breeding winter months.

3.3.6 Marine Mammals

All marine mammals are protected under the 1972 Federal Marine Mammal Protection Act (MMPA). Table 3.3-7 lists the species that could be encountered within the Project area and their occurrences and distribution throughout southern California. It is important to note, where seasonal differences occur, individuals may also be found within the area during the “off” season. Also, depending on the species, the numbers of abundant animals present in their “off” season may be greater than the numbers of less common animals in their “on” season.

Table 3.3-8 provides the most recent population estimates for marine mammals off southern California. The abundance of many of these species varies seasonally, while some pinnipeds and dolphins are considered year-round residents. Several species of whales migrate through the area (e.g., gray whales [*Eschrichtius robustus*]) or are most common during specific months (e.g., blue whales [*Balaenoptera musculus*] and humpback whales [*Megaptera novaengliae*] are most abundant in the summer months). Both permanent residents and migrants could occur within the Project area.

3.3.6.1 Cetaceans (Whales, Dolphins, and Porpoises)

The cetacean population off California includes eight baleen whale species, more than a dozen species of porpoises, dolphins, and other toothed whales. Some species are purely migrants that pass through central and southern California waters on their way to calving or feeding grounds elsewhere, some are seasonal visitors that remain for a few weeks or months, and others are resident for much or all of the year. At certain times of the year, hundreds of thousands of marine mammals may be present along the coast of central and southern California (Bonnell and Dailey, 1993).

Cetaceans consist of two suborders; the Mysticeti (baleen whales, which feed by filtering their food through long, fringed plates), and the Ondontoceti (toothed whales, which include the sperm whale (*Physeter macrocephalus*), dolphins, porpoises, and lesser known species such as the beaked whales).

Table 3.3-7. California Marine Mammal Species and Periods of Occurrence within Southern California (California/Mexico Border to Point Conception)

Family Common Name	Month of Occurrence[1]											
	J	F	M	A	M	J	J	A	S	O	N	D
MAMMALS												
Mysticeti												
California gray whale	More likely	More likely	More likely	More likely	More likely	Not expected	Not expected	Not expected	Not expected	Not expected	More likely	More likely
Blue whale (E)	More likely	More likely	More likely	More likely	More likely	Not expected	Not expected	Not expected	Not expected	Not expected	Not expected	Not expected
Fin whale (E)	Rare	Rare	Rare	Rare	More likely	More likely	More likely	More likely	More likely	More likely	More likely	Rare
Humpback whale (E)	Not expected	Not expected	Not expected	Not expected	More likely	More likely	More likely	More likely	More likely	More likely	More likely	Not expected
Minke whale	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round
Sei whale (E)	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
North Pacific right whale (E)	More likely	More likely	Not expected	Not expected	Not expected	Not expected	Not expected	Not expected	Not expected	More likely	More likely	More likely
Odontoceti												
Dall's porpoise	More likely	More likely	More likely	More likely	More likely	Rare	Rare	Rare	Rare	Rare	Rare	More likely
Short-beaked common dolphin	More likely	More likely	More likely	More likely	More likely	More likely	Rare	Rare	Rare	Rare	Rare	More likely
Long-beaked common dolphin	More likely	More likely	More likely	More likely	More likely	More likely	Rare	Rare	Rare	Rare	Rare	More likely
Pacific white-sided dolphin	Rare	Rare	Rare	More likely	More likely	More likely	More likely	More likely	More likely	Rare	Rare	Rare
Risso's dolphin	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round
Short-finned pilot whale	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Bottlenose dolphin	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round
Northern right whale dolphin	Rare	Rare	Rare	Rare	Rare	Not expected	Not expected	Not expected	Not expected	Not expected	Not expected	Rare
Sperm whale (E)	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Dwarf sperm whale	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Pygmy sperm whale	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Baird's beaked whale	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Cuvier's beaked whale	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Mesoplodont beaked whales	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Killer whale	Rare	Rare	More likely	More likely	More likely	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Pinnipedia												
Northern fur seal[2]	More likely	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	More likely	More likely
Guadalupe fur seal	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Rare
California sea lion	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round
Northern elephant seal[3]	More likely	More likely	More likely	More likely	Rare	Rare	Rare	Rare	Rare	Rare	Rare	More likely
Pacific harbor seal	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round
Fissipedia												
Southern sea otter (T)[4]	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round	Year round

Rare with uniform distribution (grey) | Not expected to occur due to seasonal distribution (white) | More likely to occur due to seasonal distribution (hatched) | Present Year Round (black)

(E) Federally listed endangered species.
(T) Federally listed threatened species.
(1) Where seasonal differences occur, individuals may also be found in the "off" season. Also, depending on the species, the numbers of abundant animals present in their "off" season may be greater than the numbers of less common animals in their "on" season.
(2) Only a small percent occurs over continental shelf (except near San Miguel rookery, May-November).
(3) Common near land during winter breeding season and spring molting season.
(4) Only nearshore (diving limit 100 feet [30.5 meters]).

Table 3.3-8. Abundance Estimates for Marine Mammals of within Southern California (California/Mexico Border to Point Conception)

Common Name *Scientific Name*	**Population Estimate**	**Current Population Trend**
MAMMALS		
Mysticeti		
California gray whale *Eschrichtius robustus*	20,125 (Eastern North Pacific Stock)	Fluctuating annually
Fin whale *Balaenoptera physalus*	2,598 (California/Oregon/Washington Stock)	Increasing off California
Humpback whale *Megaptera novaeangliae*	1,876 (California/Oregon/Washington Stock)	Increasing
Blue whale *Balaenoptera musculus*	1,551 (Eastern North Pacific Stock)	Unable to determine
Minke whale *Balaenoptera acutorostrata*	202 (California/Oregon/Washington Stock)	No long-term trends suggested
Northern Pacific right whale *Eubalaena japonica*	23 (based on photo-identification) (Eastern North Pacific Stock)	No long-term trends suggested
Sei whale *Balaenoptera borealis*	83 (Eastern North Pacific Stock)	No long-term trends suggested
Odontoceti		
Short-beaked common dolphin *Delphinus delphis*	343,990 (California/Oregon/Washington Stock)	Unable to determine
Long-beaked common dolphin *Delphinus capensis*	76,224 (California Stock)	Unable to determine
Dall's porpoise *Phocoenoides dalli*	32,106 (California/Oregon/Washington Stock)	Unable to determine
Pacific white-sided dolphin *Lagenorhynchus obliquidens*	21,406 (California/Oregon/Washington Northern and Southern Stock)	No long-term trends suggested
Risso's dolphin *Grampus griseus*	4,913 (California/Oregon/Washington Stock)	No long-term trends suggested
Short-finned pilot whale *Globicephala macrorhynchus*	465 (California/Oregon/Washington Stock)	No long-term trends suggested
Striped dolphin *Stenella coeruleoalba*	8,231 (California, Oregon, Washington)	No long-term trends suggested
Baird's beaked whale *Berardius bairdii*	466 (California, Oregon, Washington)	No long-term trends suggested

Common Name *Scientific Name*	Population Estimate	Current Population Trend
Cuvier's beaked whale *Ziphius cavirostris*	4,481 (California, Oregon, Washington Stock)	No long-term trends suggested
Mesoplodont beaked whales	389 (California, Oregon, Washington)	No long-term trends suggested
Bottlenose dolphin *Tursiops truncatus*	684 (California/Oregon/Washington Offshore Stock)	No long-term trends suggested
	290 (California Coastal Stock)	No long-term trends suggested
Northern right whale dolphin *Lissodelphis borealis*	6,019 (California / Oregon / Washington Stock)	No long-term trends suggested
Sperm whale *Physeter macrocephalus*	1,332 (California/Oregon/Washington Stock)	No long-term trends suggested
Dwarf sperm whale *Kogia sima*	Unknown (California, Oregon, Washington)	No long-term trends suggested
Pygmy sperm whale *Kogia breviceps*	271 (California/Oregon/Washington Stock)	No long-term trends suggested
Killer whale *Orcinus orca*	162 (Eastern North Pacific Offshore Stock in California / Oregon / Washington waters)	Unable to determine
	243 (West Coast Transient)	Slight decrease since mid-1990s
Pinnipedia		
California sea lion Zalophus californianus	153,337 (U.S. Stock)	Increasing
Northern fur seal Callorhinus ursinus	6,858 (California - San Miguel Island Stock)	Increasing
Guadalupe fur seal Arctocephalus townsendi	3,028 (Mexico Stock) Undetermined in California	Increasing
Northern elephant seal Mirounga angustirostris	81,368 (California Breeding Stock)	Increasing
Pacific harbor seal Phoca vitulina richardsi	27,348 (California Stock)	Stable
Fissipedia		
Southern sea otter *Enhydra lutris nereis*	3,272 (California Stock)	Unable to determine

Source: NMFS, 2017a; and Tinker and Hatfield, 2016.

Mysteceti. Three families of mysticetes, or baleen whales, occur in southern California waters. Species include the gray whale (*Eschrichtius robustus*), the northern right whale (*Eubalaena japonica*), and members of the rorquals family (*Balaenopteridae*). Rorquals are characterized as having pleated throats that expand to take in water, which is then strained outward through the baleen. Rorqual species include: blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), humpback whale (*Megaptera novaeangliae*), and minke whales (*B. acutorostrata*). Although individual species' patterns vary, baleen whales range widely in the North Pacific, migrating between coldwater summer feeding grounds in the north and winter calving grounds in the south (Bonnell and Dailey, 1993). The mating season generally begins during the southbound migration and lasts through winter. Most baleen whales feed low on the food chain, eating a variety of swarming, shrimp-like invertebrates (Bonnell and Dailey, 1993). Some species also take small schooling fishes and squid. Larger rorquals, such as the blue whale, appear to feed mainly on crustaceans, while the diets of smaller baleen whales tend to include more fish.

Due to the offshore nature of the proposed Project, several species of the mysticetes which exist within in the SCB have the potential to occur within the Project site, or to be encountered by vessels traveling to the Project site. Table 3.3-7 shows the seasonal distribution of the marine mammals and reptiles reported within the SCB. It is important to note that, where seasonal differences occur, individuals may also be found within the area during the "off" season. The "presence/absence" range shown in Table 3.3-7 reflects a general characterization of seasonal abundance that has been developed over several decades of data collection. The species with the highest potential to be encountered during Project activities are discussed in the following paragraphs.

Gray Whale. The gray whale population breeds and calves in lagoons along the west coast of Baja California and in the Gulf of California in the winter (Allen et al., 2011). At the end of the season, the population begins a 5,000-miles (8,000-kilometer) coastal migration to summer feeding grounds to the north. Migrating gray whales generally travel within 5 miles (8 kilometers) of the shoreline over most of the route (Allen et al., 2011). Off southern California, where gray whales often travel through the Channel Islands, offshore movements of up to 50 miles (80 kilometers) have been observed (Jones and Swartz, 1984; Dohl et al., 1981; Bonnell and Dailey, 1993) due to the dispersal of the population through the islands. Recent estimates of eastern North Pacific gray whale indicated that approximately 20,125 individuals are known to occur (NMFS, 2017a).

Generally, gray whales are sighted in the Project area beginning in December and continuing through May. Due to the tendency for females with calves to stay closer to shore during the northern migration period (March through May), there is a higher probability of whales being observed in the Project area in December through February during their southern migration. Due to the distance offshore and survey timing, gray whales are not expected to occur within the Project area.

Blue Whale. The blue whale is a Federally endangered species due to intensive historical commercial whaling. Blue whales are distributed worldwide in circumpolar and temperate waters, and although they are found in coastal waters, they are thought to occur generally offshore compared to other baleen whales (Allen et al, 2011). Like most baleen whales, they migrate between warmer water breeding and calving areas in winter and high-latitude feeding grounds in the summer. Feeding grounds have been identified in coastal upwelling zones off the coast of California primarily within two patches near the Gulf of the Farallones and at the western part of the Channel Islands (Irvine et al., 2014). The most recent estimates of eastern north Pacific blue whale population indicate that a minimum of 1,551 individuals exist there (NMFS, 2017a). Offshore of California blue whale sightings are made seasonally between June and December in southern California, with a peak in late summer early fall (Aleen et al., 2011). This species may occur during Project activities.

Fin Whale. The fin whale is listed as a Federally endangered species due to a severe worldwide population decline due to intensive historical commercial whaling. Fin whales occur year-round off of California, Oregon, and Washington (NMFS, 2017a). The most recent estimates of the fin whale population indicate that at least 2,598 individuals occur off California, Oregon, and Washington (NMFS, 2017a). There is some evidence that recent increases in fin whale abundance have occurred in the California current between 1991 and 2008. Although rare, fin whales may occur during Project activities.

Humpback Whale. The humpback whale Central America DPS is listed as Federally endangered and the Mexico DPS is listed as a Federally threatened population, due to intensive historical commercial whaling. In 2016 NOAA Fisheries revised the ESA listing for the humpback whale to identify 14 DPS, and listed 1 as threatened, 4 as endangered, and identify 9 others as not warranted for listing. Humpback whales are distributed worldwide and travel great distance during their seasonal migration, the farthest migration of any animal (NMFS, 2016d). Humpback whales spend the winter and spring months offshore of Central America and Mexico for breeding and calving, and then migrate to their summer and fall range between California and southern British Columbia to feed (Allen et al., 2011). Although humpback whales typically travel over deep, oceanic waters during migration, their feeding and breeding habitats are in shallow, coastal waters over continental shelves. Cold and productive coastal waters characterize feeding grounds (NMFS, 2017a). In the North Pacific, the California/Oregon/Washington stock winters in coastal Central America and Mexico, and migrates to areas ranging from the coast of California to southern British Columbia in summer/fall (NMFS, 2017a). The most recent population estimates of humpback whales indicate that at least 1,876 individuals occur off California, Oregon, and Washington (NMFS, 2017a). This population appears to be increasing (NMFS, 2017a). Some whales may linger off California in any month but are most present during April through October (Allen et al., 2011). This species may occur during Project activities.

Minke Whale. Minke whales are a coastal species that are widely distributed on the continental shelf throughout the eastern North Pacific (Allen et al., 2011) and occur year-round off the coast of California. Southern California waters appear to be relatively central to the North Pacific distribution of minke whales (Bonnell and Dailey, 1993). Minke whales are most abundant along the Santa Rosa-Cortes Ridge near San Miguel and Santa Rosa islands and in waters between Santa Catalina Island and Forty-Mile Bank southeast of San Clemente Island. From May through July, minke whales are seen most frequently in the region of Lasuen Knoll, east of Santa Catalina Island in the San Pedro Channel. The most recent estimates of minke whales indicate that at least 202 individuals are known to occur off California, Oregon, and Washington and no long-term trend for the population has been identified at this time (NMFS, 2017a). This species may occur during Project activities.

Odontoceti. Odontocetes, which are commonly found in the southern California waters include: the sperm whale, several species of dolphins, porpoises, and small whales, and at least six species of beaked whale. With the exception of killer whales, which are the top predators in the ocean and feed on a wide variety of fishes, squid, pinnipeds, and cetaceans, odontocetes generally feed on schooling fishes and squid (Bonnell and Dailey, 1993). Major fish prey species include anchovy, mackerel, lanternfish, smelt, herring, and rockfishes. Octopus and crustaceans are also eaten on occasion.

Common Dolphins. Common dolphins are found worldwide and are the most abundant cetaceans in California waters (Allen et al, 2011). Common dolphins account for 57 to 84 percent of the total seasonal cetacean population in the SCB (Dohl et al., 1981). Two species of common dolphin are found in southern California waters. The long-beaked common dolphin (*Delphinus capensis*) is commonly found within about 55 miles (88.5 kilometers) from the coastline. Its relative abundance changes both seasonally and inter-annually, with the highest densities observed during warm water events (Heyning and Perrin, 1994). A recent population estimate for this species is about 76,224 (a). The more numerous short-beaked common dolphin (*D. delphis*) ranges from the coast to 340 miles (547.2 kilometers) offshore. The most recent estimates indicate the California-Washington population of this species to be 343,990 individuals making it the most abundant cetacean off California (NMFS, 2017a). California common dolphins are very gregarious and are frequently encountered in herds of 1,000 or more. Because populations tend to vary with water temperature, no long-term population trends have been determined at this time (NMFS, 2017a). This species is commonly observed within the Project and area and may occur during Project activities.

