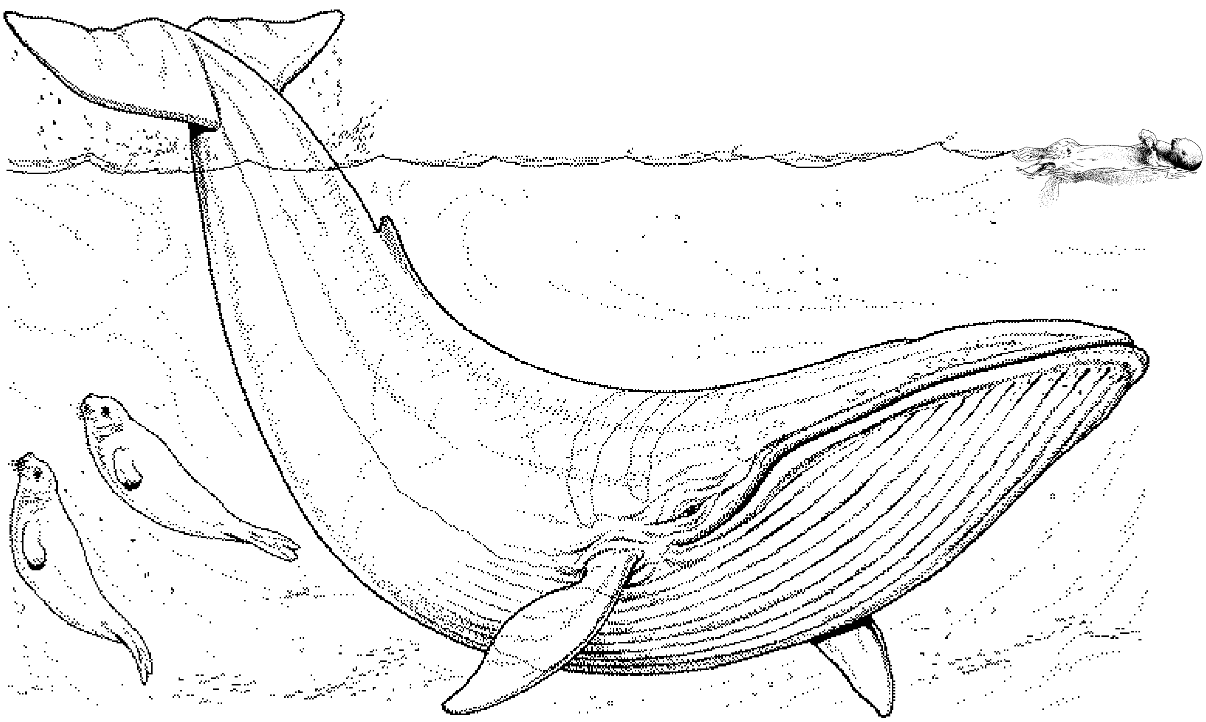
Revisions to the Point Pedernales Field Development and Production Plan Addition of Tranquillon Ridge Field

Biological Evaluation of Threatened and Endangered Species



Prepared for the National Marine Fisheries Service
and U.S. Fish and Wildlife Service
in Accordance with Section 7(c) of the Endangered Species Act of 1973,
as Amended

June 2008

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1.0 SUMMARY

Plains Exploration & Production Company (PXP) currently operates the Point Pedernales Unit, which includes all or portions of Leases OCS-P 0437, 0438, 0440, and 0441 on the federal outer continental shelf (OCS) in the southern Santa Maria Basin. The associated oil and gas drilling and production platform, Platform Irene, is located on (OCS) Lease P-0441. PXP is proposing the development of the adjacent Tranquillon Ridge field, which will encompass the following activities:

- The Tranquillon Ridge field would be developed from Platform Irene and includes hydrocarbon reserves located within adjacent State tidelands (<3 miles from shoreline).
- No new construction of offshore facilities is proposed. Minor modification of Platform Irene may be required.
- All oil and gas production from the Tranquillon Ridge field would be combined with Point Pedernales field production and transported to the Lompoc Oil and Gas Plant (LOGP) in existing pipelines. From LOGP, the combined oil production from the Tranquillon Ridge and the Point Pedernales fields would be transported to the Santa Maria Refinery via pipeline. The combined gas production would either be sold and transported via pipeline or used as fuel at the LOGP.
- No construction of new onshore facilities is proposed.
- Produced water from the Tranquillon Ridge field would be discharged to the ocean under the current National Pollutant Discharge and Elimination System (NPDES) permit or injected into an offshore geologic formation in accordance with MMS authorization.
- No geophysical (seismic) surveys are proposed for development of the Tranquillon Ridge field.
- PXP proposes to drill up to 17 development wells (14 extended-reach production and 3 utility) from Platform Irene. PXP expects drilling to begin in 2008. The PXP expects production from the Tranquillon Ridge field to begin in 2008 and last up to 15 years.
- PXP estimates that they will be able to produce 103 million barrels of oil and 40 to 50 billion standard cubic feet of gas in the 15 year timeframe.
- PXP estimates that production from the Tranquillon Ridge field will peak at around 30,000 barrels (bbl)/day of oil and 7 million standard cubic feet (MMscf)/day of gas.

This biological evaluation focuses on federally threatened and endangered species that may occur in the project area and potential effects from the proposed development of the Tranquillon Ridge field. A listing of species reviewed in this biological evaluation and the corresponding agency of oversight for each species is included as Appendix A of this report.

The primary impact-producing activities associated with the proposed development of the Tranquillon Ridge field include drilling and production operations and their associated support activities. For listed species, potential impacting agents expected from these proposed activities are noise and disturbance, platform discharges (including produced water), and accidental oil spills.

The analysis of potential impacts associated with PXP's proposal to develop the Tranquillon Ridge field indicates that the potential of accidental oil spills may affect threatened and endangered species. The most likely size of a spill is less than 200 bbl.

Threatened and Endangered Species That May be Affected by the Proposed Project

The analysis in this biological evaluation indicates that the following threatened and endangered species may be affected by the proposed development of the Tranquillon Ridge field:

> Blue whale, Humpback Whale, Fin Whale, Southern Sea Otter, California Least Tern, Western Snowy Plover, Brown Pelican, and the Leatherback Sea Turtle.

As a result, the Minerals Management Service (MMS) is formally consulting with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) pursuant to requirements under section 7(c) of the Endangered Species Act.

2.0 PURPOSE

Section 7(c) of the Endangered Species Act (ESA), as amended, requires that a federal agency to consult with NMFS and or FWS if its actions may affect a threatened or endangered species. When threatened or endangered species are believed to be present in the proposed project area, the federal agency may prepare a Biological Evaluation to evaluate potential effects of the proposed action and determine whether these effects are likely to adversely affect threatened or endangered species.

In support of this process, MMS has prepared this biological evaluation of the proposed Tranquillon Ridge field project. The project will be developed using an existing platform (Irene) and pipelines and will not result in any new construction other than installation of a new electric pump for muds handling, replacement and upgrade of several existing shipping pumps, and associated minor deck modifications. Therefore, this biological evaluation describes the project, identifies those threatened and endangered species most likely to be affected by the action, identifies potential impact sources, and analyzes potential effects, including cumulative effects.

This document has been prepared to assist the NMFS and FWS in fulfilling their requirements under Section 7(c) of the ESA.

3.0 DESCRIPTION OF PROPOSED ACTION

This section presents an overview of Plains Exploration and Production’s (PXP) proposed development project for the Tranquillon Ridge field and includes a discussion of drilling operations, associated manpower and transportation requirements, and a proposed schedule for activities.

3.1 OVERVIEW OF PROPOSED ACTION

To develop the Tranquillon Ridge field, PXP has requested approval to drill up to 14 extended-reach production wells and 3 utility wells into State tidelands from the existing Point Pedernales Unit Platform, Irene. Platform Irene is located immediately to the north and west of the field, respectively (Figure 3.1).