Bottlenose Dolphin. The bottlenose dolphin (*Tursiops truncatus*) is probably more widely distributed than any other species of small cetacean in the eastern North Pacific (Leatherwood et al., 1982). This species occurring off the coast of California has been tentatively separated into a coastal form and offshore form.

The coastal bottlenose dolphin is generally found within 0.6 miles (1 kilometers) of shore and often enters the surf zone, bays, inlets and river mouths (Leatherwood et al., 1987). The coastal population appears to form small resident groups that range along the coastline, especially off Orange and San Diego counties (Weller and Defran, 1989). The California coastal population is estimated at 290 and appears to form small resident groups that range along the coastline (NMFS, 2017a).

Offshore bottlenose dolphins are believed to have a more-or-less continuous distribution off the coast of California (Allen et al., 2011). In the SCB, this population appears to be centered around Santa Catalina Island, with possible dispersion in the winter (Dohl et al., 1981). The current minimal population of bottlenose dolphins is estimate at a minimum population size of 684 individuals off California, Oregon, and Washington (NMFS, 2017a). No long-term population trends have been determined at this time (NMFS, 2017a). This species may occur during Project activities.

Dall's Porpoise. Dall's porpoises (*Phocoenoides dalli*) are one of the most abundant small cetacean species in the North Pacific. Dall's porpoise are found in shelf, slope, and offshore waters throughout their range (Koski et al., 1998). Dall's porpoise are common off southern California in the winter and probably range south into Mexican waters during cold water periods (Allen et al., 2011). The most recent population estimates indicate that at least 32,106 individuals are known to occur off California, Oregon, and Washington (NMFS, 2017a). The population trend for this species has not yet been determined (NMFS, 2017a). This species may occur during Project activities.

Pacific Coast White-Sided Dolphin. Pacific coast white-sided dolphins (*Lagenorhynchus obliquidens*) primarily range along the coasts of California, Oregon, and Washington. This species frequents deep water foraging areas, but may move into nearshore areas. According to NMFS (NMFS, 2017a), sighting patterns from recent aerial and shipboard surveys conducted in California, Oregon and Washington suggest seasonal north-south movements, with animals found primarily off California during the colder water months and shifting northward into Oregon and Washington as water temperatures increase in late spring and summer. Pacific coast white-sided dolphin populations are not showing any long-term trend in terms of abundance, but have a current minimum population size of 21,406 off California, Oregon, and Washington (NMFS, 2017a). This species may occur during Project activities.

Risso's Dolphin. Risso's dolphins (*Grampus griseus*) are present off central and southern California year-round (Allen et al., 2011). Risso's dolphins are found off California during the colder water months and are extending their range northward as water temperatures increase (Leatherwood et al, 1982). Through the summer and autumn months, Risso's dolphins in the SCB are distributed inshore of the Santa Rosa-Cortes Ridge. Through winter and spring, the population shifts offshore except in the vicinity of the northern chain of Channel Islands. The most recent population estimates of Risso's dolphin indicate that at least 4,913 individuals are known to occur off California, Oregon, and Washington (NMFS, 2017a). No long-term population trends have been determined at this time. This species may occur during Project activities.

Northern Right Whale Dolphin. The northern right whale dolphins (*Lissodelphis borealis*) are endemic to temperate waters of the North Pacific, where they range from the Mexican border to British Columbia (Allen et al., 2011). They are primarily found over the shelf and slope in U.S. coastal waters, and are known to make seasonal north-south movements (Forney et al., 2000). Off the coast of California, they are rarely sighted south of Point Conception in the summer. In winter, they are primarily distributed from central California south (Bonnell and Dailey, 1993; Koski et al., 1998). The most recent population estimates indicate that at least 6,019 individuals are known to occur off California, Oregon, and Washington (NMFS, 2017a). No long-term population trends have been determined at this time (NMFS, 2017a). Although unlikely due to being at the southern extent of their range, northern right whale dolphins have the potential to occur within the Project area.

Sperm Whale. The sperm whale (*Physeter macrocephalus*) is considered a Federally endangered species, due to historically intensive commercial whaling. The sperm whale is the largest of the toothed whales and is found predominately in temperate to tropical waters in both hemispheres (Allen et al., 2011). Off California, sperm whales are present in offshore waters year-round, with peak abundance from April to mid-June and again from late August through November. Sperm whales are primarily pelagic species and are generally found in waters with depths of greater than 3,280 feet (1,000 meters), although their distribution does suggest a preference for continental shelf margins and seamounts, areas of upwelling and high productivity (Allen et al., 2011). The majority of sightings by Dohl et al. (1983) in their three-year study off central and northern California were in waters deeper than 5,900 feet (1,800 meters), but near the continental shelf edge. The most recent estimates indicate that at least 1,332 individuals are known to occur off California, Oregon, and Washington (NMFS, 2017a). No long-term population trends have been determined at this time (NMFS, 2017a). Although unlikely due to water depth preferences, sperm whales have the potential to occur within the Project area.

Killer Whale. The killer whale (*Orcinus orca*) occurring off the coast of California has been tentatively separated into a transient form, offshore form, and resident form. The transient form is the most frequently sighted type of killer whale off California, and have been observed from southern California to Alaska. This form feeds on marine mammals, travels in small groups often over long ranges, and are usually vocally quiet (NCCOS, 2007). The species occurs year-round in the Project area and killer whales are most frequently sighted from January-May and from September through November. The most recent population estimate for the West Coast Transient stock of killer whales is 243 animals (NMFS, 2017a). The most recent population estimate for the Eastern North Pacific Southern Offshore stock of killer whales is 162 animals (NMFS, 2017a). The Eastern North Pacific Southern Resident stock southern boundary is Monterey Bay, California and does not occur in the Project region.

Short-Finned Pilot Whale. The short-finned pilot whale (*Globicephala macrorhynchus*) is a relatively more southern or warm water species. Pilot whales were common off southern California until the early 1980s (Dohl et al., 1983), but disappeared from area waters following the 1982-83 El Nino (Bonnell and Dailey, 1993; Forney et al., 2000). Recently, pilot whales have begun reappearing in California waters, possibly in response to long-term changes in oceanographic conditions, but sightings are still rare (Forney et al., 2000). The most recent estimates indicate that at least 465 individuals are known to occur off California, Oregon, and Washington (NMFS, 2017a). No long-term population trends have been determined, at this time. Although unlikely, short-finned pilot whales have the potential to occur within the Project area.

3.3.6.2 Pinnipeds (Seals and Sea Lions)

Six of the 36 species of pinnipeds known worldwide occur off the southern California coast. Four are eared seals (family *Otariidae*) and two are earless seals (family *Phocidae*). The species most likely to be encountered within the vicinity of the Project site include the California sea lion (*Zalophus californianus*), northern fur seal (*Callorhinus uranius*), northern elephant seal (*Mirounga angustirostis*), Guadalupe fur seal (*Arctocephalus townsendi*), and Pacific harbor seal (*Phoca vitulina richardsi*).

California Sea Lion. The California sea lion is the most abundant pinniped in the SCB, representing 50 to 93 percent of all pinnipeds on land and about 95 percent of all sightings at sea (Bonnell and Ford, 1987). This species ranges from Baja California to British Columbia. In the SCB, California sea lions currently breed on four islands: San Miguel, San Nicolas, Santa Barbara and San Clemente. During the winter, the distribution in the SCB shifts eastward to the waters around Santa Catalina and San Clemente islands and southward to Tanner and Cortes banks (Bonnell and Dailey, 1993). The most recent population estimates for the California sea lion stock indicate that at least 153,337 individuals occur in California (NMFS, 2017a). This number been increasing since 2003; however, the pup weight indices were significantly lower in 2012 at rookeries on San Miguel Island and large numbers of emaciated pups stranded in early 2013, leading to NOAA declaration of an unusual mortality event (UME). Although exact causes of the UME are unknown at this time, two hypothesis which merit further study include nutritional stress of pups resulting from a lack of forage fish available to lactating females and unknown disease agents during that time period. (NMFS, 2017a). California sea lions generally fish in open waters along the Pacific coast, but are increasingly being found on man-made structures such as jetties, piers, offshore buoys and oil platforms (Saundry, 2010) including the Beta Unit Platforms. This species will be present during Project activities.

Northern Fur Seal. The northern fur seal is the most abundant otarid in the Northern Hemisphere. Most of the population is associated with rookery islands in the Bering Sea and the Sea of Okhotsk although a small population of northern fur seals has existed on San Miguel Island since the late 1950s or early 1960s (NMFS, 2003). A small percentage of the fur seal population from the Bering Sea arrive offshore California in late November (Bonnell and Dailey, 1993). Most of these animals are gone by early June (Bonnell and Dailey, 1993; Koski et al., 1998). Generally, individuals have been observed over the Santa Rosa-Cortes Ridge, the San Nicolas Basin, and the Tanner and Cortes banks (Bonnell and Dailey, 1993). The most recent population estimates for the San Miguel Island stock indicate that at least 6,858 individuals are known to occur (NMFS, 2017a). This species is unlikely to occur within the Project area due to being at southern boundary of range.

Guadalupe Fur Seal. The Guadalupe fur seal is considered a Federally threatened species, due to the near extinction by commercial sealing in the 19th century. Historically, the Guadalupe fur seal apparently ranged northward from Islas Revillagigedo off the coast of Mexico to at least Point Conception (Repenning et al., 1971; Fleischer, 1987; Walker and Craig, 1979). Presently, the species breeds only on Isla de Guadalupe off the coast of Baja California, Mexico, although individual animals appear regularly in the Channel Islands (Stewart et al., 1987; Bonnell and Dailey, 1993), and a single pup was born on San Miguel Island in 1997 (DeLong and Melin, 2000). Recent population estimates for the Guadalupe fur seal in Mexico is 3,028 individuals, with “a few” observed on the Channel Islands (NOAA, 2017a). This species is unlikely to occur within the Project area.

Northern Elephant Seal. Northern elephant seals breed along the coast from Baja California north to Point Reyes, California. San Miguel and San Nicolas Islands are the major California rookeries (85 percent of 1990 production); a few are also born on Santa Rosa, Santa Barbara, and San Clemente Islands (Bonnell and Dailey, 1993). Northern elephant seals typically haul out on land only to breed and molt and then disperse widely at sea. The most recent population estimates for the California breeding stock of Northern elephant seals indicated that at least 81,368 individuals are known to occur in California (NMFS, 2017a). This species is unlikely to occur within the Project area.

Pacific Harbor Seal. Pacific harbor seals range from Mexico to the Aleutian Islands, with the North Pacific population centered in Alaska. In the SCB, 71 percent of all harbor seals seen at sea have been within six miles (9.6 kilometers) of land; with the greatest number of sightings during autumn months, following the breeding and molting seasons (Bonnell et al., 1981). Unlike most pinnipeds occurring off southern California, Pacific harbor seal maintain haul-out sites on the mainland on which they pup and breed. The most recent minimum population estimates of the California stock indicate that at least 27,348 individuals are known to occur (NMFS, 2017a). Due to the distance from shore and absences of nearby haul-outs/rookery, harbor seals are not expected to occur within the Project area.

3.3.6.3 Fissipeds (Otters)

Southern Sea Otter. Historically the range of sea otters (*Enhydra lutris nereis*) extended from the northern islands of the Japanese Archipelago northeast along Alaska and southward along North America to Baja California (Dailey et al., 1993). The sea otter was nearly extirpated by the fur trade during the 18th and 19th centuries. The current range extends from about Pigeon Point in the north to Santa Barbara in the south. A small, satellite population of an estimated 78 animals also occurs at San Nicolas Island, the result of a translocation effort in the late 1980s (Tinker and Hartfield, 2016). This species prefers rocky shoreline with water depth of less than 200 feet (60 meters), which support kelp beds where they feed on benthic macroinvertebrates including clams, crabs, abalone, sea urchins, and sea stars (Allen et al., 2011). Recent minimum population estimates for southern sea otters in California indicate that at least 3,272 individuals are known to occur and no long-term trends in this population are available (Tinker and Hartfield, 2016). This species is unlikely to occur within the Project area, due to the Project being outside of its current range.

3.3.6.4 Pinniped Haul-Outs and Rookeries

The proposed Project activities will not occur near any NOAA documented pinniped haul-out and/or rookeries (Figure 3.3-2). The closest documented haul-out/rookery is located approximately 17.9 miles (28.8 kilometers) southwest of the Project site. However, pinnipeds are known to regularly haul-out onto the Project Platform’s support structures.

3.3.7 Special Status and Protected Species

A summary of the special status animal species that could occur within the Project site and their likelihood of occurrence are included in Table 3.3-9.

3.3.8 Regulatory Setting

The following lists and summarizes the regulations that are applicable to the assessment of potential impacts to the biological resources and/or habitats within the Project area.

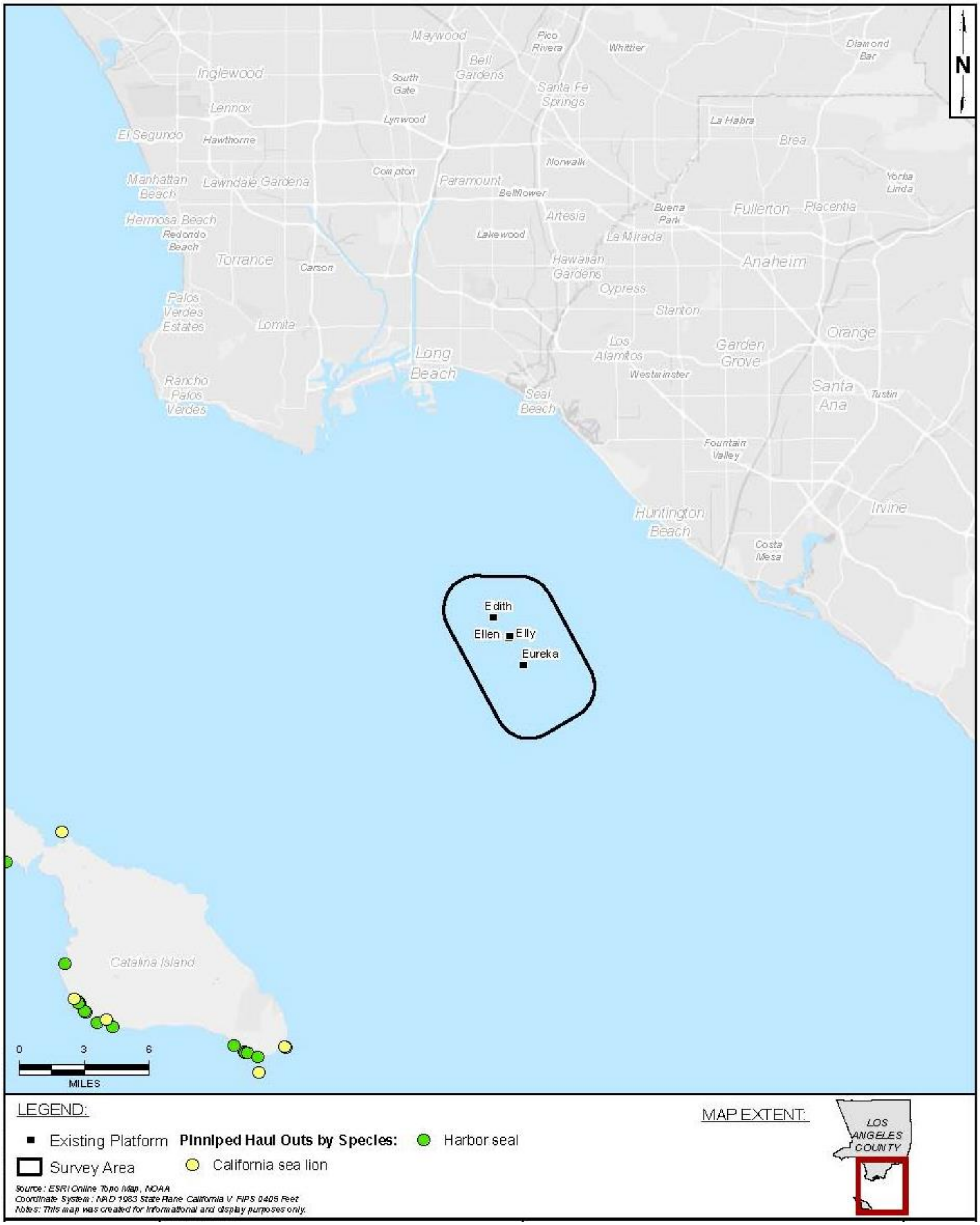

Figure 3.3-2. Pinniped Haul-Outs and Rookeries

Table 3.3-9. Special Status and Protected Species Within or Near the Project Area and Their Likelihood of Occurrence within the Project Area

Common Name	Scientific Name	Status[1]	Likelihood to occur
INVERTEBRATES			
White abalone	*Haliotis sorenseni*	FE	Possible
Black abalone	*Haliotis cracherodii*	FE	Unlikely to Occur
FISH			
Cowcod	*Sebastes levis*	NSC	Possible
Bocaccio	*Sebastes paucispinis*	NSC	Possible
Steelhead (southern CA ESU)	*Oncorhynchus mykiss*	FE	Possible
TURTLES			
Olive Ridley turtle	*Lepidochelys olivacea*	FT	Possible
Green turtle	*Chelonia mydas*	FT	Possible
Loggerhead turtle	*Caretta caretta*	FT	Possible
Leatherback turtle	*Dermochelys coriacea*	FE	Possible
BIRDS			
Xantus's murrelet	*Synthliboramphus hypoleucus*	M, SE, FC	Possible
California brown pelican	*Pelicanus occidentalis*	M, FDL, CP	Possible
Ashy storm-petrel	*Oceanodroma homochroa*	M, CSC	Possible
Black storm-petrel	*Oceanodroma melania*	M, CSC	Possible
Fork-tailed storm petrel	*Oceanodroma furcata*	M, CSC	Possible
California least tern	*Sternula antillarum*	M, FP, FE, SE	Unlikely to Occur
Marbled murrelet	*Brachyramphus marmoratus*	M, FT, SE	Unlikely to Occur
Pink-footed shearwater	*Puffinus creatopus*	M, BCC	Possible
Black-vented shearwater	*Puffinus opisthomelas*	M, BCC	Possible
Tufted puffin	*Fratercula cirrhata*	M, CSC	Unlikely to Occur
Cassin's auklet	*Ptychoramphus aleuticus*	M, CSC, TW	Possible
Short-tailed albatross	*Phoebastria albatrus*	M, FE	Unlikely to Occur
Black-footed albatross	*Phoebastria nigripes*	M, BCC	Possible
Double-crested cormorant	*Phalacrocorax auratus*	M, TW	Possible
Elegant tern	*Stema elegans*	M, TW	Possible
California gull	*Larus californicus*	M, TW	Possible
Rhinoceros auklet	*Cerorhinca monocerata*	M, TW	Possible
MAMMALS			
Cetaceans			
California gray whale	*Eshchrichtius robustus*	FP	Possible
Blue whale	*Balaenoptera musculus*	FE	Possible

Common Name	Scientific Name	Status[1]	Likelihood to occur
Fin whale	*Balaenoptera physalus*	FE	Possible
Humpback whale	*Megaptera novaeangliae*	FE	Possible
Minke whale	*Balaenoptera acutorostrata*	FP	Possible
Northern right whale	*Eubalaena glacialis*	FE	Unlikely to Occur
Sperm whale	*Physeter macrocephalus*	FE	Unlikely to Occur
Short-finned pilot whale	*Globicephala macrorhynchus*	FP	Possible
Common dolphin	*Delphinus* spp	FP	Possible
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	FP	Unlikely to Occur
Risso's dolphin	*Grampus griseus*	FP	Possible
Dall's porpoise	*Phocoenoides dalli*	FP	Possible
Bottlenose dolphin	*Tursiops truncatus*	FP	Possible
Pinnipeds			
Pacific harbor seal	*Phoca vitulina*	FP	Possible
Northern fur seal	*Callorhinus ursinus*	FP	Possible
Guadalupe fur seal	*Arctocephalus townsendi*	FT, ST	Possible
Northern elephant seal	*Mirounga angustirostris*	FP	Unlikely to Occur
California sea lion	*Zalophus californicus*	FP	Possible
Stellar sea lion	*Eumetopias jubatus*	FE	Unlikely to Occur
Fissipeds			
Southern sea otter	*Enhydra lutris nereis*	FT	Unlikely to Occur

Status[1]

M = Protected under the Federal Migratory Bird Treaty Act (MBTA)
FE = Federally Endangered SE = California State Endangered FC= Federal Candidate for Listing
FT = Federally Threatened ST = California State Threatened BCC = USFWS Bird of Conservation Concern
FDL = Federally Delisted CSC = California Species of Special Concern NSC = NOAA Species of Concern
FP = Federally Protected CP = California Fully Protected Species TW = California designated taxa to watch

3.3.8.1 The Federal Endangered Species Act

The Federal Endangered Species Act (FESA) of 1973 (Section 9 and implementing regulations 50 CFR Part 17) protects Federally listed (endangered and/or threatened) marine wildlife species found within the U.S. Exclusive Economic Zone (200 miles [321.8 kilometers] limit) including those found off the coast of California. The FESA makes it unlawful to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect an endangered species, or to attempt to engage in any such conduct. Violations of the FESA and regulations are subject to a fine and imprisonment. An "endangered species" is defined by the Secretaries of the Department of the Interior and/or the Department of Commerce as any species that is in danger of extinction throughout all or a portion of its range. A "threatened species" is defined as any species, likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The USFWS and NMFS are responsible for implementation of the Federal FESA.

3.3.8.2 The Marine Mammal Protection Act

In addition to the FESA, NOAA Fisheries is also responsible for enforcing the MMPA of 1972, which protects all marine mammals within U.S. waters. Specifically, the MMPA prohibits the intentional killing or harassment of these marine mammals; however, incidental harassment, with authorization from the appropriate Federal agency, may be approved.

3.3.8.3 The Migratory Bird Treaty Act

The USFWS also administers the Federal Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711). The focus of the MBTA was the “establishment of a prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention for the protection of migratory birds, or any part, nest or egg of any such bird.” (16 USC 703). Implementing regulations at 50 CFR 10 list the migratory birds covered under the MBTA and the MBTA prevents the removal or harassment of active nests of migratory bird species that may result in the loss of eggs or nestlings. See Table 3.3-5 for active breeding areas in Southern California.

3.3.8.4 Magnuson-Stevens Fishery Conservation and Management Act

The MSA requires “the identification of EFH for Federally managed species and the implementation of measures to conserve and enhance this habitat.” Any project requiring Federal authorization, such as a USACE permit, is required to complete and submit an EFH Assessment with the application and either show that no significant impacts to the essential habitat of managed species are expected or identify mitigations to reduce those impacts.

3.3.8.5 Coastal Zone Management Act

Coastal states with an approved Coastal Zone Management Plan, which defines permissible land and water use within the state’s coastal zone, can review Federal actions, licenses, or permits for “Federal consistency.” California’s coastal zone management program, created in response to the Coastal Zone Management Act, is the California Coastal Act. Federal consistency is the requirement that those Federal permits and licenses likely to affect any land/water use or natural resources of the coastal zone be consistent with the state program’s enforceable policies.

3.3.8.6 Executive Order 13112 Invasive Species

Federal agencies must use authorities to prevent introduction of invasive species, respond to and control invasions in a cost-effective and environmentally sound manner, and provide for restoration of native species and habitat conditions in ecosystems that have been invaded.

3.3.8.7 Ballast Water Management Act

This statute requires all ships to: (1) prepare Ship Invasive Species Management Plans outlining procedures to prevent introductions of invasive organisms; (2) report ballast operations, treatment and management practices; and (3) carry out Best Management Practices to reduce the movement of species by ships.

3.3.8.8 California Endangered Species Act (CESA)

Section 2080 of the Fish and Game Code prohibits "take" of any species that the commission determines to be an endangered species or a threatened species. Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." CESA allows for take incidental to otherwise lawful development projects. CESA emphasizes early consultation to avoid potential impacts to rare, endangered, and threatened species and to develop appropriate mitigation planning to offset project caused losses of listed species populations and their essential habitats.

In some instances, State laws and regulations do not allow for the take of native species. Four sections of the Fish and Game Code list 37 fully protected species (Fish and Game Code Sections 3511, 4700, 5050, and 5515). Each of these statutes: (1) prohibits take or possession "at any time" of the species listed in the statute, with few exceptions, (2) states that "no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to "take" the species, and (3) states that no previously issued permits or licenses for take of the species "shall have any force or effect" for authorizing take or possession.

3.3.8.9 California Aquatic Invasive Species Management Plan

Provides a framework for agency coordination and identifies actions to minimize the harmful effects of aquatic invasive species in California.

3.3.8.10 Marine Life Protection Act

The Marine Life Protection Act (MLPA) was passed in 1999 and is part of the California Fish and Wildlife Code. This Act aims to protect California's marine natural heritage through establishing a statewide network of marine protected areas (MPAs) designed, created, and managed using sound science and stakeholder input. MPAs are developed on a regional basis with MLPA and MPA-specific goals in mind and are evaluated over time to assess their effectiveness in meeting these goals. The overall goals of the MLPA are to maintain the diversity of marine ecosystems, conserve its populations, better educate people on human-marine life interactions, protect habitats, and effectively enforce MPA. Executive Order 13158 defines an MPA as: "...any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.

3.3.9 Impact Assessment

Potential impacts due to Project activities includes noise impacts from 24/7 operations, damage to seafloor habitats from placement of nodes, impacts from increased lighting to marine wildlife, accidental collisions with marine wildlife, and degradation of water quality or seafloor habitats from the discharge of petroleum in the event of an accidental spill. Potential impacts are described below.

3.3.9.1 Noise Impacts of Geophysical Survey on Marine Wildlife

Acoustic Effects on Invertebrates. The white abalone is the only listed marine invertebrate with the potential to occur in the survey area. No specific data were found concerning the effect of acoustic noise on white abalone. The only data found generally involved crustaceans and cephalopods, but not mollusks.

Pathological Effects. Controlled seismic sound experiments have been conducted on adult crustaceans and adult cephalopods (Christian et al., 2003, 2004; DFO, 2004; McCauley et al., 2000a, b). No significant pathological impacts were found. It has been suggested that exposure to seismic survey activities had injured giant squid (Guerra et al., 2004), but there is no evidence to support such claims.

Physiological Effects. Primary and secondary stress responses in crustaceans, as measured by changes in hemolymph levels of enzymes, proteins, etc., were noted several days and months after exposure to acoustic sounds (L-DEO, 2011).

Behavioral Effects. In a study by McCauley et al., 2000a,b, in L-DEO, 2011), squid exhibited a startle response during exposure to acoustic sounds. No behavioral impacts were exhibited by crustaceans (Christian et al., 2003, 2004; DFO, 2004, in L-DEO, 2011). Adriguetto-Filho et al. (2005, in L-DEO, 2011) noted anecdotal reports of reduced catch rates of shrimp after exposure to acoustic surveys; however, other studies have not reported significant changes in catch rates. Parry and Gason (2006, in L-DEO, 2011) did not find evidence of a reduced catch rate for lobsters exposed to acoustic surveys.

Acoustic Effects on Fish. Seismic surveys using underwater geophones and high-energy geophysical systems can disturb and displace fishes and interrupt feeding, but displacement may vary among species. Pelagic or nomadic fishes leave seismic survey areas, and displace up to 33 kilometers (20.5 miles) from the survey center (Engås et al., 1996; Lokkeborg and Soldal, 1993, in MMS, 2005). Lamont-Doherty Earth Observatory [L-DEO] (2011) noted that the potential effects of seismic surveys on fish include: (1) pathological; (2) physiological; and (3) behavioral.

Pathological. The potential for pathological damage to hearing structures in fish depends on the energy level of the received sound and the physiology and hearing capabilities of the species in question (L-DEO, 2011). McCauley et al., 2003, (in MMS, 2005) noted that the

Australasian snapper (*Pagrus auratus*) exposed to operating high-energy geophysical systems may sustain extensive damage to their auditory hair cell, which would likely adversely affect hearing. Two months after exposure, the damage had not been repaired. Further, fishes with impaired hearing may have a temporary reduction in fitness resulting in increased vulnerability to predation, less success in locating prey and sensing their acoustic environmental, and, in the case of vocal fishes, reduction in ability to communicate. Some fishes displayed aberrant and disoriented swimming behavior, suggesting vestibular impacts. There was also evidence that seismic survey acoustic-energy sources could damage eggs and fry of some fishes, but the effect was limited to within one to two meters (3.2 to 6.4 feet) of the array.

Popper et al. (2005, in MMS, 2005) investigated the effects of a 730 cubic inches source array on the hearing of northern pike, broad whitefish, and lake chub in the Mackenzie River Delta. Threshold shifts were found for exposed fish at exposure of sound levels of 177 dB re 1µPa2.s, as compared to controls in the northern pike and lake chub, with recovery within 24 hours. There was no threshold shift in the broad whitefish.

An experiment of the effects of a single, 700 cubic inches source was conducted in Lake Mead, Nevada (USGS, 1999). The data were used in an environmental assessment of the effects of a marine reflection survey of the Lake Mead fault system by the National Park Service (Paulson et al., 1993, in USGS, 1999). The sound source was suspended 3.5 meter (11.4 feet) above a school of threadfin shad in Lake Mead and was fired three successive times at a 30-second interval. Neither surface inspection nor diver observations of the water column and bottom found any dead fish.

For a proposed seismic survey in Southern California, USGS (1999) conducted a review of the literature on the effects of high-energy geophysical systems on fish and fisheries. They reported a 1991 study of the Bay Area Fault system from the continental shelf to the Sacramento River using a 10-source system, 5,828 cubic inches source array. Brezina and Associates were hired to monitor the effects of the surveys, and concluded that geophysical operations were not responsible for the death of any of the fish carcasses observed, and the geophysical profiling did not appear to alter the feeding behavior of sea lions, seals, or pelicans observed feeding during the surveys.

Fish eggs and larvae are distributed throughout the water column and are more sensitive to sound waves than adults. Some studies have reported, some equivocally, that mortality of fish, fish eggs, or larvae can occur at close range to seismic sources (Kostyuchenko, 1973; Dalen and Knutsen, 1986; Boorman et al., 1996; Dalen et al., 1996, in L-DEO, 2011). Some of the reports claimed seismic effects from treatments quite different from actual seismic survey sounds or even reasonable surrogates. However, Payne et al. (2009, in L-DEO, 2011) reported no statistical differences in mortality/morbidity between control and exposed groups of capelin eggs or monkfish larvae. Saetre and Ona (1996, in L-DEO, 2011) applied a “worst-case scenario” mathematical model to investigate the effects of seismic energy on fish eggs and larvae. They concluded that mortality rates caused by exposure to seismic surveys are so low, as compared against natural mortality rates, that the impact of seismic surveying on recruitment to a fish stock must be regarded as insignificant.

Physiological. Physiological effects refer to cellular and/or biochemical responses of fish to acoustic stress. Such stress potentially could affect fish populations by increasing mortality or reducing reproductive success. Primary and secondary stress responses of fish after exposure to seismic survey sound appear to be temporary in all studies done to date (Sverdrup et al., 1994; Santulli et al., 1999; McCauley et al., 2000a, b, in L-DEO, 2011). The periods necessary for the biochemical changes to return to normal are variable and depend on numerous aspects of the biology of the species and the sound stimulus.

Behavioral Effects. Behavioral effects include changes in the distribution, migration, and mating of exposed fish. Studies investigating the possible effects of sound (including seismic survey sound) on fish behavior have been conducted on both uncaged and caged individuals (Chapman and Hawkins, 1969; Pearson et al., 1992; Santulli et al., 1999; Wardle et al., 2001; Hassel et al., 2003, in L-DEO, 2011). Typically, fish exhibited a sharp startle response at the onset of a sound followed by habituation and a return to normal behavior after the sound ceased.