No new facilities or major equipment will be required to develop the Tranquillon Ridge field. Drilling of the field wells and production of the resources is expected to last 15 years

3.2 PROPOSED DRILLING/PRODUCTION ACTIVITIES

PXP expects to drill development wells into the Tranquillon Ridge field from Platform Irene using extended-reach drilling (ERD) technology. Platform Irene is located in 73.7 m (242 ft) of water on Lease OCS-P 0441 in the adjacent Point Pedernales Unit, approximately 7.56 km (4.7 mi) from the mainland; its exact location is 34°28.1'N/120°40.8'W. There are 72 slots on the platform, of which 12 are currently in use for development of the Point Pedernales field.

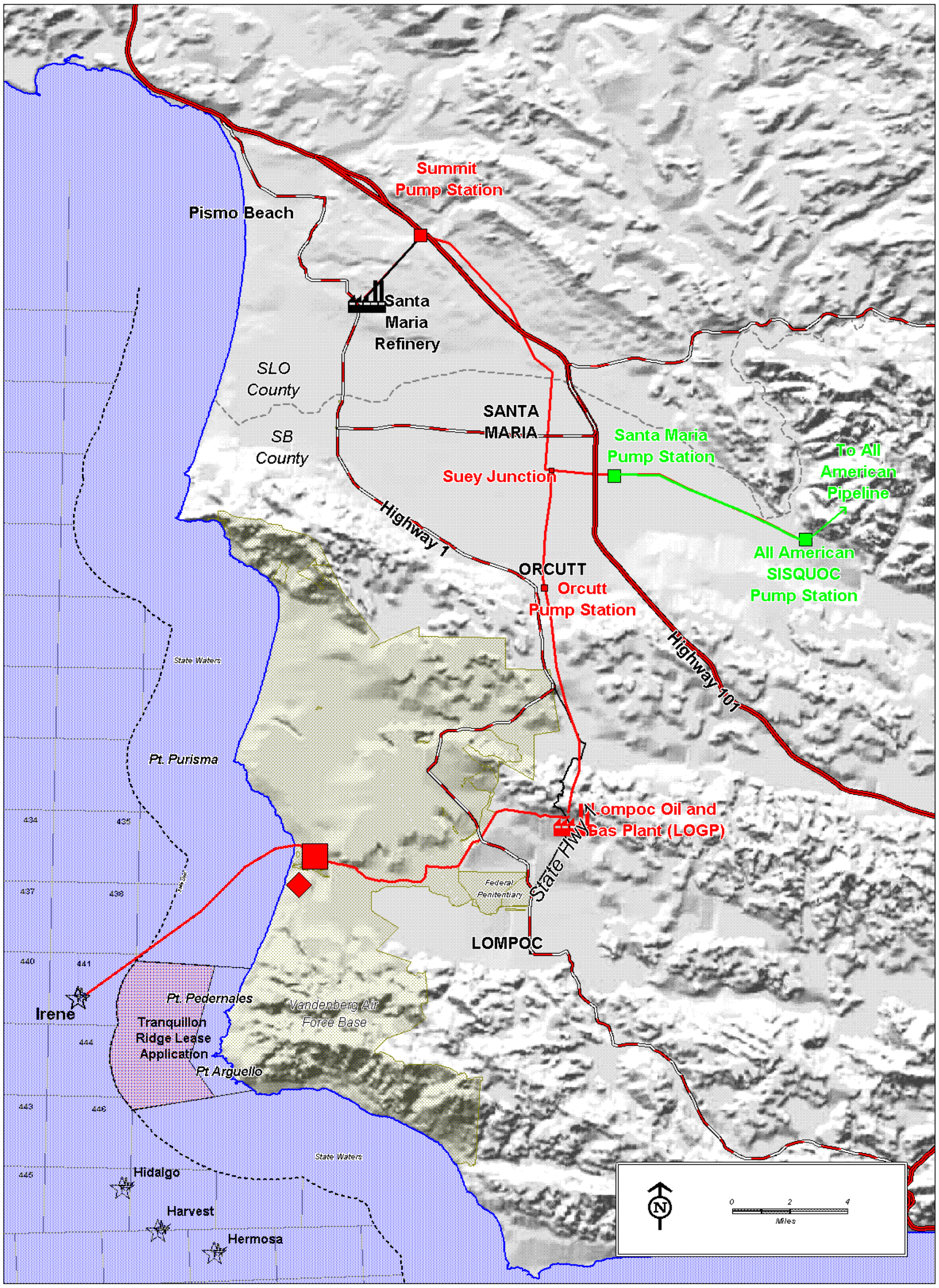
The proposed development wells would be drilled from Platform Irene to bottom well locations in State waters. All of the wells will be drilled using existing well slots on the platform. Total measured well lengths for the 14 wells will range from 12,000 to over 25,000 feet, with vertical depths below the ocean surface averaging between three and five thousand feet (3,000-5,000 feet).

The proposed drilling program sequence includes rig installation and necessary platform modifications, drilling and tripping operations, setting the well casing, well logging, and well completion and testing. Drilling each well is estimated to require 2 to 4 months. Under the current schedule for the Tranquillon Ridge field, the first production well will be spudded during the second or third quarter of 2008, and drilling activities are expected to continue for 15 years. Production is expected to begin in the third or fourth quarter of 2008 and last up to 15 years.

Drill Muds and Cuttings. During drilling operations, a mud system is used to control formation pressure, lubricate the drill pipe and bit, and return drill cuttings to the surface. These muds comply with the current, existing Pollution Discharge Elimination System (NPDES) permit for operations at Platform Irene (EPA 2000a, b).

The discharge of drilling muds to be used for the proposed Tranquillon Ridge field drilling program will comply with the General Permit requirements. Under the permit, Platform Irene is authorized to discharge up to 30,000 bbls of cuttings and 105,000 bbl of drilling muds/fluid per year. The PXP estimates that 42,812 bbls of cuttings and 180,737 bbls of drilling muds/fluid will be discharged during the multi-year, 17-well drilling program for the proposed project. Oil based muds will likely be used for drilling the longer, more horizontal portions of the wells. Any oil based muds or muds containing additives not approved by EPA, or containing additives in concentrations above EPA limits will be transported ashore for disposal or they may be reinjected down disposal wells, subject to approval by MMS.

Figure 3.1 Location of Tranquillon Ridge Field in Relation to Other OCS Units Off Pt. Arguello.



Produced Water. Oil and gas production from the Tranquillon Ridge field would be combined with the Point Pedernales field production and transported to the Lompoc Oil and Gas Plant (LOGP) in existing pipelines. Approximately 1.26 million gallons (40,000 barrels) per day (MGD) of water produced from Point Pedernales and Tranquillon Ridge combined will be shipped from the LOGP to Platform Irene for discharge. Produced water generated by the Tranquillon Ridge field development will be discharged in accordance with the existing NPDES General Permit. Under the permit, Platform Irene is authorized to discharge up to 55,845,000 bbl of produced water per year, which equates to an average of 50,000 barrels per day. Part of the produced water that will be shipped to Platform Irene may still be injected into Point Pedernales reservoir wells, as is currently the operation, or also into Tranquillon Ridge utility wells. Offshore water injection will be conducted as authorized by the MMS.

Support Activities. Personnel requirements for the Tranquillon Ridge field will necessitate additional helicopter and supply boat trips during each drilling phase. While helicopter routes in the past have originated in Lompoc, they now originate from Santa Maria Airport and pass to the north of restricted air space area R-2516 over Vandenberg Air Force Base (VAFB). The present flight path is designed to limit flights over urban areas and sensitive wildlife areas on VAFB. Development of the Tranquillon Ridge field under routine production operations will increase the number of roundtrip flights by about 4 percent from 12.6 flights per week (2005 levels) to 13.1 flights per week. During drilling operations, the number of roundtrip helicopter flights will increase to an average of 42.1 flights per week.