MMS (2005) assessed the effects of a proposed seismic survey in Cook Inlet. The seismic survey proposed using three vessels, each towing two, four-source arrays ranging from 1,500 to 2,500 cubic inches. MMS (2005) noted that the impact to fish populations in the survey area and adjacent waters would likely to very low and temporary. Seismic surveys may displace the pelagic fishes from the area temporarily when active sources are in use. However, fishes displaced and avoiding the sound are likely to backfill the survey area in minutes to hours after cessation of seismic testing. Fishes not dispersing from the sound (e.g., demersal species) may startle and move short distances to avoid source emissions.

The effects of sound on the habitat is expected to be less than significant and is expected to affect only those organisms that are in close proximity of the sound source. Studies have shown that the most common effects of seismic surveys on fish have been behavioral modifications. Results of seismic survey trials in Estero Bay, California, found that sound levels caused changes in rockfish swimming behaviors. There were significant differences in vertical distributions, and startle responses were also observed (Pearson, et al. 1992). Fish returned to pre-exposure behavior after only a few minutes which suggest that the effects on fish would be temporary. Boeger et al. (2006) observed coral reef fishes in field cages before, during, and after exposure to an eight-active source seismic array. There was no result of mortality or external damage to fishes throughout the study. The results did show that most source discharges caused a startle response in the fish, although these behavioral changes lessened with repeated exposure, suggesting habituation.

Wardle et al. (2001) used video and telemetry to observe behavioral responses of marine fishes. The source discharges also caused a startle response in the fish, but Wardle noted that there was no affect to their diurnal migrations or their distribution around the reef. There were also indications of responses to visual stimuli; if the seismic source was visible to the fish they would swim away from it. However, if the source was out of the fish's line of sight, they would continue to swim towards the sound source.

Acoustic Effects on Marine Birds. There are no underwater acoustic guidelines for diving birds and diving birds are especially vulnerable approaching a sound source not only because birds have higher thresholds of hearing (i.e., less sensitive hearing) than humans, but also because the sound-reflecting nature of the air-sea interface tends to trap waterborne sounds beneath the sea surface. Birds are likely to detect lower-level sound source energy only shortly before encountering the water when surveys are in progress, and there likely would be few or no indicators of underwater noise until a bird lands upon or dives into the water. Birds on the water or diving in the area have the potential to be exposed to the maximum sound energy.

The duration of underwater sound exposure for diving birds is expected to be short (~0.1 seconds); therefore, temporary threshold shift (TTS), which is a short-term hearing impairment, and permanent threshold shift (PTS), resulting from survey activities are unlikely. Impacts to birds above water would likely be limited to startle responses and avoidance of the area during survey activities. Further, the Project does not occur near shore or nesting habitat, so breeding and nesting activities would not be impacted.

Acoustic Effects on Sea Turtles. There have been few studies on the effects of geophysical survey noise on sea turtles, and little is known about the sound levels that result in behavioral changes or reactions. There have been some directed studies that focused on short-term behavioral responses of sea turtles in enclosures to a single high-energy source. However, comparisons of the results of these studies are difficult because experimental designs and reporting procedures varied and few studies provided specific information on the sound levels received by the turtles. Although monitoring studies are now providing some information on responses of free-ranging sea turtles to seismic surveys, we are not aware of any directed studies on responses of free-ranging sea turtles to seismic sounds, or on the long-term effects of seismic, or other sounds on sea turtles. Adults of only two species (loggerhead and green sea turtles) and 1 juvenile have undergone auditory studies. Auditory testing and behavioral studies show that turtles can detect low-frequency sounds such as those produced by geophysical surveys (LGL, 2012).

Current NMFS noise exposure standards are that marine turtles should not be exposed to pulsed underwater noise at received levels exceeding 190 dB re 1 μPa (rms) (Fahy, personnel communication).

<u>Behavioral Disturbance</u>. In captive enclosures, sea turtles generally respond to seismic noise by startling, increasing swimming speed, and/or swimming away from the noise source. Animals resting on the bottom often become active and move toward the surface where received sound levels normally will be reduced, although some turtles dive following exposure. Quantitative data for free-ranging sea turtles exposed to seismic pulses are very limited, and potential long-term behavioral effects of seismic exposure have not been investigated. The lack of data precludes clear predictions of sea turtle responses to seismic noise. Available data suggests that localized behavioral and distributional effects on sea turtles are likely during seismic operations, including responses to the seismic vessel, source arrays, and other gear (Pendoley, 1997; Weir, 2007; LGL, 2012). Pendoley (1997) summarized potential effects of seismic operations on the behavior and distribution of sea turtles, and identified biological periods and habitats considered most sensitive to potential disturbance. The possible responses of free-ranging sea turtles to seismic pulses could include:

- Avoiding the entire seismic survey area to the extent that turtles move to less preferred habitat;
- Avoiding only the immediate area around the active seismic vessel (i.e., local avoidance of the source vessel but remain in the general area); and
- Exhibiting no appreciable avoidance, although short-term behavioral reactions are likely.

Complete avoidance of an area, if it occurred, could exclude sea turtles from their preferred foraging area and could displace them to areas where foraging is sub-optimal. Avoidance of a preferred foraging area may prevent sea turtles from obtaining preferred prey. The potential alteration of a migration route might also have negative impacts. However, it is not known whether avoidance by sea turtles would ever be on a significant geographic scale, or be sufficiently prolonged, to prevent turtles from ultimately reaching the destination.

Available evidence suggests that the zone of avoidance around seismic sources is not likely to exceed a few kilometers (McCauley, et al. 2000a, b). Avoidance reactions on that scale could prevent sea turtles from using important coastal areas or bays if there was a prolonged seismic operation in the area, particularly in shallow waters (Pendoley, 1997). Sea turtles might be excluded from the area for the duration of the seismic operation, or they might remain but exhibit abnormal behavioral patterns (e.g., lingering longer than normal at the surface where received sound levels are lower). Whether those that were displaced would return quickly after the seismic operation ended is unknown.

It is unclear whether exclusion from a particular nesting beach by seismic operations, if it occurred, would prevent or decrease reproductive success. If a sea turtle is excluded from a particular beach, it may select a more distant, undisturbed nesting site in the general area (Miller, 1997). Bjorndal et al. (1983) reported a maximal intra-seasonal distance between nesting sites of 290 kilometers (56 miles), indicating that turtles use multiple nesting sites spaced up to a few hundred kilometers apart. Also, it is uncertain whether a turtle that failed to go ashore because of seismic survey activity would abandon the area for that full breeding cycle, or would simply delay going ashore until the vessel moved to a different area.

Shallow coastal waters can contain relatively high densities of sea turtles during nesting, hatching, and foraging periods. Thus, seismic operations in these areas could correspondingly impact a relatively higher number of turtles during sensitive biological periods. Samuel et al. (2005) noted that anthropogenic noise in vital sea turtle habitats, such as a major coastal foraging area off Long Island, New York, could affect sea turtle behavior and ecology. There are no specific data that demonstrate the consequences to sea turtles if seismic operations with large or small arrays occur in important areas at biologically important times of year (Pendoley, 1997).

Temporary Threshold Shift. Few studies have directly investigated hearing or noise-induced hearing loss in sea turtles. However, Moein et al. (1994) used an evoked potential method to test the hearing of loggerhead sea turtles exposed to a few hundred pulses from a single acoustic source. Turtles were tested for stress levels and hearing thresholds before and after the seismic trials. A temporary alteration of blood chemistry values after exposure to the sound source indicated that these turtles might have been affected by exposure to repeated acoustic stimuli. Values indicated both an increase in the stress level of the animal as well as damage to tissues. However, the magnitude of the changes did not indicate significant injury to the turtle's organs, and levels returned to normal in approximately two weeks. The results are consistent with the occurrence of TTS upon exposure of the turtles to source pulses. Unfortunately, the report did not state the size of the source used, or the received sound levels at various distances. Thus, the levels of source sounds that apparently elicited TTS are not known. However, it is noteworthy that there was evidence of TTS from exposure to pulses from a single source.

Lenhardt (2002), exposed loggerhead turtles in a large net enclosure to sound pulses. A TTS of greater than 15 dB was evident for one loggerhead turtle, with recovery occurring in two weeks. Turtles in the open sea might move away from an operating source at a fixed location, and in the more typical case of a towed source array, very few shots would occur at or around one location. Thus, exposure to underwater sound during net-enclosure experiments was not typical of that expected during an operational seismic survey.

Studies with terrestrial reptiles have demonstrated that exposure to airborne impulse noise can cause hearing loss. For example, desert tortoises (*Gopherus agassizii*) exhibited TTS after exposure to repeated high-intensity sonic booms (Bowles et al. 1999). Recovery from these temporary hearing losses was usually rapid (less than one hour), which suggested that tortoises can tolerate these exposures without permanent injury (Bowles et al., 1999).

The results from captive, restrained sea turtles exposed repeatedly to seismic sounds in enclosed areas indicate that TTS is possible under these artificial conditions, but may not accurately represent the effects of the proposed survey.

<u>Permanent Threshold Shift (PTS)</u>. There is no data to indicate whether there are any plausible field situations in which exposure to repeated sound pulses at close range could cause PTS or hearing impairment in sea turtles. Hearing impairment (whether temporary or permanent) from seismic sounds is considered unlikely to occur at sea because turtles are unlikely to be exposed to more than a few strong pulses close to the sound source, as individuals are mobile, and the vessel travels relatively quickly compared to the swimming speed of a sea turtle. If sea turtles exhibit little or no behavioral avoidance, or if they acclimate to seismic noise to the extent that avoidance reactions cease, sea turtles might sustain hearing loss if they are close enough to seismic sources.

<u>Non-auditory Effects</u>. Other potential direct non-auditory effects to sea turtles during seismic operations include entanglement with seismic gear (e.g., cables, buoys, streamers, etc.) and ship strikes (Pendoley, 1997; Ketos Ecology, 2007; Weir, 2007; Hazel et al., 2007). Entanglement of sea turtles with marine debris, fishing gear, and other equipment has been documented; turtles can become entangled in cables, lines, nets, or other objects suspended in the water column and can become injured or fatally wounded, drowned, or suffocated (Lutcavage et al., 1997). Seismic-survey personnel have reported that sea turtles) became fatally entrapped between gaps in tail-buoys associated with industrial seismic vessel gear deployed off West Africa in 2003 (Weir, 2007). However, no incidents of entanglement of sea turtles have been

documented during NSF-funded seismic surveys, which since 2003 have included dedicated ship-based monitoring by trained biological observers, and in some cases in areas with high population densities (Holst et al., 2005a,b; Holst and Smultea, 2008; Hauser et al., 2008).

Acoustic Effects on Marine Mammals.

Tolerance. Numerous studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response (Richardson et al., 1995; Southall et al., 2007). That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales and toothed whales, and (less frequently) pinnipeds, have been shown to react behaviorally to sound pulses under some conditions, at other times mammals of all three types have shown no overt reactions. The relative responsiveness of baleen and toothed whales are quite variable.

Masking. Masking is the obscuring of sounds of interest by interfering sounds, generally at similar frequencies (Richardson et al., 1995). Introduced underwater sound will, through masking, reduce the effective communication distance of a marine mammal species if the frequency of the source is close to that used as a signal by the marine mammal, and if the anthropogenic sound is present for a significant fraction of the time (Richardson et al., 1995). If little or no overlap occurs between the introduced sound and the frequencies used by the species, communication is not expected to be disrupted. If the introduced sound is present only infrequently, communication is not expected to be disrupted. The duty cycle of array is low, and the source sounds are pulsed, with relatively quiet periods between pulses. In most situations, strong source sounds will only be received for a brief period (less than one second), separated by at least several seconds of relative silence, and longer in the case of deep-penetration surveys or refraction surveys. A single array might cause appreciable masking when propagation conditions are such that sound from each sound pulse reverberates strongly and persists between sound pulses (Simard et al., 2005; Clark and Gagnon, 2006).

Although masking effects of pulsed sounds on marine mammal calls and other natural sounds are expected to be limited, there are few specific studies on this. Some whales continue calling in the presence of seismic pulses and calls have been heard between the seismic pulses (e.g., Richardson et al., 1986; McDonald et al., 1995; Greene et al., 1999a,b; Nieukirk et al., 2004; Smultea et al., 2004; Holst et al., 2005a,b, 2006; Dunn and Hernandez, 2009). However, there is one recent summary report indicating that calling fin whales distributed in one part of the North Atlantic Ocean went silent for an extended period starting soon after the onset of a seismic survey in the area (Clark and Gagnon, 2006). It was not clear whether the whales ceased calling because of masking, or whether this was a behavioral response not directly involving masking. Also, bowhead whales in the Beaufort Sea may decrease their call rates in response to seismic operations, although movement out of the area might also have contributed to the lower call detection rate (Richardson et al., 1986). In contrast, DiIorio and Clark (2009) found evidence of increased calling by blue whales during operations by a lower-energy seismic source (i.e., a sparker).

Among the odontocetes, there has been one report that sperm whales ceased calling when exposed to pulses from a very distant seismic ship (Bowles et al., 1994). However, more recent studies of sperm whales found that they continued calling in the presence of seismic pulses (Madsen et al., 2002; Tyack et al., 2003; Smultea et al., 2004; Holst et al., 2006; Jochens et al., 2008). Madsen et al., (2006) noted that seismic sounds would not be expected to mask sperm whale calls given the intermittent nature of sound pulses. Dolphins and porpoises are also commonly heard calling while seismic sources are operating (Gordon et al., 2004; Smultea et al., 2004; Holst et al., 2005a,b; Potter et al., 2007). Masking effects of seismic pulses are expected to be negligible in the case of the smaller odontocetes, given the intermittent nature of seismic pulses plus the fact that frequently used sounds are predominantly at much higher frequencies than are the dominant components of source sounds.

Pinnipeds and fissipeds have the most sensitive hearing and/or produce most of their sounds at frequencies higher than the dominant components of the high-energy sound, but there is some overlap in the frequencies of the sound pulses and the calls. However, the intermittent nature of source pulses presumably reduces the potential for masking.

Marine mammals are thought to be able to compensate for masking by adjusting their acoustic behavior through shifting call frequencies, increasing call volume, and increasing vocalization rates. For example, blue whales are found to increase call rates when exposed to seismic survey noise in the St. Lawrence Estuary (DiIorio and Clark, 2009). The North Atlantic right whales exposed to high shipping noise increased call frequency (Parks et al., 2007), while some humpback whales respond to low-frequency active sonar playbacks by increasing song length (Miller et al., 2000).

Disturbance Reactions. Marine mammals may behaviorally react to sound when exposed to anthropogenic noise. These behavioral reactions are often shown as: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (e.g., pinnipeds flushing into water from haul-outs or rookeries).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, and/or reproduction. Some of these significant behavioral modifications include:

- Drastic change in diving/surfacing patterns (such as those thought to be causing beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Habitat abandonment due to loss of desirable acoustic environment; and
- Cessation of feeding or social interaction.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Richardson et al., 1995; Southall et al., 2007).

Currently, NMFS uses 160 dB re 1 µPa at received level for impulse noises (such as high-energy sound pulses) as the onset of behavioral harassment (Level B) for marine mammals that are under its jurisdiction.

Hearing Impairment and Other Physical Effects. Exposure to very strong sounds could affect marine mammals in a number of ways. These include temporary threshold shift (TTS), which is a short-term hearing impairment, and permanent threshold shift (PTS), which is a permanent hearing loss. Non-auditory physical effects may also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that might (in theory) occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. It is possible that some marine mammal species (i.e., beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong transient sounds.

However, as discussed below, there is no definitive evidence that any of these effects occur even for marine mammals in close proximity to large survey arrays. It is unlikely that any effects of these types would occur during the present survey given the brief duration of exposure of any given mammal and the planned monitoring and mitigation measures. The following subsections discuss in more detail the possibilities of TTS, PTS, and non-auditory physical effects.

Temporary Threshold Shift (TTS). TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. It is a temporary phenomenon, and (especially when mild) is not considered physical damage or "injury" (Southall et al., 2007). Rather, the onset of TTS is an indicator that, if the animal is exposed to higher levels of that sound, physical damage is ultimately a possibility.

The magnitude of TTS depends on the level and duration of noise exposure, on the frequency, and the species exposed (Kryter, 1985; Richardson et al., 1995; Southall et al., 2007). For sound exposures at or somewhat above the TTS threshold, hearing sensitivity recovers rapidly after exposure to the noise ends. In terrestrial mammals, TTS can last from minutes or hours to days. New data on marine mammal hearing, marine mammal equal latency contours, and the effects of noise on marine mammal hearing have been obtained since the Southall (2007) publication, and these data have been incorporated into NOAA's Technical Guidance (2016e) and Finneran (2016). As a result, new weighting functions and TTS and PTS thresholds have been developed. Table 3.3-10 identifies the new TTS thresholds for impulsive sound sources for both weighted sound exposure levels (SEL) and peak sound pressure levels (SPL) thresholds.

Table 3.3-10. TTS Thresholds for Impulsive Sound Sources

Hearing Group	SEL (weighted) (dB SEL)	Peak SPL (dB SPL)
LF	168	213
MF	170	224
HF	140	196
OW	188	226
PW	170	212

Note: SEL thresholds are in dB re 1 μPa2s and peak SPL thresholds are in dB re 1 μPa.
Source: NMFS, 2016e

For toothed whales, experiments on a bottlenose dolphin and beluga whale showed that exposure to a single impulse at a received level of 207 kilopascal (kPa) (or 30 psi) peak-to-peak (p-p), which is equivalent to 228 dB re 1 μPa (p-p), resulted in a 7.0 and 6.0 dB TTS in the beluga whale at 0.4 and 30 kHz, respectively. Thresholds returned to within 2 dB of the pre-exposure level within 4 minutes of the exposure (Finneran et al., 2002).

Finneran et al. (2005) examined the effects of tone duration on TTS in bottlenose dolphins. Bottlenose dolphins were exposed to 3 kHz tones (non-impulsive) for periods of 1, 2, 4, or 8 seconds, with hearing tested at 4.5 kilohertz (kHz). For one second exposures, TTS occurred with sound exposure limits (SELs) of 197 dB, and for exposures greater than one second, SEL greater than 195 dB resulted in TTS (SEL is equivalent to energy flux, in dB re 1 μPa2-s). At an SEL of 195 dB, the mean TTS (4 minutes [min] after exposure) was 2.8 dB. Finneran et al. (2005) suggested that an SEL of 195 dB is the likely threshold for the onset of TTS in dolphins and belugas exposed to tones of durations one to eight seconds (i.e., TTS onset occurs at a near-constant SEL, independent of exposure duration). That implies that, at least for non-impulsive tones, a doubling of exposure time results in a 3 dB lower TTS threshold.

However, the assumption that, in marine mammals, the occurrence and magnitude of TTS is a function of cumulative acoustic energy (SEL) is probably an oversimplification. Kastak et al. (2005) reported preliminary evidence from pinnipeds that, for prolonged non-impulse noise, higher SELs were required to elicit a given TTS if exposure duration was short than if it was longer, i.e., the results were not fully consistent with an equal-energy model to predict TTS onset. Mooney et al. (2009a) showed this in a bottlenose dolphin exposed to octave-band non-impulse noise ranging from 4 to 8 kHz at SPLs of 130 to 178 dB re 1 μPa for periods of 1.88 to 30 minutes. Higher SELs were required to induce a given TTS if exposure duration was shorter than if it was longer. Exposure of bottlenose dolphins to a sequence of brief sonar signals showed that, with those brief (but non-impulse) sounds, the received energy (SEL) necessary to elicit TTS was higher than was the case with exposure to the more prolonged octave-band noise (Mooney et al. 2009b). The researchers concluded that, when using (non-impulse) acoustic signals of duration approximately 0.5 seconds SEL must be at least 210 to 214 dB re 1 μPa2-s to induce TTS in the bottlenose dolphin. Most recent studies conducted by Finneran et al. also support the notion that exposure duration has a more significant influence compared to SPL as the duration increases, and that TTS growth data are better represented as functions of SPL and duration rather than SEL alone (Finneran et al., 2010a,b). In addition, Finneran et al. (2010b) concluded that when animals are exposed to intermittent noises, there is recovery of hearing during the quiet intervals between exposures through the accumulation of TTS across multiple exposures. Such findings suggest that when exposed to multiple seismic pulses, partial hearing recovery also occurs during the seismic pulse intervals.

Although there are no direct measurements of hearing sensitivity in any mysticete species, an audible frequency range of approximately 10 Hz to 30 kHz has been estimated from observed vocalization frequencies, observed reactions to playback sounds, and anatomical analyses of the auditory system. In the absence of data for mysticetes (LF), their frequency of best hearing is assumed to be the median threshold at the frequency of best hearing for the other hearing groups (MF, HF, PW, and OW), which is 54 dB re 1 µPa; therefore, the estimated TTS threshold for mysticetes was set at 180 dB re 1 µPa2s (Finneran, 2016). However, no cases of TTS are expected given the strong likelihood that mysticetes would avoid the approaching sound sources (or vessel) before being exposed to levels high enough for there to be any possibility of TTS, and the special provisions for endangered low-frequency whales.

In pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. Initial evidence from prolonged exposures suggested that some pinnipeds may incur TTS at somewhat lower received levels than do small odontocetes exposed for similar durations (Kastak et al., 1999, 2005). However, more recent indications are that TTS onset in the most sensitive pinniped species studied (harbor seal) may occur at a similar SEL as in odontocetes (Kastak et al., 2005).

Most cetaceans show some degree of avoidance of seismic vessels operating an array. It is unlikely that these cetaceans would be exposed to sound source pulses at a sufficiently high level for a sufficiently long period to cause more than mild TTS, given the relative movement of the vessel and the marine mammal (NMFS, 2010). TTS would be more likely in any odontocetes that bow- or wake-ride or otherwise linger near the array. However, while bow- or wake-riding, odontocetes would be at the surface and thus not exposed to strong sound pulses given the pressure release and Lloyd’s mirror effects at the surface. But if bow- or wake-riding animals were to dive intermittently near seismic arrays, they would be exposed to strong sound pulses, possibly repeatedly (NMFS, 2010).

If some cetaceans did incur mild or moderate TTS through exposure to seismic survey sounds in this manner, this would very likely be a temporary and reversible phenomenon. However, even a temporary reduction in hearing sensitivity could be deleterious in the event that, during that period of reduced sensitivity, a marine mammal needed its full hearing sensitivity to detect approaching predators (NMFS, 2010).

Some pinnipeds show avoidance reactions to sound sources, but their avoidance reactions are generally not as strong or consistent as those of cetaceans. Pinnipeds occasionally seem to be attracted to operating seismic vessels (NMFS, 2010). There are no specific data on TTS thresholds of pinnipeds exposed to single or multiple low-frequency pulses. However, given the indirect indications of a lower TTS threshold for the harbor seal than for odontocetes exposed to impulse sound, it is possible that some pinnipeds exposed for a prolonged time of a large array could incur TTS (NMFS, 2010).

It has been shown that most marine mammals show at least localized avoidance of ships and/or seismic operations. In addition, ramping up sound sources, which is standard operational protocol for many seismic operators, should allow cetaceans near the survey area at the time of startup (if the sounds are aversive) to move away from the seismic source and to avoid being exposed to the full acoustic output of the sound sources. Thus, most mysticetes likely will not be exposed to noise at high energy levels provided the ramp-up procedure is applied and effective. Likewise, many odontocetes close to the track line are likely to move away before the sounds from an approaching seismic vessel become sufficiently strong for there to be any potential for TTS or other hearing impairment. Hence, there is little potential for mysticetes or odontocetes that show avoidance of ships or sound sources to be close enough to a survey array to experience TTS. Therefore, it is not likely that marine mammals in the vicinity of the proposed marine seismic surveys by Beta would experience TTS as a result of these activities with implementation of the mitigation measures detailed in Section 3.3.10.

Permanent Threshold Shift (PTS). When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness. In other cases, the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

There is no specific evidence that exposure to pulses from sound sources in seismic surveys can cause PTS in any marine mammal, even with large, high energy arrays. However, given the possibility that mammals close to a seismic array might incur at least mild TTS in the absence of appropriate mitigation measures, there has been further speculation about the possibility that some individuals occurring very close to sound sources might incur PTS (e.g., Richardson et al., 1995; Gedamke et al., 2008). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing TTS onset might elicit PTS. Table 3.3-11 details the new PTS thresholds for impulsive sound sources for weighted SEL and SPL thresholds.

Table 3.3-11. PTS Thresholds for Impulsive Sound Sources

Hearing Group	SEL (weighted) (dB SEL)	Peak SPL (dB SPL)
LF	183	219
MF	185	230
HF	155	202
OW	203	232
PW	185	218

Note: SEL thresholds are in dB re 1 μPa2s and peak SPL thresholds are in dB re 1 μPa.
Source: NMFS, 2016e

Since marine mammal PTS data from impulsive noise exposures do not exist, onset-PTS levels for impulsive exposures were estimated by adding 15 dB to the SEL-based TTS threshold and adding 6 dB to the peak pressure based thresholds. These relationships were derived by Southall et al. (2007) from impulse noise TTS growth rates in chinchillas. The appropriate frequency weighting function for each functional hearing group is applied only when using the SEL-based thresholds to predict PTS (Finneran, 2016). The low-to-moderate levels of TTS that have been induced in captive odontocetes and pinnipeds during controlled studies of TTS have been confirmed to be temporary, with no measurable residual PTS (Kastak et al., 1999; Schlundt et al., 2000; Finneran et al., 2002, 2005; Nachtigall et al., 2003, 2004). However, very prolonged exposure to sound strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause PTS, at least in terrestrial mammals (Kryter, 1985). In terrestrial mammals, the received sound level from a single, non-impulsive sound exposure must be far above the TTS threshold for any risk of permanent hearing damage (Kryter, 1994; Richardson et al., 1995; Southall et al., 2007). However, there is special concern about strong sounds whose pulses have very rapid rise times. In terrestrial mammals, there are situations when pulses with rapid rise times (e.g., from explosions) can result in PTS even though their peak levels are only a few decibels higher than the level causing slight TTS; however, the rise time of sound source pulses are not as fast as that of an explosion.

Some factors that contribute to onset of PTS, at least in terrestrial mammals, are as follows:

- Exposure to single very intense sound;
- Fast rise time from baseline to peak pressure;
- Repetitive exposure to intense sounds that individually cause TTS but not PTS; and
- Recurrent ear infections or (in captive animals) exposure to certain drugs.

Sound impulse duration, peak amplitude, rise time, number of pulses, and inter-pulse interval are the main factors thought to determine the onset and extent of PTS. Ketten (1993) has noted that the criteria for differentiating the sound pressure levels that result in PTS (or TTS) are location and species specific. PTS effects may also be influenced strongly by the health of the receiver’s ear.

As described above for TTS, in estimating the amount of sound energy required to elicit the onset of TTS (and PTS), it is assumed that the auditory effect of a given cumulative SEL from a series of pulses is the same as if that amount of sound energy were received as a single strong sound. There are no data from marine mammals concerning the occurrence or magnitude of a potential partial recovery effect between pulses.

It is unlikely that an odontocete would remain close enough to a large seismic array for sufficiently long to incur PTS. As detailed in Section 3.3.10, within the proposed monitoring and mitigation measures, the sound source would immediately be shut down if an animal were to enter the Exclusion Zone, thereby preventing marine mammals from prolonged exposure. There is some concern about bow-riding odontocetes, but for animals at or near the surface, auditory effects are reduced by Lloyd’s mirror and surface release effects (Carey, 2009). The presence of the vessel between the source array and bow-riding odontocetes could also, in some, but probably not all cases, reduce the levels received by bow-riding animals (e.g., Gabriele and Kipple, 2009). It is assumed that mysticetes generally avoid the immediate area around operating seismic vessels. So, it is unlikely that a mysticete, low-frequency whale could incur PTS from exposure to sound source pulses. The TTS (and PTS) thresholds of pinnipeds, as well as the members of the family Delpinidae, are higher, and therefore the potential exposure areas extend to a somewhat greater distance for those animals (Kastak et al., 2005; Southall et al., 2007; Lucke et al., 2009). Again, Lloyd's mirror and surface release effects will ameliorate the effects for animals at or near the surface.

Although it is unlikely that source operations during most seismic surveys would cause PTS in many marine mammals, caution is warranted given:

- The limited knowledge about noise-induced hearing damage in marine mammals, particularly mysticetes and pinnipeds;
- The seemingly greater susceptibility of certain species (e.g., Dall's porpoise and harbor seal) to TTS and presumably also PTS; and
- The lack of knowledge about TTS and PTS thresholds in many species.

The avoidance reactions of many marine mammals, along with commonly applied monitoring and mitigation measures (See Section 3.2-10), would reduce the already low probability of exposure of marine mammals to sounds strong enough to induce PTS.

Stranding and Mortality. Marine mammals close to underwater detonations of high explosives can be killed or severely injured, and the auditory organs are especially susceptible to injury (Ketten et al., 1993; Ketten, 1995). However, explosives are no longer used for marine waters for commercial seismic surveys or (with rare exceptions) for seismic research. These methods have been replaced entirely by acoustic sources or related non-explosive pulse generators. Sound pulses are less energetic and have slower rise times, and there is no specific evidence that they can cause serious injury, death, or stranding, even in the case of large source arrays.

Specific sound-related processes that lead to strandings and mortality are not well documented, but may include (1) swimming in avoidance of a sound into shallow water; (2) a change in behavior (such as a change in diving behavior) that might contribute to tissue damage, gas bubble formation, hypoxia, cardiac arrhythmia, hypertensive hemorrhage, or other forms of trauma; (3) a physiological change such as a vestibular response leading to a behavioral change or stress-induced hemorrhagic diathesis, leading in turn to tissue damage; and, (4) tissue damage directly from sound exposure, such as through acoustically mediated bubble formation and growth or acoustic resonance of tissues. Some of these mechanisms are unlikely to apply in the case of impulse sounds. However, there are increasing indications that gas-bubble disease (analogous to "the bends"), induced in supersaturated tissue by a behavioral response to acoustic exposure, could be a pathologic mechanism for the strandings and mortality of some deep-diving cetaceans exposed to sonar. The evidence for this remains circumstantial and associated with exposure to naval mid-frequency sonar, not seismic surveys (Cox et al., 2006; Southall et al., 2007).

Seismic pulses and mid-frequency sonar signals are quite different, and some mechanisms by which sonar sounds have been hypothesized to affect beaked whales are unlikely to apply to sound pulses. Sounds produced by source arrays are broadband impulses with most of the energy below 1 kHz. Typical military mid-frequency sonar emit non-impulse sounds at frequencies of 2 to 10 kHz, generally within a relatively narrow bandwidth at any one time. A further difference between seismic surveys and naval exercises is that naval exercises can involve sound sources on more than 1 vessel. Thus, it is not appropriate to assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals. However, evidence that sonar signals can, in special circumstances, lead (at least indirectly) to physical damage and mortality (e.g., Balcomb and Claridge, 2001; NOAA and USN, 2000; Jepson et al., 2003; Fernández et al., 2004, 2005; Hildebrand, 2005; Cox et al., 2006) suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity “pulsed” sound.

LDEO (2011) noted there is currently no conclusive evidence of cetacean stranding or deaths at sea as a result of exposure to seismic surveys, but a few cases of strandings in the general area where a seismic survey was ongoing have led to speculation of a possible link.

Engel et al., (2004, in LDEO, 2011) suggested that humpback whales wintering off Brazil might have been displaced or even stranded during seismic surveys. Others have suggested the evidence was circumstantial and subject to alternative explanations (IAGC, 2004), or inconsistent with subsequent results from the same area (IAGC, 2004; Parente et al. 2006, in LDEO, 2011). Based on data from subsequent years, no observable direct correlation between strandings and seismic surveys was found (IWC, 2007, LDEO, 2011).

In September 2002, 2 Cuvier’s beaked whales stranded in the Gulf of California, Mexico at the same time when the LDEO vessel R/V Maurice Ewing was operating a 20-source, 8,490 cubic inch source array in the general area. The link was inconclusive and not based on any physical evidence (Hogarth, 2002; Yoder, 2002, LDEO, 2011). A need for caution is recommended when conducting seismic surveys in area occupied by beaked whales until more in know about effect on those species (LDEO, 2011).