The proposed project would increase supply boat traffic servicing Platform Irene only during drilling operations. Supply-boat traffic would increase approximately 12 percent, from the current average of 4.5 roundtrips per month to 5 roundtrips per month. The drilling rig and equipment, rig supplies, and bulk drilling mud and cement materials for the project will be transported to Platform Irene by supply boat from Port Hueneme.

4.0 PROTECTED SPECIES

4.1 SPECIES EXCLUDED FROM THIS ANALYSIS

Over 50 federally threatened and endangered species are known to occur or may occur in coastal Ventura, Santa Barbara, and San Luis Obispo counties and the surrounding waters. However, a number of these species are unlikely to be affected by any of the activities associated with the development of the Tranquillon Ridge field. Therefore, after reviewing the relevant literature and consulting with area experts, we have identified the following federally listed species for exclusion from this analysis:

4.1.1 Wildlife

Morro Bay kangaroo rat (*Dipodomys ingens*). No onshore facilities are proposed for this project, and this species' current habitat would not be subject to either direct or indirect effects from a project-related oil spill.

California coastal gnatcatcher (*Polioptila californica californica*). No onshore facilities are proposed for this project, and this species' current habitat would not be subject to either direct or indirect effects from a project-related oil spill.

The marbled murrelet (*Brachyramphus marmoratus*). This small, secretive seabird was listed as threatened in 1992 by the FWS. It inhabits the pacific coast of North America from the Bering Sea south to the Santa Cruz mountains. The marbled murrelet is an unusual member of the auk family, staying close to shore when at sea, and nesting up to 70km inland in old growth forests. There are approximately 1,000 murrelets remaining in central California; the next closest population is located 3,000 kilometers away, off of the Humboldt County coast in northern California.

Recent radio-telemetry studies have uncovered that although the foraging range of breeding marbled murrelets is less than twenty-five kilometers, several birds have been tracked nearly 200 kilometers south, down to the southern end of the Monterey Bay National Marine Sanctuary near Pt. Piedras Blancas. The birds were presumably traveling a considerable distance for some predictable food source. Little is known of the at-sea distribution or seasonal occurrence of marbled murrelets in this area; however, their numbers at this southern extreme appear to be limited. Although marbled murrelets may migrate long distances and enter the project area at the southern end of their range, critical areas of their habitat, such as the old growth forests where they breed within or near the project area. Therefore, the Tranquillon Ridge field project activities are not likely to affect this species.

Island night lizard (*Xantusia riversiana*). This species is an island endemic found on three of the southern Channel Islands (San Clemente, San Nicolas, and Santa Barbara Islands). Its habitat would not be subject to either direct or indirect effects from a project-related oil spill.

Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*). Although the unarmored threespine stickleback is listed as present in San Antonio and Canada Hondo Creeks within Vandenberg AFB. Studies on the biology of California sticklebacks suggest that a slow continuous flow of water in a headwater stream, isolated, except during rainy periods, from the ocean by stretches of dry streambed, is necessary for this particular form to thrive. This stickleback avoids zones of swift current and those without any current (FWS, 1980a). Unarmored threespine sticklebacks reproduce throughout the year in freshwater areas with substantial aquatic vegetation and gentle flow of water where males establish and vigorously defend territories. Field studies on the populations in both San Antonio and Canada Hondo Creeks by Dr. Jonathan Baskin indicate that this species is not located within the project area. During rainy periods or during the time freshwater floods to the ocean, California unarmored sticklebacks in San Antonio Creek remain isolated upstream in microhabitats of slow or negligible water flow and are not present at the ocean-creek boundary (FWS, 1985). According to Swift et al. (1993), the population in Canada Hondo Creek was transplanted from San Antonio Creek and is located several miles upstream from the Pacific Ocean. Unpublished genetic studies on the population in San Antonio and Canada Hondo Creeks suggest that they are not the *G. a. williamsoni* subspecies (Jonathan Baskin, Cal Poly Pomona, pers. comm., 2005). The September 1997, 163 bbl, Torch pipeline spill washed ashore along a length of Santa Barbara County including the mouth of both Canada Hondo and San Antonio Creeks. Immediate assessment and surveillance at the time of the oil spill from the beach up both creeks by Jessica Altstatt of the Santa Barbara ChannelKeeper revealed no sticklebacks at or near the ocean-creek interface and none for as far up the creeks as she surveyed. Although this species may reside in two creeks within Vandenberg AFB, the MMS maintains that the unarmored threespine stickleback is not within the project area where they would be impacted by direct or indirect effects from project-related activities or an oil spill.

North American green sturgeon (*Ambystoma medirostris*). The southern distinct population (SDP) of the North American green sturgeon (*Ambystoma medirostris*) was listed as threatened in July 2006 (NMFS, 2006a). The SDP is comprised of those sturgeon that spawn in rivers and estuaries south of the Eel River. Within this population segment, a majority of spawning adults are concentrated in the Sacramento River. Green sturgeon are anadromous; they live much of the time in marine waters, but return to fresh water (rivers) to spawn. Additionally, young green sturgeon may remain in freshwater rivers and streams for the first few years of their lives before traveling out to sea. Although green sturgeon are a highly migratory species and travel widely at sea, critical areas of their habitat, such as the rivers and estuaries where they spawn and gather do not occur within the project area. Therefore, the Tranquillon Ridge field project activities are not likely to affect this species.

Santa Ana sucker (*Catostomus santaanae*). The Santa Ana sucker was listed as threatened under the Endangered Species Act on April 12, 2000. The FWS has designated critical habitat for the Santa Ana Sucker (in three noncontiguous populations) in the Santa Ana River in San Bernardino, Riverside, and Orange counties; the San Gabriel River in Los Angeles County; and lower Big Tujunga Creek, in Los Angeles County. The Santa Clara River and estuary system also supports a population of Santa Ana suckers, but this population is outside the species' native range and is regarded as introduced and was not designated as threatened pursuant to the Act by FWS. Consequently, this species' current, native range is not in the area of concern for the Tranquillon Ridge field project activities.

Morro shoulderband snail (*Helminthoglypta walkeriana*). The Morro shoulderband snail was listed as endangered on January 17, 1995. It is found in the Los Osos area near Morro Bay, usually within or near coastal dune scrub vegetation. However, an oil spill would not impact the habitat of this species, and any clean-up efforts would avoid the established coastal dunes and scrub vegetation that make up its habitat.

4.1.2 Plants

The habitats of the following Channel Islands endemic plants would not be subject to either direct or indirect effects from a project-related oil spill:

- Hoffmann's rock-cress (*Arabis hoffmannii*),
- Santa Rosa Island manzanita (*Arctostaphylos confertiflora*),
- Island barberry (*Berberis pinnata* ssp. *insularis*),
- Soft-leaved paintbrush (*Castilleja mollis*),
- Santa Cruz Island dudleya (*Dudleya nesiotica*),
- Island bedstraw (*Galium buxifolium*),
- Hoffmann's slender-flowered gilia (*Gilia tenuiflora* ssp. *hoffmannii*),
- Island rush-rose (*Helianthemum greenei*),
- Santa Cruz Island bushmallow (*Malacothamnus fasciculatus* ssp. *nesioticus*),
- Santa Cruz Island malacothrix (*Malacothrix indecora*),
- Island malacothrix (*Malacothrix squalida*),
- Island phacelia (*Phacelia insularis* ssp. *insularis*),
- Santa Cruz Island fringepod (*Thysanocarpus conchuliferus*), and
- Santa Barbara Island liveforever (*Dudleya traskiae*).