3.3.9.2 Damage or Disturbance to Seafloor Habitats From Placement of Autonomous Nodes

Placement of autonomous nodes (nodes) has the potential to create localized turbidity and affect nearby soft-bottomed seafloor habitat, and/or rocky substrate. Potentially significant impacts could occur if nodes create turbidity that would reduce water clarify and increase sediment deposition, or if the cable/rope, tethering the nodes, are placed onto or cut across sensitive habitats. Deeper water rock habitats are considered more sensitive in that they are not routinely subjected to natural disturbances (i.e., storm waves) and they support long-lived, slow-growing organisms that are particularly sensitive to disturbance. Further, placing nodes onto habitats could crush attached organisms and tether lines that cross habitat features could abrade and remove or damage attached epibiota.

3.3.9.3 Lighting

The following is a summary of studies on the effects of lighting on marine and aquatic wildlife. Saleh (2007), Schaar (2002), Anonymous (2002), and Harder (2002) summarize several of the more recent studies on the effects of light on wildlife, including those on birds, turtles, fish, and insects. These studies suggest that light effects include disorientation, structural-related mortality due to disorientation, and interruption of natural behaviors. Recommended mitigations include the elimination of “bare bulbs” and upward-pointing lights, shielding or cantering light sources, and minimizing overall light level to that which is needed for safe operations (Saleh, 2007).

Several studies (i.e., Cochran and Graber, 1958; Bruderer, et al., 1999; and Reed, et al, 1985) have shown that migrating birds are affected by artificial light on buildings. Effects range from attraction to disorientation, as well as alteration of flight patterns, and can result in an increase in mortality from striking buildings, and/or exhaustion and, ultimately, increased predation. The results of these studies tend to indicate that birds are “trapped” by light beams and are generally reluctant to leave the beam once entering it. Indirect light sources of more than approximately 0.5 mile away, tend to be less attractive than direct sources. Gauthreaux and Belser (2002) suggest that night-migrating birds showed “nonlinear flight” near towers with white and red strobe lights; however, they also stated that the attraction may have been more attributable to the constant tower lighting with the red strobe lights. Podolsky (2002) indicates that artificial lighting appears to “confuse” seabirds, particularly during their migration between urbanized nesting sites and their offshore feeding grounds. Longcore and Rich (2001) reported that migrating birds can be attracted to tall, well-lit structures, which can result in collisions.

It is assumed that migrating birds use visual cues to orient while flying, ultimately affecting their course of action. Poot et al. (2008), hypothesize that artificial light can interfere with the magnetic compass of the birds, which is an important orientation mechanism especially during overcast nights. Magnetic orientation is thought to be based on specific light receptors in the eye which have been shown to be light and wavelength-dependent. Poot et al. (2008) found that white and red light interfere with the magnetic compass of migrating birds, where they caused disorientation at low light intensity, compared to a high-intensity green light that caused less disorientation. The researchers concluded that the disorientation is due to the wavelength; green and blue lights have a short wavelength resulting in very little observable impact to birds’ orientation. In 2007, lights on gas-production platform L15 were replaced with green lighting. The platform is still visible from a distance with the new lighting and the platform crew has commented that the lighting is less blinding and they have increased contrast vision during crane operations (Poot et al., 2008).

Moor and Kohler (2002) found that the spectra of artificial light that strikes urban lakes was dominated by the yellow region (wave length of approximately 590 nm), which corresponded to the emission spectra of high pressure sodium lamps and was of a similar intensity as that of a full moon. They also found that artificial light was detectable to a water depth of about 10 feet by crustacean grazers and fish. Nightingale and Simenstad (2002) report that juvenile chum salmon and their predators (hake, dogfish, sculpin, and large Chinook and Coho salmon) tend to congregate below night security lights in the rivers and estuaries of the Pacific Northwest. Also, juvenile herring and sand lance appear to be attracted to night-lit water areas and are apparently "heavily preyed upon" during those periods. That report also indicates that there is insufficient data to allow conclusive evidence that the increased predation due to night-lighting is affecting species abundance or distribution. Juell and Fosseidengen (2004) found that Atlantic salmon responded positively to artificial light and suggest that it might be used to reduce exposure of those fish to undesirable water conditions. Studies by Oppedal, et al. (2001) suggest that vertical migration and feeding characteristics of caged Atlantic salmon were modified by exposing them to extended periods of light.

Very little data on the potential effects of existing platform lighting on marine species including marine birds and fish species have been documented. According to Reitherman and Gaede (2010), who conducted 20 all-night observations of avian activities on southern California oil production platforms (including Edith and Elly) observed no cases of birds being entrained around or confused by particular lights on the platform. Reitherman and Gaede (2010) also did not observe birds deviating significantly from their migratory pathway within their 300-foot observable radius. In addition, Project-area platform operators have not reported any significant incidents of bird mortalities resulting from nighttime operations; however, nighttime roosting, and in one case of nesting, has been reported on platforms in the Santa Barbara Channel. Black (2005) describes two incidents of bird strikes on a vessel operating in the southern ocean (South Georgia Island off the southern tip of South America) wherein vessels operating at night experienced relatively large numbers (~900 and 62) of bird strikes. The vessels were either moored or in transit during foggy and rainy conditions and both had "ice lights", which are used to assist in observations of floating ice too small to be detected by radar. As a result of these incidents, some vessel operators instituted the use of blackout curtains overnight-lit port holes and further focused deck lighting onto smaller areas.

The platforms are currently and will continue to be lit for compliance with USCG navigational hazard requirements. Shielding of the lighting to direct it downward and to limit the area will reduce the potential impacts to flying seabirds by precluding horizontal light. Lighting on the platform will be sufficient to assure safe operations and to be in compliance with USCG navigation hazard requirements but are not expected to result in significant impacts to the marine wildlife found in the region. Nighttime marine construction is anticipated and therefore lit Project vessels are expected to be present along the power cable route or while transiting between the port and the site. USCG-required vessel lighting will be onboard and on deck lighting will be shielded and directed inward to avoid over-water lighting. The potential effects of lighting on marine wildlife, particularly birds, are expected to be minimal, if any; however, to reduce the possibility of bird strikes during night operations, some Project-specific mitigations are recommended as further described in Section 3.2.10 (Summary of Project Incorporated Measures).

3.3.9.4 Vessel Collision

Collisions of Project-related vessels would be expected to most likely affect marine mammals and sea turtles. Such collisions have been documented in southern California; however, those collisions are typically associated with large ship interactions with slower-moving marine wildlife on the ocean surface rather than smaller work vessels. Impacts from vessel operations can range from a change in the animal's travel route or time on the surface to direct mortality.

NMFS (2017c) reports 54 known or possible ship strikes of large whales from 2007 through 2016 off of California. Strikes are usually fatal when vessel speed exceeds 10 knots, (POLB, 2008). Offshore California, gray whales are the most commonly reported, 14 recorded collisions from 2007 to 2016. Humpback whales constituted the next highest species for recorded ship strikes, (13 records), then fin whale (12 recorded), blues whale (10 record), and minke, sei and Baird's beaked whale (one record). Some collision incidents were reported as "unidentified species" (two records).

Vessel strikes involving pinnipeds and sea otters primarily involve small, fast boats. Propeller slashes to these smaller animals have been proportionally small, and collision reports have come from small vessels (NMFS, 2017c).

NMFS (2017c) reports 22 known or possible ship strikes of marine turtles from 2007 through 2016 off of California. Offshore California, green turtles are the most commonly reported, 21 recorded collisions and one recorded leatherback sea turtle. The risk to marine turtles from boat strikes increases with an increase in vessel speed. Hazel et al. (2007) analyzed behavioral responses of turtles to approaching vessel and found that turtles fled frequently in encounters with slow vessels (2 knots), infrequently with moderate vessels (6 knots), and rarely in encounters with fast vessels (10 knots).

The Project vessel will progress slowly along transit routes during mobilization and during survey activities, interactions with whales are, therefore, not expected. Therefore, the vessel collision impacts on marine wildlife will not be significant.

3.3.9.5 Oil Spill Potential

The unintentional release of petroleum into the marine environment from proposed Project activities could result in potentially significant impacts to the marine biota, particularly avifauna and early life stage forms of fish and invertebrates, which are sensitive to those chemicals. Refined products (i.e., diesel, gasoline.) are more toxic than heavier crude or Bunker-type products, and the loss of a substantial amount of fuel or lubricating oil during survey operations could affect the water column, seafloor, intertidal habitats, and associated biota, resulting in their mortality or substantial injury, and in alteration of the existing habitat quality. The release of petroleum into the marine environment is considered a potentially significant impact.

Marine organisms have created many adaptive strategies to survive within their environment. However, when these marine organisms are introduced to oil or other petroleum products, they can be adversely affected physiologically. For example, physiological effects from oil spills on marine life could include the contamination of protective layers of fur or feathers, loss of buoyancy, and loss of locomotive capabilities. In addition, oil and petroleum products may lead to direct lethal toxicity, or sub-lethal irritation. Introduction of enough oil or product into the water column can alter the chemical make-up of the temporary alteration of the chemical make-up of the ecosystem. Variables to consider when dealing with the impact of an oil or petroleum product spill may include: oil type, season of occurrence, animal behavior, oceanographic and meteorological conditions, and the method of clean-up or removal.

The possible effects of oil on marine wildlife has been studied and discussed by Federal and State agencies such as the NOAA NMFS and the CDFG. In 1995, the Office of Oil Spill Prevention and Response (OSPR) organized California's existing oiled wildlife centers into the Oiled Wildlife Care Network (OWCN). OSPR is an office within the CDFG charged with oil spill prevention and response. The office directs spill response, cleanup, and natural resource damage assessment activities (Santa Barbara Wildlife Care Network [SBWCN], 2010). The research and experiments conducted by these agencies is a cumulative ongoing effort to better understand what potential effects an oil spill of any magnitude will or may have on special status and protected species that includes invertebrates, fish, turtles, marine birds, cetaceans, pinnipeds, and fissipeds. The following text summarizes the potential impacts from exposure to oil spills.

Marine Invertebrates. Oil spill impacts on sensitive marine invertebrates, including the black abalone, would likely result from direct contact, ingestion of contaminated water and food (algae), and secondary impacts associated with response operations. In the event of a spill related to the proposed Project activities, the oil could undergo some weathering before reaching the mainland, which could limit toxicity.

Fish Resources. The effects of oil on fish have been well documented both in the field and within a laboratory. This research shows that fish that are unable to avoid hydrocarbons and take them up from food, sediments, and surrounding waters. Once these hydrocarbons are in the organism's tissues, they will affect the life span through a variety of behavioral, physiological, or biochemical changes. Also, exposure to oil will affect a species' ability to search, find, and capture food, which will affect its nutritional health. Early development life stages, such as larvae, will be especially impacted (Jarvela et al., 1984). Small amounts of oil can impact fish embryos by causing physical deformities, damage to genetic material, and mortality (Carls, et. al., 1999). Fishes experience the highest mortalities due to oil exposure when they are eggs or larvae. However, these deaths would not be significant in terms of the overall population in offshore water (Jarvela et al, 1984). Brief encounters with oil by juvenile and adult fish species would not likely be fatal.

While a release of petroleum would be expected to have some short-term effect on the habitats and fish within the Project area, the likelihood of such an event occurring and the existing mitigations that have been built into the Project design reduce the possibility to less than significant.

Project activities are not expected to have long-term, significant effects on open water habitat. All Project activities will be subject to the requirements and guidelines included within the "Beta Unit Complex (Platforms Elly, Ellen & Eureka, Beta Pipeline and Beta Pump Station) Oil Spill Prevention and Response Plan (OSPRP) - Revision 3" (2016), (Appendix H). In addition, the Project survey will occur via the use of the M/V *Silver Arrow* or equivalent. The M/V *Silver Arrow* is approximately 1,900 gross tons and operates under a vessel-specific Oil Spill Response Plan (OSRP). These documents outline the containment and recovery of Project-related petroleum products that may be accidentally released into the marine waters. In addition, onboard and supporting equipment and the procedures specified in the Project Platforms and vessel-specific oil spill plans are expected to reduce the effects of accidentally discharged petroleum by facilitating rapid response and cleanup operations. The Project vessels will adhere to a zero-discharge policy.

Turtles. Oil spills are not considered a high cause for mortality for sea turtles, although recent reports from the Gulf of Mexico Deepwater Horizon spill indicate a possible increase in strandings of oil impacted turtles. Since sea turtle species have been listed as threatened or endangered under the Federal ESA, there is very little direct experimental evidence about the toxicity of oil to sea turtles. Sea turtles are negatively affected by oil at all life stages: eggs on the beach, post hatchings, young sea turtles in near shore habitats, migrating adults, and foraging grounds. Each life stage varies depending on the rate, severity, and effects of exposure.

Sea turtles are more vulnerable to oil impacts due to their biological and behavior characteristics including indiscriminate feeding in convergence zones, long pre-dive inhalations, and lack of avoidance behavior (Milton et al., 1984). This type of diving behavior puts sea turtles at risk because they inhale a large amount of air before diving and will resurface over time. During an oil spill, this would expose sea turtles to long periods of both physical exposure and petroleum vapors, which can be the most harmful during an oil spill.

Marine Birds. Marine birds can be affected by direct contact with oil in three ways: (1) thermal effects due to external oiling of plumage; (2) toxic effects of ingested oil as adults; and (3) effects on eggs, chicks, and reproductive abilities.

The loss of waterproofing is the primary external effect of oil on marine birds. Buoyancy is lost if the oiling is severe. A main issue with oil on marine birds is the damage oil does to the arrangement of feathers, which is responsible of water repellency (Fabricius, 1959). When this happens, the water can go through the dense layers of feathers to the skin causing a loss of body heat (Hartung, 1964). To survive, the bird must metabolize fat, sugar, and eventually skeletal muscle proteins to maintain body heat. The cause of oiled bird deaths can be the result from exposure and loss of these energy reserves as well as the toxic effects of ingested oil (Schultz et al., 1983).

The internal effect of oil on marine birds varies. Anemia can be the result of bleeding from inflamed intestinal walls. Oil passing into the trachea and bronchi could result in the development of pneumonia. A bird's liver, kidney, and pancreatic functions can be disturbed due to internal oil exposure. Ingested oil can inhibit a bird's mechanism for salt excretion that enables seabirds to obtain fresh water from salt water and could result in dehydration (Holmes and Cronshaw, 1975).

Studies have shown that ingested oil may alter egg yolk structure, reduce egg hatchability, and reduce egg-laying rate for seabirds (Grau et al., 1977; Hartung, 1965). When oil contacts the exterior of eggs, it could reduce the hatching success (Hartung, 1965; Albers and Szaro, 1978; King and Lefever, 1979; Patten and Patten, 1979; Coon et al., 1979; McGill and Richmond, 1979).

A bird's vulnerability to an oil spill depends on each individual species' behavioral and other attributes. Some of the more vulnerable species are alcids and sea ducks due to the large amount of time they spend on the ocean surface, the fact that they dive when disturbed, and their gregarious behavior. Also, alcids and other birds have low reproductive rates, which result in a lengthy population recovery time. A bird's vulnerability depends on the season as well. For example, colonial seabirds are most vulnerable between early spring through autumn because they are tied to breeding colonies.

Cetaceans. The documentation of the effects of oil on whales, dolphins, and porpoises is limited due to the difficult reclusive nature and migratory behavior (Australian Maritime Safety Authority, 2010). The impact of direct contact with oil on the animal's skin varies by species. Cetaceans have no fur. Therefore, they are not susceptible to the insulation effects of hypothermia in other mammals. However, external impacts to cetaceans from direct skin contract with oil could include: eye irritation, burns to mucous membranes of eyes and mouth, and increase vulnerability to infection.

Baleen whales skim the surface of water for feeding and are particularly vulnerable to ingesting oil and baleen fouling. Adult cetacean would most likely not suffer from oil fouling of their blowholes because they spout before inhalation, clearing the blowhole. Younger cetaceans are more vulnerable to inhale oil. It has been suggested that some pelagic species can detect and avoid contact with oil (Australian Maritime Safety Authority, 2010). This still presents a problem for those animals that must come up to the surface to breathe and to feed (MMS, 1983).

Internal injury from oil is more likely for cetaceans due to oil. Oil inhaled could result in respiratory irritation, inflammation, emphysema, or pneumonia. Ingestion of oil could cause ulcers, bleeding, and disrupt digestive functions. Both inhalation and ingested chemicals could cause damage in the liver, kidney, lead to reproductive failure, death, or result in anemia and immune suppression.