The habitats of the following mainland plants would not be subject to either direct or indirect effects from a project-related oil spill:

- Gaviota tarplant (*Deinandra increscens ssp. villosa*),
- La Graciosa thistle (*Cirsium loncholepis*),
- Lompoc yerba santa (*Eriodictyon capitatum*),
- Morro manzanita (*Arctostaphylos morroensis*),
- Marsh sandwort (*Arenaria paludicola*),
- Nipomo Mesa lupine (*Lupinus nipomensis*),
- Pismo Clarkia (*Clarkia speciosa* ssp. *immaculata*).

4.2 MARINE MAMMALS

The following marine mammals are considered in this evaluation:

4.2.1 Blue Whale (Endangered)

Status. The blue whale (*Balaenoptera musculus*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. The blue whale recovery plan was finalized in 1998, (NMFS, 1998). The main reason for listing was a severe worldwide population decline due to intensive commercial whaling. The current population worldwide remains unknown; however, the eastern pacific population, which frequents the waters off California, has been estimated at slightly over 2,100 individuals.

Range and Habitat. The largest of all animals, blue whales are distributed worldwide in circumpolar and temperate waters and inhabit both coastal and pelagic environments (Leatherwood et al., 1982; NMFS, 1998). Like most baleen whales, they migrate between warmer waters used for breeding and calving in winter and high-latitude feeding grounds where food is plentiful in the summer. In the eastern North Pacific, blue whales are found from the Gulf of Alaska south to at least Costa Rica (NMFS, 1998; Mate et al., 1999). Rice (1992) concluded that the California population is separate from that in the Gulf of Alaska and the eastern Aleutians, and this view is supported by other recent work (Barlow, 1995; Calambokidis and Steiger, 1995; Calambokidis et al., 1995).

The eastern North Pacific stock of blue whales feeds off California in summer and fall, and migrates to Mexico to breed and calve in winter and spring. Blue whales occur along the west coast of Baja California from March through July (Gendron and Zavala-Hernández, 1995). They are first observed in Monterey Bay, around the Channel Islands, and in the Gulf of the Farallones in June-July, and are present on the continental shelf in these areas from August to November (Calambokidis et al., 1990; Calambokidis, 1995; Larkman and Veit, 1998; NMFS, 1998; Mate et al., 1999). Based on sighting data collected off southern California from 1992 through 1999 by Cascadia Research Collective (Cascadia Research, unpubl. data), blue whales tend to aggregate in the Santa Barbara Channel along the shelf break (seaward of the 200-m line). Sighting frequencies were highest west of San Miguel Island and along the north sides of San Miguel, Santa Rosa, and the western half of Santa Cruz Island.

It is known that some blue whales do migrate south to Mexican waters in the fall, reaching waters off Baja California in October; calving may occur in subtropical waters farther to the south or offshore (Rice, 1974; NMFS, 1998). Some blue whales apparently remain in lower latitudes, such as waters off Central America and in the Gulf of California, year-round (Leatherwood et al., 1987; Bonnell and Dailey, 1993). Data from radio-tracking experiments indicate that blue whales feeding off California in the summer winter in the vicinity of the Costa Rican Dome (Mate et al., 1999; Stafford et al., 1999), supporting the hypothesis of Reilly and Thayer (1990) that blue whales may select winter habitat suitable for feeding. Mate et al. (1999) hypothesize that, given their larger size and higher absolute energy requirements, blues whales may not be able to fast through the winter reproductive season (as gray and humpback whales do).

Reproduction. In the North Pacific, mating occurs on the wintering grounds from October-November through February or March (Mizroch et al., 1984a). Gestation lasts approximately 10-12 months, and calves are weaned at 6-7 months of age (Leatherwood et al., 1982; NMFS, 1998). Females may calve as often as every 2 to 3 years (Mizroch et al., 1984a). Age at sexual maturity is thought to be 5-15 years (Mizroch et al., 1984a; Yochem and Leatherwood, 1985).

Diet. Blue whales are filter feeders that feed primarily on a variety of euphausiids. In the North Pacific, predominant prey species include *Euphausia pacifica* and *Thysanoessa spinifera* (Rice, 1986; Schoenherr, 1991). *Thysanoessa inermis*, *T. longipes*, *T. raschii*, and *Nematoscelis megalops* also have been reported as prey in the North Pacific (Kawamura, 1980; Yochem and Leatherwood, 1985; NMFS, 1998). Off Baja California, blue whales have also been observed to eat pelagic red crabs (*Pleuroncodes planipes*) (Leatherwood et al., 1982; Rice, 1986). In the Santa Barbara Channel, Croll et al. (1998) recorded blue whales diving to depths where krill concentrations were most dense (mean = 68.1 ± 57.5 m).

Population Status. Blue whales were heavily exploited by commercial whalers following the introduction of modern whaling equipment and techniques in the late19th century. Worldwide, the blue whale population was reduced from a pre-exploitation estimate of 228,000 animals to less than 10,000 (Brownell et al., 1989). The pre-exploitation population of blue whales in the North Pacific has been estimated at 4,500-5,000 animals (Braham, 1984; Leatherwood, et al., 1987). No reliable population estimate exists for the North Pacific, except for the population that summers off California (NMFS, 1998). More than 700 individual blue whales had been photo-identified in California and Mexican coastal waters through 1993 (Calambokidis, 1995), and the best estimate for this stock is 2,134 blue whales (CV = 0.27; NMFS, 1998). Mate et al. (1999) hypothesized that these animals may constitute the largest remnant blue whale population in the world. Although the population appears to be growing, the observed increase in blue whale abundance off California during the past two decades is considered to have been too large to be explained by population growth alone and may be due to a shift in their distribution (Barlow et al., 1997; NMFS, 1998).

4.2.2 Fin Whale (Endangered)

Status. The fin whale (*Balaenoptera physalus*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. The latest draft fin whale recovery plan was issued in 2006, (NMFS, 2006a). The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. The second largest cetaceans, fin whales are distributed worldwide. NMFS recognizes three stocks in U.S. Pacific waters: Alaska; California, Oregon, and Washington; and Hawaii (Mizroch et al., 1984b; Barlow et al., 1997; Hill et al., 1997; NMFS, 2006a). According to Rice (1974), the summer distribution of fin whales includes immediate offshore waters throughout the North Pacific, from central Baja to Japan and north to the Chukchi Sea. Numbers in these areas peak in late May-early July. In recent years, fin whales have occurred year-round off central and southern California, with peak numbers in summer and fall (Dohl et al., 1981, 1983; Barlow, 1995; Forney et al., 1995). In the Southern California Bight, summer distribution is generally offshore and south of the northern Channel Island chain, particularly over the Santa Rosa-San Nicolas Ridge (Leatherwood et al., 1987; Bonnell and Dailey, 1993). Since fin whale abundance decreases in winter/spring off California (Dohl et al., 1981, 1983; Forney et al., 1995) and Oregon (Green et al., 1992), the distribution of this stock probably extends outside these waters seasonally.

Fin whale migratory behavior in the eastern North Pacific appears to be complex, with either inshore-offshore or north-south movements depending on individual's age, reproductive status, or "stock" affinity (NMFS, 2006a). Evidence from serological studies (Fujino, 1960) and field observations (Brueggeman et al., 1987; Stewart et al., 1987a) indicates that fin whales migrate back to the same feeding areas each year. Analysis of data from several studies of humpback whale distribution (Nasu, 1974; Dohl et al., 1983; Brueggeman et al., 1987) shows the relationship of fin whales to the continental shelf, particularly near submarine canyons in Alaska and the shelf break in California and Alaska. These are areas that presumably feature seasonal convergence zones where upwelling occurs, resulting in high prey concentrations for feeding whales (Green et al., 1989).

Reproduction. Fin whales breed during the winter, from November through March, in lower latitude oceanic waters (generally between 20° and 40°N), although wintering grounds have not been precisely defined (Rice, 1974; Haug, 1981). The gestation period lasts about 11 months, and calves are usually weaned on the feeding grounds at 6-7 months of age (Leatherwood et al., 1982; Bonnell and Dailey, 1993). Although apparently capable of calving every year, females often rest one or more years between pregnancies (Leatherwood et al., 1982). Sexual maturity apparently occurs at 10 years of age or greater in populations near carrying capacity, and possibly as early as 6-7 years of age in exploited populations (Gambell, 1985b).

Diet. In the North Pacific, fin whales feed primarily on euphausiids (including *Euphausia pacifica*, *Thysanoessa longipes*, *T. spinifera*, and *T. inermis*) and large copepods (mainly *Calanus cristatus*). They also feed to a lesser extent on schooling fish such as herring, walleye pollock, capelin, and lanternfish, and occasionally on squid (Nemoto, 1970; Kawamura, 1982; Leatherwood et al., 1982). Several euphausiid species known to be important to North Pacific fin whales occur only in waters less than 300 m deep (Nemoto and Kayusa, 1965, cited in Green et al., 1989).

Population Status. The world population of fin whales before exploitation may have been as high as 500,000 animals (Gambell, 1985a). Due to their strength and speed, fin whales were not effectively harvested by early whalers, but came to be intensively hunted with the development of modern whaling equipment and techniques in the late 1800's (Tonnesson and Johnsen, 1982; Webb, 1988). By 1976, when fin whales were protected from commercial harvest, the world population had been reduced to approximately 103,000-122,000 animals (Gambell, 1985a).

The pre-exploitation population of fin whales in the North Pacific has been estimated at 42,000-50,000 animals (Ohsumi and Wada, 1974; Tillman, 1975; Allen, 1980). Recent estimates range between 7,890 and 20,000 animals (Ohsumi and Wada, 1974; Rice, 1974; Wada, 1976; Allen, 1980), with approximately 60% occurring in the eastern half of the North Pacific (Ohsumi and Wada, 1974). Allen (1980) argued that it would take 25 to 30 years for the eastern North Pacific population to recover to 90% of its original levels. Current estimates place the California-Oregon-Washington population at about 750-930 animals (Barlow and Gerrodette, 1996; Barlow et al., 1997). There is some evidence that recent increases in fin whale abundance have occurred in California waters (Barlow, 1994; Barlow and Gerodette, 1996), but these have not been significant (Barlow et al., 1997).

4.2.3 Sei Whale (Endangered)

Status. The sei whale (*Balaenoptera borealis*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. A draft fin and sei whale recovery plan was issued in 1998, (Reeves et al., 1998). The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. Sei whales are distributed worldwide and are primarily a pelagic, temperate-water species (Leatherwood et al., 1982; Barlow et al., 1997; Reeves et al., 1998). There are believed to be three stocks in the North Pacific (Mizroch et al., 1984c). In the eastern North Pacific, sei whales migrate northward from wintering grounds in temperate and subtropical waters to feeding grounds that extend from west of the California Channel Islands as far north as the Gulf of Alaska and the Aleutians in the summer (Leatherwood et al., 1982; Mizroch et al., 1984c). Evidence from tag recoveries indicates movement between central California and Vancouver Island (Rice, 1977; Reeves et al., 1998). Unlike fin whales, sei whales seldom enter the Bering Sea (Leatherwood et al., 1982). The winter range stretches from about 18°30'N latitude off Baja California to near 35°30'N off the central California coast (Leatherwood et al., 1982), but may be centered between 20° and 23°N (Mizroch et al., 1984c). Some individuals apparently approach the equator (Leatherwood et al., 1982).

Reproduction. Sei whales breed mainly on the wintering grounds, from September through March (Rice, 1977). Gestation lasts approximately 12 months (Rice, 1977; Leatherwood et al., 1982). Calves are born in wintering areas and are weaned on summer feeding grounds, approximately 6 to 9 months later (Rice, 1977; Mizroch et al., 1984c). Females most often give birth at 3-year intervals (Rice, 1977; Leatherwood et al., 1982). The mean age at sexual maturity is 10 years (Rice, 1977).

Diet. Sei whales are generally skimming feeders. They are known to prefer copepods, but also take a variety of prey, including euphausiids, small schooling fishes, and squid (Nemoto and Kawamura, 1977; Leatherwood et al., 1982; Bonnell and Dailey, 1993). Off central California, sei whales have been known to consume northern anchovy, Pacific saury, and jack mackerel (Leatherwood et al., 1982).

Population Status. Sei whales were heavily exploited by commercial whalers in the 1960's, following the decline of the fin whale populations; their numbers were reduced from an estimated pre-exploitation world population of 256,000 to about 50,000 whales (Brownell et al., 1989). Pre-whaling abundance in the North Pacific was estimated at 58,000-62,000 by Ohsumi and Wada (1974). Tillman (1977) revised this estimate to 42,000 and further estimated a population of 7,260-12,620 for 1974. The North Pacific population is currently estimated at 22,000-37,000 whales (DOC, 1987).

Sei whales are now rare in California waters (Dohl et al., 1981, 1983; Bonnell and Dailey, 1993; Mangels and Gerodette, 1994; Barlow, 1995; Forney et al., 1995; Barlow et al., 1997). Although there is no current estimate for the sei whale population off California, the population in these waters is believed to be very low, in the tens to several hundreds (Reeves et al., 1998).

4.2.4 Humpback Whale (Endangered)

Status. The humpback whale (*Megaptera novaeangliae*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. The humpback whale recovery plan was finalized in 1991, (NMFS, 1991a). The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Distribution. Humpbacks are distributed worldwide and undertake extensive migrations in parts of their range (Leatherwood et al., 1982). They aggregate from late spring through fall to feed in productive waters of temperate and high latitudes and migrate in winter months to lower latitudes for breeding and calving, which often occur near tropical islands and in shallow coastal waters. In the eastern North Pacific, humpbacks range from arctic waters south to central California in the summer. On their feeding grounds, humpbacks are found primarily on the continental shelf near shallow banks and inshore marine waters (Rice, 1974; Wolman, 1986). Humpback whales winter in three areas: waters off Mexico (Rice, 1974); Hawaii (Baker et al., 1986); and the Marianas, Bonin, and Ryukyu Islands and Taiwan (Nishiwaki, 1959). Whales from all three wintering grounds apparently intermingle during the summer months in Alaskan waters (Baker et al., 1986).

Based on photo-identification work, Calambokidis et al. (1996) concluded that humpback whales off California, Oregon, and Washington form a single, intermixing population, with very little interchange with areas farther north. Whales from this population feed off California through summer and fall (Dohl et al., 1983; Calambokidis et al., 1996). Based on sighting data collected off southern California from

1992 through 1999 by Cascadia Research Collective (Cascadia Research, unpubl. data), humpback whales occur throughout the western two-thirds of the Santa Barbara Channel and, to a lesser extent, in the Santa Maria Basin. As was the case for blue whales, there appears to be a tendency for humpbacks to concentrate along the shelfbreak north of the Channel Islands.

Reproduction. Breeding activity occurs year-round, with a strong winter-spring peak (Leatherwood et al., 1982; NMFS, 1991a). Most calves are born on the wintering grounds between January and March, following a 12-month gestation period (Leatherwood et al., 1982), and are weaned after approximately 11 months (Johnson and Wolman, 1984). Female humpbacks give birth approximately every other year, although annual and multi-year calving has been reported (Glockner-Ferrari and Ferrari, 1984; Clapham and Mayo, 1987; Baker et al., 1988; NMFS, 1991a).