Pinnipeds. Seals and sea lions that come in contact with oil could experience a wide range of adverse impacts including: thermoregulatory problems, disruption of respiratory functions, ingestions of oil as a result of grooming or eating contaminated food, external irritation (eyes), mechanical effects, sensory disruption, abnormal behavioral responses, and loss of food by avoidance of contaminated areas.

Guadalupe fur seals and northern fur seals could experience thermoregulatory problems if they come into contact with oil (Geraci and Smith, 1976). Oil makes hair of a fur seal lose its insulating qualities. Once this happens, the animal's core body temperature may drop and increases its metabolism to prevent hypothermia. This could potentially be fatal to a distressed or diseased animal and highly stressful for a healthy animal (Engelhardt, 1983).

Pinnipeds rely on blubber for insulation (California sea lion, harbor seal, northern elephant seal, and Stellar sea lion) and do not experience long-term effects to exposure to oil (Geraci and St. Aubin, 1982). Newborn harbor seal pups, which rely on a dense fur for insulation, would be subject to similar thermoregulatory problems of the previously discussed fur seal species (Oritsland and Ronald, 1973; and Blix et al., 1979).

When pinnipeds are coated with viscous oil, it may cause problems in locomotion and breathing. Pinnipeds that are exposed to heavy coating from oil will experience swimming difficulties, which may lead to exhaustion (Engelhardt, 1983; Davis and Anderson, 1976), and possible suffocation from breathing orifices that are clogged. The viscosity of the oil is a major factor in determining the effects on pinnipeds. Severe eye irritation is caused by direct contact with oil but non-lethal (Engelhardt, 1983). Skin absorption, inhalation, and ingestion of oil while grooming are all possible pathways of ingestion. However, there have not been enough studies on the long-term effects of chronic exposure to oil on pinnipeds.

3.3.10 Project-Incorporated Measures to Reduce Potential Impacts

The Project-incorporated and design measures to detailed in the following section will be implemented to further minimize the potential disturbance of marine wildlife during Project operations. The Project incorporates both design and operational procedures for minimizing potential impacts to marine wildlife and other special-status species.

3.3.10.1 Measures to Reduce Potential Noise Impacts on Marine Wildlife

Scheduling. Beta proposes to conduct offshore surveys during Fall 2018 to coincide with the reduced number of cetaceans in the area, and outside the peak humpback whale migration period. The humpback whales are most common offshore southern California during April through October. Then in late autumn, humpback whales will begin their migration southward to warmer Mexican waters for calving. This time frame also is outside breeding and pupping periods for phocid and otariid species (March to June) which have rookeries adjacent to the Project area.

Survey timing was chosen to: 1) reduce risks from unsafe sea conditions, and 2) reduce the potential impacts to Federally listed and/or protected species that could occur within the Project vicinity. Fall and winter months are the best time to avoid highly mobile species, particularly whales and breeding birds, which could occur within the Project vicinity.

Pre-Activity Environmental Orientation. A marine biologist will present an environmental orientation for all Project personnel prior to conducting work. The purpose of the orientation is to educate Project personnel on identification of wildlife in the Project area and to provide an overview of the APMs that will be implemented during the Project. Specifically, the orientation will include, but not be limited to, the following:

- Identification of wildlife expected to occur in the Project area and periods of occurrence along the central coast;
- Overview of the Marine Mammal Protection Act (MMPA), Federal Endangered Species Act (Federal ESA), and California Endangered Species Act (California ESA) regulatory agencies responsible for enforcement of the regulations, and penalties associated with violations;
- Procedures to be followed during mobilization and demobilization, transiting of Project vessels, and the implementation of shutdowns and ramp-ups throughout the duration of the Project; and

- Reporting requirements in the event of an inadvertent collision and/or injury to a marine wildlife or sensitive habitats.

Prior to Project activities briefings will be held between the Beta representatives, the vessel captains, vessel representatives and the PSOs. Topics will include personnel safety, identification of key personnel, communication protocol, and lines of authority.

Reducing Sound Source. The discharge pressure of the array is approximately 2,000 pounds per square inch (psi). To reduce potential noise, the sound source will be operated in “distributed or popcorn mode”. During discharge, a brief (~0.1 seconds) pulse of sound is emitted. The sound sources would be silent during the intervening periods. Because the actual source is a distributed sound source (11 sound sources in each of the three sub-array) rather than a single point source, the highest sound levels measurable at any location in the water will be significantly less than the nominal single point source level emitted (as would be the case during other non-related “typical” geophysical surveys). Specifically, rather than activating all sound sources at the same time to generate a sharp source peak, the sound sources are initiated independently over a short period of time to generate a firing sequence with reduced peak amplitudes. As only one sound source would be firing at any given time, the effective (perceived) source level for sound propagating would be substantially lower than the nominal source level because of the distributed nature of the sound from the sound source array. The sound source array is designed to focus maximum energy downwards rather than in the horizontal directions.

Sound Source Verification. Prior to the start of survey operations, a sound source verification (SSV) will be conducted by the source vessel to ensure actual acoustic energy levels from the sound source array are consistent with previous modeling. The results of the SSV will be used to adjust the Exclusion and Buffer Zones as necessary.

Establishment of Exclusion and Buffer Zones. Beta will establish and monitor 1,640 feet (500 meter) Exclusion Zone radius and 3,280 feet (1,000 meter) Buffer Zone. These Zones will be based on the radial distance from any element of the source array, rather than being based on based on the center of the array or around the vessel itself. The survey vessel shall avoid the presence of sensitive marine wildlife (marine mammals and turtles) within the Exclusion Zone to the maximum extent feasible.

The Buffer and Exclusion Zones for marine wildlife is customarily defined as the distance within which received sound levels are above specific harassment levels defined by NOAA and NMFS. “Level A” harassment has been historically correlated with impacts to marine mammals within the Exclusion Zone, while “Level B” harassment is correlated with impacts within the Buffer Zone. This criterion is based on an assumption that sound energy received at lower received levels outside of each respective Zone will not injure or impair the hearing abilities of these animals or effect their natural behaviors. Although the Exclusion and Buffer Zones are not directly based on the acoustic modeling and the “Level A” or “Level B” harassment criteria, it is Beta’s intent to provide a standard monitoring distances that will:

1. Encompass zones for most species within which auditory injury could occur on the basis of instantaneous exposure;

2. Provide additional protection from the potential for more severe behavioral reactions for marine wildlife at close range to the acoustic source;

3. Provide consistency for PSOs; and

4. To define a distance within which detection probabilities are reasonably high for most species under typical conditions. In addition, standard zones have been proven as a feasible measure through prior implementation by operators in the Gulf of Mexico (NMFS, 2017b).

Vessel-Based Marine Wildlife Contingency Plan. Beta will implement a Marine Wildlife Contingency Plan (MWCP) that includes measures designed to reduce the potential impacts on marine wildlife, particularly marine mammals, by the proposed operations. This program will be implemented in compliance with measures developed in consultation with the NMFS and will be based on anticipated Exclusion and Buffer Zones derived from modeling of the selected source levels. These proposed Exclusion and Buffer Zones would be reviewed in context with the Incidental Harassment Authorization (IHA) to be issued by NMFS as part of the Project review under the Federal Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA).

The MWCP will be implemented by a team of experienced Protected Species Observers (PSOs). PSOs will be stationed aboard the survey vessels throughout the duration of the Project. Reporting of the results of the vessel-based monitoring program will include the estimation of the number of takes as stipulated in the Final IHA and level of analysis (LOA).

The vessel-based work will provide:

- The basis for real-time mitigation, if necessary, as required by the various permits issued to Beta;
- Information needed to estimate the number of “takes” of marine mammals by harassment, which must be reported to NMFS and USFWS;
- Data on the occurrence, distribution, and activities of marine wildlife in the areas where the survey program is conducted; and,
- Information to compare the distances, distributions, behavior, and movements of marine mammals relative to the survey vessel at times with and without acoustic activity.

Protected Species Observers. Vessel-based, and as needed platform-based, monitoring for marine wildlife will be performed by trained PSOs throughout the period of survey activities to comply with expected provisions in the IHA and LOA that Beta receives. Visual monitoring will occur primarily during daylight. However, when Passive Acoustic Monitoring (PAM) and/or thermal imaging cameras detects marine mammals in the survey area at night, visual monitors will be deployed to attempt visual detection. The monitors will monitor the occurrence and behavior of marine wildlife near the survey vessels during all operations. PSO duties will include watching for and identifying marine wildlife; recording their numbers, distances, and reactions to the survey operations; and, documenting “take by harassment” as defined by

NMFS. A sufficient number of PSOs will be required onboard the survey vessel to meet the following criteria:

- 100 percent monitoring coverage during all periods of survey operations in daylight;
- Maximum of four consecutive hours on watch per PSO; and,
- Maximum of ~12 hours of watch time per day per PSO.

An experienced field crew leader will supervise the PSO team onboard the survey vessels. Crew leaders and most other biologists will be individuals with experience as observers during similar monitoring projects in California, or other offshore areas in recent years. Resumes for those individuals will be provided to NMFS and USFWS for review and acceptance of their qualifications.

PSOs will have the appropriate safety and monitoring equipment to conduct their observations, including night-vision equipment, low light reticulated binoculars, and thermal imaging cameras for 24/7 operations. In addition, bigeye binoculars will be mounted on the survey vessel for PSO observation purposes. PSOs will utilize a handheld global positioning system (GPS) or the ship's navigation system to record latitude and longitude for each marine wildlife observation. Each PSO will have a handheld radio for communication with the bridge, other Project vessels, and Beta platforms, as necessary. In addition, cell phones, VHS radio, and email capabilities will be available to communicate with onshore personnel.

Vessel Based Monitoring. Vessel-based monitoring of marine wildlife will consist of both visual and acoustic observations. Visual observations will be completed by qualified onboard PSO throughout the daylight periods of the survey. Acoustic monitoring will occur during both day and night operations and will utilize onboard acoustic equipment.

<u>Visual Monitoring</u>. The PSOs will coordinate with the captain of the survey vessel or his representative to select an appropriate monitoring position where they can monitor the Exclusion Zone radius and will have a clear view of the area of ocean that is in the direction of the course of travel while the vessel is transiting. The PSOs will observe marine wildlife and will request procedures to shut-down or ramp-up sound source operations, and/or avoid potential collisions and/or entanglement with marine wildlife. The PSOs will be on station at least 30 minutes before survey activities begin and will remain on duty until at least 30 minutes after all survey activities have been completed. The PSOs will arrange their own schedules to ensure complete coverage while Project activities are occurring.

The PSOs will establish and monitor a 1,640 feet (500 meter) Exclusion Zone radius and 3,280 feet (1,000 meter) Buffer Zone. These Zones will be based on the radial distance from any element of the sound source array, rather than being based on based on the center of the array or around the vessel itself. If a PSO should observe marine wildlife within the Exclusion Zone of the survey vessel, the monitor will immediately report that observation to the vessel operator who will shut-down the survey operations, slow the vessel and/or change course in order to avoid contact, as deemed necessary by the PSO, unless those actions will jeopardize the safety of the vessel or crew. The path of the marine animal will be closely monitored to determine when it has safely passed through the designated impact area and Project activities can be ramped up as detailed below. The PSO will have the authority to stop any activity that could result in harm to marine wildlife.

Passive Acoustic Monitoring. PAM will be used to detect cetacean species and will complement the visual monitoring program. Visual monitoring typically is not as effective during periods of poor visibility or at night. Even with good visibility, visual monitoring is unable to detect marine mammals when they are below the surface or beyond visual range. Acoustic monitoring can be used in addition to visual observations to improve detection, identification, and location of vocalizing cetaceans. Acoustic monitoring will be conducted in real time so that the visual observers can be advised when cetaceans are detected. Detection distance will depend on the target species and hardware used during monitoring.

The PAM system consists of hardware (i.e., hydrophones) and software. The "wet end" of the system consists of a towed hydrophone array that is connected to the vessel by a tow cable. The tow cable is approximately 800 feet (250 meters) long, and the hydrophones are fitted in the last 32 feet (10 meters) of cable. A depth gauge is attached to the free end of the cable, and the cable is typically towed at depths less than 66 feet (20 meters). The array will be deployed by a winch located on the aft deck and a deck cable will connect the tow cable to the electronics unit in the main computer lab where the acoustic station, signal conditioning, and processing system will be located. The acoustic signals received by the hydrophones are amplified, digitized, and then processed by the Pamguard software, or a comparable, preferred software. The system can detect marine mammal vocalizations at frequencies up to 250 kHz.

At least one acoustic PAM operator (in addition to the four visual PSOs) will be onboard the survey vessel area during survey operations. The PAM operator will monitor the acoustic detection system by listening to the signals from two channels via headphones and/or speakers and watching the real-time spectrographic display for frequency ranges produced by cetaceans. The PAM operating shift can be from one to six hours long and PSOs are expected to rotate through the PAM operating position, although the lead operator will be on PAM duty more frequently.

When a vocalization is detected inside the Exclusion Zone during daylight operations, the PAM operator will contact the visual PSO immediately, to alert him/her to the presence of cetaceans (if they have not already been seen), and to allow sound source shut down to be initiated, if required. In addition, PAM shall be performed during night-time operations and may be supplemented by visual monitoring using equipment to enhance detection rates, including advanced infrared equipment, sodium lighting, and/or millimeter waves radar. When a cetacean is detected by acoustic monitoring within the Exclusion Zone during non-daylight hours, a visual PSO, the Project crew, and the captain of the survey vessel will be notified immediately so that applicant proposed measures (APMs) may be implemented. The PAM operator will continue to monitor the hydrophones and inform a visual PSO, Project crew, and the captain when the mammal(s) appear to be outside the Exclusion Zone.

The information regarding each call will be entered into a database. The data to be entered include: an acoustic encounter identification number; whether it was linked with a visual sighting; date and time when first and last heard, and whenever any additional information was recorded; position and water depth when first detected; bearing, if determinable; species or species group, types and nature of sounds heard (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.); and, any other notable information.

Thermal Imaging Cameras. Thermal imaging cameras will be utilized during hours of darkness to assist with nighttime ramp up pre-clearance searches. The dual camera system enables consistent visual monitoring in low visibility and night time conditions. Real-time monitoring stations can be set up on the vessel and/or image data can be recorded for later playback analysis. The camera system consists of two modules: a High Definition (HD) camera and a thermal imaging camera configured for maritime use with pan and tilt functionality. The system uses Seiche proprietary software Real-Time Automated Distance Estimate at Sea (RADES) to stabilize image and enable accurate distance estimation. Various configuration options are available to ensure optimal visual coverage of up to 360 degrees. Three Cameras would be installed for full 360 degrees coverage. In addition, Buffer and Exclusion Zone distances can be overlaid onto thermal images to assist in monitoring wildlife within impact zones.

Platform Based Monitoring. To achieve complete observation of both the Exclusion and Buffer Zones, additional monitoring will be implemented from Project platforms during active sound source operations, as necessary based on the presence and density of marine wildlife observed. PSOs stationed on platforms will be in direct contact with PSOs stationed on the survey vessel through VHF radios or cell phones, whichever provides better service based on the survey vessel's location. The PSO on duty will be stationed on the highest deck (i.e., helideck or approximately 100 feet [37 meters] above sea level) of the platform where he/she can safely monitor the entire range of the Exclusion and Buffer Zone. In addition, PSOs will be able to monitor the behavior and reactions of pinnipeds in the water adjacent to the platform during active sound source operations. If a PSO on a platform should observe marine wildlife within the Buffer or Exclusion Zone of the survey vessel, the monitor will immediately report that observation to the on duty PSO on the survey vessel. The vessel-based PSO will notify the vessel operator and/or survey team, who will shut-down the survey operations, slow the vessel and/or change course in order to avoid contact, as deemed necessary by the PSO, unless those actions will jeopardize the safety of the vessel or crew. The path of the marine animal will be closely monitored to determine when it has safely passed through the designated impact zone. Daily observation records will be cross-referenced between the platform and vessel-based PSOs field reports to ensure observations are not duplicated.