Diet. Humpback whales exhibit a variety of feeding behaviors and appear to feed whenever and wherever sufficient concentrations of suitable-sized prey are encountered (Winn and Reichley, 1985; NMFS, 1991a). Major humpback whale prey includes a number of species of small schooling fishes and large zooplankton, mainly euphausiids (Tomilin, 1967; Nemoto, 1970; Wolman, 1986). Fish species eaten by humpbacks in the North Pacific include Pacific herring, capelin, walleye pollock, northern anchovy, eulachon, mackerel, sand lance, cod, salmon, and rockfishes (Rice, 1963, 1977; Frost and Lowry, 1981). Important invertebrate prey includes euphausiids (*Euphausia pacifica*, *Thysanoessa raschii*, *T. spinifera*, *T. longipes*), mysids (*Mysis oculata*), pelagic amphipods (*Parathemisto libellula*), shrimps (*Eualus gaimardii*, *Pandalus goniurus*), and copepods (*Calanus* spp.) (Rice, 1963; Tomilin, 1967; Bryant et al., 1981; Frost and Lowry, 1981).

Population Status. The pre-exploitation world population of the humpback whale has been estimated at about 115,000 animals (Brownell et al., 1989). Made vulnerable by their coastal distribution and gregariousness, humpback whale populations were greatly depleted throughout the world in this century by both land station and pelagic whaling operations (Rice, 1974, 1978; Tønnessen and Johnsen, 1982; Brownell et al., 1989). The total humpback population in the North Pacific is now believed to be greater than 3,000 animals (Barlow, 1994; Barlow et al., 1997). The best current estimate for the west coast population is about 600 animals (Calambokidis and Steiger, 1995; Barlow et al., 1997), and there are indications that this population has increased during the past two decades (Barlow, 1994; Barlow and Gerodette, 1996; Barlow et al., 1997).

4.2.5 Northern Right Whale (Endangered)

Status. The northern right whale (*Eubalaena glacialis*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). The overall range of the North Pacific right whale at the time it was listed extended from about 40ºN to 60ºN. Critical habitat for this species, encompassing a total of approximately 36,750 square nm within the Gulf of Alaska and the Bering Sea, became effective on 7 August 2006. The northern right whale recovery plan was finalized in 1991, (NMFS, 1991b). The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. Right whales apparently migrate from high-latitude feeding grounds toward more temperate waters in the fall and winter. The location of calving grounds is unknown; summer feeding grounds may generally stretch across the North Pacific from about 50° to 63°N (Omura, 1958; Omura et al., 1969). In the northeastern Pacific, the major northern right whale whaling ground was the "Kodiak Ground," which encompassed essentially the Gulf of Alaska and was a major summer feeding ground for the species (Leatherwood et al., 1982). Waters off the eastern Aleutian Islands and in the southern Bering Sea were apparently also important areas of concentration (Braham and Rice, 1984; NMFS, 1991b).

Catches of right whales on the summer feeding grounds were widespread on the continental margin, generally away from shore (Townsend, 1935; Brueggeman et al., 1985).

The scarcity of sightings along the west coast of North America suggests that right whales migrate to summer grounds from the western or central North Pacific or well offshore in the eastern North Pacific (Braham and Rice, 1984), although the location of seasonal migration routes is unknown (Scarff, 1986). Reeves and Brownell (1982) concluded that the usual wintering ground of northern right whales extended from northern California to Washington, although sightings have been recorded as far south as 23°N off Baja California and near the Hawaiian Islands (Scarff, 1986; NMFS, 1991b; Gendron et al., 1999). However, Scarff (1986) reviewed the literature and whaling records and concluded that right whales overwinter in the western or mid-North Pacific. Since 1955, five sightings of right whales have been recorded in waters off southern California. However, all these sightings were of individuals and were recorded between February and May (Scarff, 1991; Carretta et al., 1994). Although right whales have, on rare occasions, been recorded off California, there is no evidence that this region was ever important habitat for right whales.

Reproduction. Almost nothing is known about the reproductive biology of right whales in the Pacific, although productivity is obviously very low (Leatherwood et al., 1982). The gestation period for North Atlantic right whales is thought to be around 16 months (NMFS, 1991b), and females in that population give birth once every 3-5 years (Knowlton and Kraus, 1989). Sexual maturity apparently occurs between ages 5 and 9 (Knowlton and Kraus, 1989).

Diet. Northern right whales are not known to eat fish; their primary prey includes calanoid copepods, particularly *Calanus cristatus* and *C. plumchrus*, and euphausiids (Omura, 1958; 1986; Omura et al., 1969; Nemoto, 1970; Leatherwood et al., 1982).

Population Status. The current population size of right whales in the North Pacific is likely fewer than 1,000 animals. A large portion of this estimate, approximately 900 right whales, comes from minke whale surveys conducted off Kamchatka. To date, the largest number of eastern North Pacific right whale individuals identified in the Bering Sea is 23 based on genetic sampling. This appears to include at least 2 calves. Based on the current population size, the continued anthropogenic threats and other factors discussed below, the North Pacific right whale faces a high risk of extinction throughout its range into the foreseeable future. The life history characteristics and habitat requirements of this species make it extremely vulnerable to environmental variation and demographic stochasticity at such low numbers (NMFS, 2006d)

4.2.6 Sperm Whale (Endangered)

Status. The sperm whale (*Physeter macrocephalus*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No recovery plan has been prepared for this species. The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. The largest of the toothed whales, sperm whales are found predominantly in temperate to tropical waters in both hemispheres (Gosho et al., 1984). In the North Pacific, females and juveniles generally remain south of about 45°N latitude year-round, while adult males range northward as far as the Bering Sea in the summer (Gosho et al., 1984). During the winter, most of the population is distributed south of 40°N (Gosho et al., 1984). 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 as they pass by during migration (Dohl et al., 1981, 1983; Gosho et al., 1984; Barlow et al., 1997).

Sperm whales are primarily a pelagic species and are generally found in waters with depths of greater than 1,000 m (Watkins, 1977), although their distribution does suggest a preference for continental shelf margins and seamounts, areas of upwelling and high productivity (Leatherwood and Reeves, 1986). The majority of sightings by Dohl et al. (1983) in their three-year study off central and northern California were in waters deeper than 1,800 m, but near the continental shelf edge.

Reproduction. Sperm whale groups generally fall into two categories: breeding schools (also called harems), and bachelor schools. One or more mature males may be associated with the breeding schools, which form in early spring (Gosho et al., 1984) and consist of females and juvenile males. Bachelor schools consist almost entirely of younger, but sexually mature, males. Older males are generally solitary and join breeding schools only during the mating season.

The sperm whale mating season lasts from April through August (Rice et al., 1986). Gestation lasts 14-15 months, and calves are normally born between June and November (Leatherwood et al., 1982; Rice et al., 1986). Calves are weaned at 1-2 years of age, and females give birth at 3- to 5-year intervals (Leatherwood et al., 1982).

Diet. Sperm whales are deep divers and feed primarily on large squid and deepwater fishes (Leatherwood and Reeves, 1986; Rice, 1988). Stomachs of whales taken or stranded off Oregon, Washington, and British Columbia contained predominantly squid and octopus, with some deepwater rockfish and ragfish (Pike and MacAskie, 1969; Mate, 1981).

Population Status. Prized for the high quality of its spermaceti oil, the species was subjected to two major phases of commercial whaling: during the mid-18th to mid-19th centuries; and in the modern whaling era, particularly between 1946 and 1980 (Gosho et al., 1984; Brownell et al., 1989). Between 1958 and 1975, the annual world catch rose to more than 20,000 animals, with a peak of 27,000 in 1966 (Gosho et al., 1984; Brownell et al., 1989). The eastern North Pacific stock was given protective status from commercial whaling in 1980 (Leatherwood and Reeves, 1986). The current world population of sperm whales has been estimated at 1,950,000 animals, down from an estimated pre-exploitation population of 2,400,000 (Brownell et al., 1989). The initial population size for the eastern North Pacific (mature animals only) was estimated at 311,000 animals, and the population is currently estimated at 274,000 animals (Braham 1984).

Using acoustic methods, Barlow and Taylor (1998) estimated 39,200 sperm whales in a 7.8 million-km^2 study area encompassing waters between the U.S. west coast and Hawaii. The sperm whale population off California has been estimated between about 900 and 1,200 animals (Forney et al., 1995; Barlow and Gerrodette, 1996).

4.2.7 Steller Sea Lion (Threatened)

Status. The Steller, or northern sea lion (*Eumetopias jubatus*), was listed as a federal threatened species on December 4, 1990 (55 FR 50006). Critical habitat identified for this species includes the major California rookeries at Año Nuevo and the Farallon Islands. The Steller sea lion recovery plan was finalized in 1992, (NMFS, 1992). The main reason for listing was a severe decline in the Steller sea lion population, particularly in the Alaskan portions of its range, for reasons that were not clearly understood.

Range and Habitat. The species' range extends along the North American coast from the Bering Strait in Alaska to southern California. At least 90% of the species' world population is centered in the Gulf of Alaska, the Bering Sea, and the Sea of Okhotsk (Loughlin et al., 1984). Steller sea lions breed during the summer on rookery islands from the Pribilof Islands, Alaska, south to Año Nuevo Island in central California (Green et al., 1989). Following the breeding season, adult males in California and Oregon move northward into Washington, British Columbia, and Alaska; by the end of October, no adult males are found along the Oregon Coast (Bartholomew and Boolootian, 1960; Gentry, 1970; Mate, 1975; 1981). Female and immature Steller sea lions may not disperse as widely following the breeding season (Green et al., 1989).

Steller sea lions are presently uncommon in southern California waters (Bonnell and Dailey, 1993). A few adult or subadult males occasionally may occupy territories on relict rookeries at the west end of San Miguel Island and adjacent rocks in the summer months, but the last reported pups on San Miguel Island were seen in the summer of 1980 (Bonnell and Dailey, 1993; DeLong and Melin, 2000). North of Point Conception, a few animals have been sighted in on offshore rocks at Point Sal, at Diablo Canyon near Point Buchon, and at Point Piedras Blancas (Bonnell et al., 1983). Off California, Steller sea lion sightings at sea have been concentrated in shallow waters over the shelf and upper slope (<400 m) and within 50 km from land (Bonnell et al., 1983).

Reproduction. The timing of the Steller breeding season is uniform throughout the species' range (Gentry, 1970; Sandegren, 1970; Calkins and Pitcher, 1982). Adult males begin arriving on the rookeries first, in mid-May, and establish territories. Pregnant females arrive in late May and give birth to a single pup (Gentry, 1970; Higgins et al., 1988). Females and pups begin leaving the rookeries in September (Orr and Poulter, 1967), and pups typically remain with their mother through the first year (Le Boeuf, 1981).

Diet. Steller sea lions are known to feed on a variety of nearshore, sublittoral prey in estuarine and marine waters. Jones (1981) reported that Steller sea lions feed mainly on bottom-dwelling fishes, and that all the prey items normally eaten by this species inhabit waters less than about 200 m deep. Common prey of the Steller sea lion includes lamprey, rockfishes, herring, anchovy, salmon, smelts, whiting, pollock, tomcod, greenlings, sculpins, sand lance, flatfishes, midshipman, sharks, skates, squid, octopus, shellfish, and shrimp (Wilke and Kenyon, 1952; Spalding, 1964; Fiscus and Baines, 1966; Jameson and Kenyon, 1977; Antonelis and Fiscus, 1980; Jones, 1981; Roffe and Mate, 1984). Stellers are also known to prey upon the pups of several other species of pinnipeds and on sea otters (Gentry and Johnson, 1981; Pitcher, 1981; Pitcher and Fay, 1982; Hoover, 1988; Byrnes and Hood, 1994).

Population Status. The Steller sea lion population in the U.S., which occurs primarily in Alaska, has declined to less than 75,000 during the past 20 plus years; this is a decrease of approximately 75% (Calkins et al., 1999). Although the reasons for this decline are still unclear, recent research indicates that a major factor may be nutritional stress (Merrick et al, 1987; Calkins et al., 1998). This may result from reduction in the abundance or availability of prey and/or a change in prey composition to less nutritious species (Calkins et al., 1998).

Although total numbers in Oregon and California have been relatively stable in recent decades, the overall Steller sea lion distribution appears to have shifted northward (Hill et al., 1997). Once the most abundant sea lion in California, the Steller sea lion has declined in numbers since the 1940s (Bonnot, 1928; Bartholomew, 1967; Le Boeuf and Bonnell, 1980; Bonnell et al., 1981). Ainley and Lewis (1974) hypothesized that the Steller sea lion decline in California might have been connected with the collapse of the Pacific sardine (*Sardinops sagax*) fishery in California in the 1940s and 1950s. Año Nuevo Island is now the southernmost Steller sea lion rookery in the species' range and the largest in California, although it too is decreasing in size (Bonnell et al., 1983). Between 1990 and 1993, pup counts at Año Nuevo dropped from about 310 to 230 (Westlake et al., 1997). Smaller rookeries also exist at Cape Mendocino, the Farallon Islands, and the Point St. George Reef (Bonnell et al., 1983).

4.2.8 Guadalupe Fur Seal (Threatened)

Status. The Guadalupe fur seal (*Arctocephalus townsendi*) was listed as a federal threatened species on December 16, 1985 (50 FR 51252). No recovery plan has been prepared for this species. The main reason for listing was the reduction of the population to near extinction by commercial sealing in the nineteenth century.

Range and Habitat. The Guadalupe fur seal is the only representative of the genus *Arctocephalus* in the Northern Hemisphere (Repenning et al., 1971). 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, 1978; Walker and Craig, 1979). Like the other species of *Arctocephalus*, its numbers were severely reduced by commercial hunting in the nineteenth century, and for many years it was considered extinct (Hubbs, 1956). At present, the species breeds only on Isla de Guadalupe off the coast of Baja California, Mexico, although individual animals appear regularly in the California Channel Islands (Stewart et al., 1987b; Bonnell and Dailey, 1993), and a single pup was born on San Miguel Island in 1997 (DeLong and Melin, 2000).

Little is known about the distribution of Guadalupe fur seals at sea (Gallo-Reynoso, 1994), but strandings have been reported from as far north on the California coast as Sonoma County (Antonelis and Fiscus, 1980; Hanni et al., 1993).

Reproduction. Guadalupe fur seals breed during the summer (Peterson et al., 1968; Pierson, 1987; Figueroa-Carranza, 1994; Gallo-Reynoso, 1994). Adult males arrive on Isla de Guadalupe in late May or early June and establish territories, while females begin arriving on the rookery in June, with the major influx occurring during the last two weeks of the month. Pupping apparently peaks in late July. Females alternate foraging trips to sea with stays on land to nurse their pups; nursing probably continues for at least 8 months. Territorial males leave the rookery by mid-August.

Diet. Limited analysis of Guadalupe fur seal scats and stomach contents indicates that they feed on pelagic squid and schooling fishes such as mackerel and sardine (Hanni et al., 1993; Gallo-Reynoso, 1994).

Population Status. The Guadalupe fur seal population is still small, but is growing; Gallo-Reynoso (1994) calculated the growth rate between 1955 and 1993 to have been 13.7% per year and estimated the 1993 population at approximately 7,400 animals.