Equipment Shut Downs. The operating sound source(s) will be shut down completely if a marine mammal approaches or enters the Exclusion Zone to reduce exposure of the animal to less than radius of the Exclusion Zone. Full sound source array activity will not resume until the marine mammal or turtle has cleared the Exclusion Zone in accordance with the criteria above.

When four shut downs occur for mysticete whales (low-frequency cetacean) in the Exclusion Zone, a Project review will be initiated immediately with the BSEE and NMFS to assess the safety of Project area conditions. The two agencies will be notified within twenty-four hours of the fourth consecutive shut down, however the survey activity may proceed while the agencies assess the situation, unless otherwise directed by the agencies.

Special-Status Species Shutdowns. If at any time an endangered species (i.e. blue whale, fin whale, humpback whale, sei whale, north pacific right whale, or sperm whale) is visually or acoustically detected at any distance, the PSO and/or PAM operator on duty will call for the immediate shut down of the seismic acoustic source. When the PSO or PAM operator on duty confirms that no marine mammal has been detected within the 3,280 feet (1000 meter) Buffer Zone for at least a 30-minute period, a ramp up can commence, and survey operations can continue.

Delphinoid and Pinniped Shutdowns and Ramp ups. No mitigation action will be required if delphinoids (members of the family Delphinidae) or pinnipeds (otariids and/or phocids) are visually observed to be "voluntarily approaching" the survey vessel or towed seismic equipment. A voluntary approach is defined as a clear and purposeful approach toward the vessel by a dolphin or pinniped at a speed and vector that indicates the animal(s) intends to approach the vessel (BOEM 2014). NMFS (2001, p.9293) states that an exposure to a specific activity that does not disrupt an animal's normal behavioral pattern should not require a take authorization. Therefore, a delphinoid or pinniped voluntarily approaching the survey vessel during acquisition would not be considered to display an adverse behavioral reaction that is significant enough to constitute a disturbance. A shutdown will be observed when a delphinoid or pinniped is:

- Visually detected not exhibiting a travelling behavior. If animals are stationary for any reason and the vessel approaches the animals then a shutdown will occur (NMFS, 2017); or
- Acoustically detected entering the exclusion zone and a visual observation to determine the dolphin's intent is not possible.

If a delphinoid or pinniped comes within 10 meters (32 feet) of the seismic acoustic source where received sound levels are estimated to be ≥185 dB (mid-frequency cetacean PTS criteria) then a shutdown will commence immediately. A ramp-up will be initiated when the animal is confirmed to have moved at least 10 meters (32 feet) away from the source. Full power will resume when the PSO and/or PAM operator can confirm the dolphins or otariid pinniped have left the 500 meters (1,640 feet) Exclusion Zone or are engaged in bow riding or wake riding.

In addition, no shut down will be required for pinnipeds if they are hauled out on or in the water adjacent to Beta platforms within the survey area. If a otariid pinniped comes within 10 meters (32 feet) of the seismic acoustic source where received sound levels are estimated to be ≥203 dB (otariid PTS criteria) then a shutdown will commence immediately. A ramp-up will be initiated when the animal is confirmed to have moved at least 10 meters (32 feet) away from the source, or the vessel has moved greater than 10 meters (32 feet) from the associated platform. These measures are proposed in an effort to reduce the cumulative sound energy input into the marine environment, decrease the total duration of active surveys, and therefore, reduce the total impact to marine wildlife populations in the region.

Ramp Up of Equipment. The ramping up of the sound source array provides a gradual increase in sound levels, and involves a step-wise increase in the number and total volume of sound sources firing until the full volume is achieved. The purpose of a ramp up (or soft start) is to "warn" cetaceans, pinnipeds and other sensitive wildlife in the vicinity of the array by generating lower level noise thus providing the animals time for them to leave the area and thus avoid any potential injury or impairment of their hearing abilities.

Anytime survey operations require an increase in noise/energy production, the survey operator will ramp up the sound source cluster slowly (6 dB/5 min). Full ramp ups (i.e., from a cold start after a shut down, when no sound sources have been firing) will begin by firing a single sound source in the array. The minimum duration of a shut-down period, which must be followed by a ramp up, is typically the amount of time it will take the source vessel to travel across the Exclusion Zone. Full power will be obtained no sooner than 30 minutes from restarting the equipment.

A full ramp up, after a shut down, will not begin until there has been a minimum of 45 minutes of observation of the Exclusion Zone with no marine mammals or turtles present. The entire Exclusion Zone must be visible during the 45-minute lead-in to a full ramp up. If the entire Exclusion Zone is not visible, then ramp up from a cold start cannot begin. If a marine mammal(s) or turtle is sighted within the Exclusion Zone during the 45-minute watch prior to ramp up, ramp up will be delayed until the marine mammal(s) or turtle are sighted outside of the Exclusion Zone or the animal(s) has/have not been sighted for at least 30 minutes for small odontocetes and pinnipeds, or 45 minutes for baleen whales and large odontocetes. PSOs will be on duty during both day and night 45-minute observation periods prior to and during ramp-ups. The seismic operator and PSOs will maintain records of the times when ramp-ups start, and when the sound source arrays reach full power.

Entanglement. To minimize the risk of entanglement with marine wildlife, lines and cables necessary to perform the survey tasks will be left in the water only as long as necessary to perform the task and then be retrieved back on deck. All other non-essential lines and cables will be kept clear of the water when not in use. All lines and cables will be kept as short as possible and with a minimum amount of slack. In addition, while the sound source array is being deployed, the survey vessel speed will be limited to two knots. Line and cables associated with the sound source array and autonomous nodal system will be greater than 0.25 inches (0.64 centimeters) in diameter or will be modified to increase the diameter and rigidity of the lines.

The seafloor nodal system is autonomous and would not require electrical cable connection for operation, though nodes are physically tethered together by cable/rope, which dimensions would be approved by NMFS to reduce the likelihood of entanglement. Autonomous nodes would be deployed and recovered by the M/V *Clean Ocean* utilizing commercial deployment methods.

Marine Wildlife Carcasses. If an injured or dead marine mammal, turtle or bird is sighted within an area where sound sources had been operating within the past 24 hours, the array will be shut down immediately. Activities can resume after the lead PSO has (to the best of his/her ability) determined that the injury resulted from something other than Project survey operations. After documenting those observations, including supporting documents (e.g., photographs or other evidence), the operations will resume. Within 24 hours of the observation, the vessel operator will notify NMFS and provide them with a copy of the written documentation.

If the cause of injury or death cannot be immediately determined by the lead PSO, the incident will be reported immediately to either the NMFS Office of Protected Resources or the NMFS Southwest Regional Office. The sound source array shall not be restarted until NMFS is able to review the circumstances, make a determination as to whether modifications to the activities are appropriate and necessary, and has notified the operator that activities may be resumed.

Field Data Recording, Verification, Handling, and Security. Information to be recorded by onboard PSOs will include data which has been documented during recent monitoring programs associated with other marine geophysical surveys completed offshore California. When a mammal sighting is made, the following information about the sighting will be recorded:

- Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if determinable), bearing and distance from sound source array, apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and pace;
- Time, location, speed, and activity of the vessel, sea state, and visibility; and,
- The positions of other vessel(s) near the observer location.

The ship's position, speed of the vessel, water depth, sea state, and visibility will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a substantial change in any of those variables.

The PSOs will record their observations onto datasheets or directly into handheld computers. Between watches and during periods when operations are suspended, those data will be entered into a laptop computer running a custom computer database. The accuracy of the data entry will be verified in the field by computerized validity checks as the data are entered, and by subsequent manual checking of the database printouts against the original raw data on the field sheets. These procedures will allow initial summaries of data to be prepared during and shortly after the field season, and will facilitate transfer of the data to statistical, graphical, or other programs for further processing. Quality control of the data will be facilitated by: (1) the start-of-season training session; (2) subsequent supervision by the onboard field crew leader; and, (3) ongoing data checks during the field session.

Acoustic Monitoring Data. Each vocalization detected by the PAM operator will be entered into a database that will include: a unique acoustic encounter identification number; whether the vocalization was linked to a visual sighting; date and time when vocalization was first and last heard; position and water depth when vocalization was first detected; bearing from the vessel, if determinable; species or species group, if possible; type(s) and nature of sounds (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses) and strength of signal; and, any other notable information. Each vocalization sound will be recorded on the computer for further analysis.

The data will be backed up regularly onto USB or external hard drives, and stored at separate locations on the vessel. If possible, data sheets will be photocopied daily during the field season. Data will be secured further by having data sheets and backup data compact discs carried back to the shore during crew rotations.

Field Reports. Throughout the Project, PSOs will prepare a weekly report, summarizing the results of the monitoring program throughout the progression of the Project. The reports will summarize the species, numbers of marine wildlife sighted and levels of harassment marine wildlife are exposed to, and any required actions taken. These reports will be provided to Beta, NMFS, and BOEM.

Final Monitoring Report. A monitoring report will be prepared documenting the Project activities, observations of marine wildlife, and a summary of encounters with any marine wildlife and subsequent actions taken during the survey. The report will be prepared within 90 days of completion of offshore activities and submitted to Beta for dissemination to the required agencies.

The results of the vessel-based monitoring, including estimates of "take by harassment", and final technical reports will be presented within 30 days of the completion of the Project survey. Reporting will address the requirements established by NMFS and BOEM. The technical report(s) will include:

- Summaries of monitoring effort: total observational hours, total number of line miles of seismic data collection, and distribution of marine mammals and other sensitive wildlife through the study period accounting for sea state and other factors affecting visibility and detectability of marine mammals;
- Analyses of the effects of various factors influencing detectability of marine wildlife including sea state, number of observers, and fog/glare;
- Species composition, occurrence, and distribution of marine wildlife sightings including date, water depth, numbers, age/size/gender categories, and group sizes;
- Analyses of the effects of survey operations:
  - Sighting rates of marine wildlife during periods with and without survey activities (and other variables that could affect detectability);
  - Initial sighting distances versus sound source activity state;
  - Closest point of approach versus sound source activity state;
  - Observed behaviors and types of movements versus sound source activity state;
  - Numbers of sightings/individuals seen versus sound source activity state;
  - Distribution around the survey vessel versus sound source activity state; and
  - Total downtime if operations due to implementation of mitigation measures; and estimates of "take by harassment".
- Summaries of any correspondence with agencies that occurred during the survey activities and the results of those contacts;

- Geophone deployment activities and marine wildlife observations during deployment and recovery; and
- Summary of other species of interest observed during the Project survey.

3.3.10.2 Measures to Reduce Seafloor Impacts from Node Placement

- **Pre-Project Seafloor Clearance**
  - A pre-Project seafloor clearance will be conducted to confirm habitat type that the nodes will be placed on. In addition, this will provide information on what debris currently exists within the survey area.
- **Post-Project Seafloor Clearance**
  - A post-Project seafloor clearance will be completed by a remote operated vehicle (ROV) once the Project is complete and all nodes are removed from the seafloor. This seafloor clearance will aid in confirmation that no debris was left behind and to help access if damage occurred as a result of node placement.

3.3.10.3 Measures to Reduce Lighting Impacts

To minimize the potential for seabirds to be attracted to the vessel, lighting on the work areas will be directed inboard and downward. Where feasible, the vessel cabin windows will be equipped with shades, blinds or shields that block internal light during nighttime operations. In addition, the vessel will carefully contain and remove garbage and food waste to minimize attracting predatory and scavenging birds.

The onboard monitors will routinely inspect the vessel for birds that may have been attracted to the lighted vessel. The monitors shall make every effort for the vessel to maintain a distance of 300 feet from aggregations of feeding or resting marine birds. The monitors shall maintain a log of all birds found onboard the vessels which are incapacitated (dead or alive) and noting the status and health of birds upon retrieval and release. The log will be provided to BOEM when the Project has been completed.

If an injured bird is discovered on a vessel, the bird will be transported on the next returning work vessel to an approved wildlife care facility. The nearest approved wildlife care facility will be contacted upon transport of the bird. The incapacitated bird will be reported on the daily summary report, and added to a cumulative log, which will be sent to BOEM at the completion of the Project.

3.3.10.4 Measures to Reduce Potential Oil Spill Impacts

- **Beta Unit Oil Spill Prevention and Response.** All Project activities will be subject to the requirements and guidelines included within the "Beta Unit Complex (Platforms Elly, Ellen & Eureka, Beta Pipeline and Beta Pump Station) Oil Spill Prevention and Response Plan (OSPRP) - Revision 3" (2016), (Appendix H).
- **Vessel Specific Oil Spill Response Plan.** The geophysical survey will occur via the use of the M/V *Silver Arrow* or equivalent and will be subject to the requirements and guidelines included within the vessel-specific Oil Spill Response Plan.

- **Vessel Discharges.** All vessel discharges will comply with the requirements of the Clean Water Act under the USCG regulation including the proper treatment and monitoring of vessel effluents as necessary.

3.3.10.5 Measures to Reduce Potential Collision Impacts On Marine Wildlife

Because of the procedures described for Exclusion and Buffer Zones during survey operations and the slow speed at which the survey vessel will maintain during Project operations, collisions with marine wildlife are very unlikely. However, the potential exists for such collisions when transiting to the Project site by the survey vessel and support vessels. The following measures and procedures will be implemented to minimize the possibility of such collisions.

On-board personnel, including the onsite PSOs, will be watchful for marine mammals and turtles during transit and Project activities. Pinnipeds, the most common marine mammals within the vessel transit corridors, are “nimble” enough to avoid these vessels. Slower moving and surface dwelling turtles and larger cetaceans could potentially be affected. Blue and humpback whales are not common within the Project site and transit corridor. More common marine mammals in the Project area, such as dolphins and pinnipeds, would be agile enough to avoid vessels. Irrespective, all vessel operators shall observe the following guidelines:

- Make every effort to maintain the appropriate separation distance from sighted whales and other marine wildlife (e.g., sea turtles);
- Do not cross directly in front of (perpendicular to) migrating whales or any other marine mammal or turtle;
- When paralleling whales, vessels will operate at a constant speed that is not faster than that of the whales;
- Care will be taken to ensure that female whales are not be separated from their calves; and,
- If a whale engages in evasive or defensive action, vessels will reduce speed or stop until the animal calms or moves out of the area.

If a collision with a marine mammal or turtle occurs, the vessel operator must document the conditions under which the accident occurred, including the following:

- Location of the vessel when the collision occurred (latitude and longitude);
- Date and time;
- Speed and heading of the vessel;
- Observation conditions (e.g., wind speed and direction, swell height, visibility in miles or kilometers, and presence of rain or fog);
- Species of marine wildlife contacted;
- Whether an observer was standing watch for the presence of marine wildlife; and,

- Name of vessel, operator (the company), and captain or officer in charge of the vessel at time of accident.

Following an unanticipated strike, the vessel will stop if safe to do so. The vessel is not obligated to stand by and may proceed after confirming that it will not further damage the animal by doing so. The vessel will then communicate by radio or telephone all details to the vessel's base of operations. From the vessel's base of operations, a telephone call will be placed to the Stranding Coordinator, NMFS, Southwest Region, Long Beach, to obtain instructions (see below).

Alternatively, the vessel captain may contact the NMFS' Stranding Coordinator directly using the marine operator to place the call or directly from an onboard telephone, if available. It is unlikely that the vessel will be asked to stand by until NMFS or CDFG personnel arrive, but that will be determined by the Stranding Coordinator. Under the MMPA, the vessel operator is not allowed to aid injured marine wildlife or recover the carcass unless requested to do so by the NMFS Stranding Coordinator. The Stranding Coordinator will then coordinate subsequent action, including enlisting the aid of marine mammal rescue organizations, if appropriate.

Although NOAA Fisheries has primary responsibility for marine wildlife in both State and Federal waters, the CDFW will also be advised if an incident has occurred in State waters affecting a protected species. Reports will be communicated to the Federal and State agencies listed in Table 3.3-13.

Table 3.3-12. Collision Contact Information

Federal	State
Justin Viezbicke Stranding Coordinator NOAA Fisheries Service Long Beach, California (562) 980-3230	Enforcement Dispatch Desk California Department of Fish and Wildlife Los Alamitos, California (562) 598-1032

As proposed, and with the existing measures incorporated into the vessel operations, vessel strikes could, but are not likely to, affect Federally listed marine species.

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