4.2.9 Southern Sea Otter (Threatened)

Status. The southern sea otter (*Enhydra lutris nereis*) was listed as a federal threatened species on January 14, 1977 (42 FR 2968). The original recovery plan was finalized in 1982 (FWS, 1982). A revised recovery plan was finalized in 2003 (FWS, 2003). No critical habitat has been identified for this species. The main reasons for listing the southern sea otter were 1) its small population size and limited distribution, and 2) the threat of oil spills, pollution, and competition with humans. The current population consists of approximately 2,800 individuals (USGS, 2007).

Range and Habitat. Before commercial hunting began in the late 18th century, sea otters inhabited coastal waters of the North Pacific in an almost continuous band stretching from central Baja California, Mexico, across the Aleutians to the northern islands of Japan (Kenyon, 1969). By 1911, when sea otters were afforded protection under the North Pacific Fur Seal Convention, only 13 isolated colonies remained throughout the species' range; most of these eventually became extinct (Kenyon, 1969; Estes, 1980).

From that low point, the species began slowly to recover. Several surviving Alaskan populations began reoccupying former habitats from Prince William Sound southwest across the Aleutian Islands (Kenyon, 1969). Meanwhile, a small remnant California population in California, near Big Sur, began recovering from a low of about 50 animals around 1914 (Bryant, 1915; Riedman, 1987). Beginning in 1965, efforts were made to recolonize former habitats by translocating Alaskan otters to areas in southeast Alaska, the Pribilof Islands, British Columbia, Washington, and Oregon (Jameson et al., 1982; Riedman, 1987).

Since early part of this century, the California sea otter population has expanded much farther southward than northward from its initial location near Point Sur. Northward expansion had more or less stopped at Año Nuevo by the mid-1990s (FWS, 2003); however, 20 otters were sighted between Point Año Nuevo and a point 30 miles north in the late 1990s (CDFG, 1998). In contrast, by 1995, sea otters were relatively common as far south as Point Arguello and were routinely sighted near Point Conception (FWS, 2003).

In spring 1998, about 100 sea otters were sighted south of Point Conception (FWS, 2003). By mid-summer, most of these otters had presumably returned to waters north of the point. However, by January 1999, more than 150 animals were again counted south of Conception (FWS, 2003). As late as May 1999, tens of otters were still present along the Santa Barbara Channel shoreline as far east as Goleta Point (USGS, unpubl. data). This trend continued into 2005, when more than 88 otters were spotted east of Point Conception during the spring census survey (USGS 2007). The range of the mainland population currently extends from Half Moon Bay in the north to Goleta in the south (USGS, 2007).

Sea otters typically inhabit shallow nearshore waters with rocky or sandy bottoms supporting large populations of benthic invertebrates (Riedman, 1987). Observed densities are higher over rocky (about $5/km^2$) than sandy habitat (about $0.8/km^2$) (Riedman and Estes, 1990). In California, otters live in waters less than 18 m deep and rarely move more than 2 km offshore (Riedman, 1987).

Sea otter home ranges generally consist of several heavily used areas connected by travel corridors (Riedman and Estes, 1990). Males generally have larger home ranges, due in part to seasonal movements they make to either end of the parent range. These migrations coincide with the breeding season (June to November) and the non-breeding season (November to May). During the breeding season, the size of the southernmost group declines dramatically, due to a general northward movement of animals towards the center of the range (Bonnell et al., 1983; Estes and Jameson, 1983). This movement of males from the population fronts into the more established areas occupied by females during the summer and fall breeding season is a feature of the sea otter's annual cycle (Bonnell et al., 1983). Recent studies also suggest that resource limitations near the center of the otter’s range may be influencing these migration movements (Tinker et al., 2008). Female otters are more sedentary, but are also known to travel long distances (Riedman and Estes, 1990).

Breeding males maintain territories in female areas seasonally, excluding juvenile and subordinate males from their areas (Garshelis and Garshelis, 1984; Ralls and Siniff, 1990). They generally join male groups in the winter and spring (Riedman and Estes, 1990; FWS, 2003).

Reproduction. Sea otters breed and pup throughout the year in all parts of the range, but there appear to be one or more peaks in most areas (Riedman, 1987; Rotterman and Simon-Jackson, 1988). In California, peak pupping occurs from January through March (Riedman and Estes, 1990). Females typically give birth to a single pup (Jameson and Bodkin, 1986; Riedman, 1987), and births occur both on land and in the water (Kenyon, 1969; Jameson, 1983). Although the time between fertilization and implantation of the embryo may vary substantially, the period between copulation and parturition appears to last about 6 months (Riedman, 1987; Rotterman and Simon-Jackson, 1988; Jameson and Johnson, 1993). Pups remain with their mothers for approximately 6 months, and the normal pupping interval for females that successfully raise pups to independence appears to be a little over a year (Wendell et al., 1984; Rotterman and Simon-Jackson, 1988; Jameson and Johnson, 1993).

Diet. Sea otters have high metabolic demands and may consume up to 23-33% of their body weight per day (Riedman and Estes, 1990). Ralls and Siniff (1990) found that sea otters in California tend to be crepuscular in activity, resting mainly in the middle of the day; they estimated that California otters spend 35 to 50% of their time foraging.

California sea otters feed almost entirely on macroinvertebrates (Ebert, 1968; Wild and Ames, 1974; Estes et al., 1981). In rocky areas along the central California coast, major prey items include abalones (*Haliotis* spp.), rock crabs (*Cancer* spp.), and sea urchins (*Strongylocentrotus* spp.), and, in areas where populations of principal prey species have been reduced, kelp crabs (*Pugettia* spp.), clams (various spp.), turban snails (*Tegula* spp.), mussels (*Mytilus* spp.), octopus (*Octopus* spp.), barnacles (*Balanus* spp.), scallops (*Hinnites* spp.), sea stars (*Pisaster* spp.), chitons (*Cryptochiton stelleri*), and echiuroid worms (*Urechis caupo*) (Boolootian, 1961; Ebert, 1968; Estes, 1980; Estes et. al., 1981; Wendell et al., 1986, FWS 2003, Tinker et al., 2008). These species occur at water depths ranging from the littoral zone to approximately 100 m (328 feet). Not surprisingly, most of the animals occur between shore and the 20 m (65 feet) water depth (FWS, 2003).

In sandy areas, sea otters prey primarily on bivalve molluscs, such as Pismo clams (*Tivela stultorum*), which are a principal prey item in sandy areas in Monterey and Morro Bays, gaper clams (*Tresus nuttalii*), and Washington clams (*Saxidomus nuttali*) (Wade, 1975; Stephenson, 1977; Wendell et al., 1986; Riedman and Estes, 1990). Sea otters in California have occasionally been observed to prey on seabirds (VanWagenen et al., 1981), but predation on fish is very rare (Hall and Schaller, 1964; Miller, 1974; Estes 1986). Diet and foraging strategies apparently differ significantly with high specialization amongst individuals (Tinker et al., 2008).

Population Status. Kenyon (1969) estimated the original North Pacific sea otter population at 100,000 to 150,000 animals, while Johnson (1982) suggested that there may have been as many as 300,000 before exploitation by the fur trade decimated the population between 1741 and 1911(Kenyon 1969). However, taxonomic investigations conducted in the early 1990's (Wilson et al., 1991) support recognition of the California sea otter, or southern sea otter, as a distinct subspecies, *Enhydra lutris nereis*. The southern sea otter population is estimated to have numbered approximately 14,000 animals before the onset of commercial hunting (FWS, 2003), and is currently estimated at about 2,800 individuals (USGS 2007).

By 1911, when sea otters were first protected by international treaty, sea otters were no longer found off the Oregon or Washington coasts, and were thought have been extirpated from California waters as well. The present population in California is descendent from a remnant group of less than 50 animals that were rediscovered at Bixby Creek, near Big Sur. The remnant California population began recovering from a low of about 50 animals around 1914 (Bryant, 1915; Riedman, 1987). The California sea otter population grew steadily at a rate of about 5% per year until the mid-1970's, when it was estimated to contain nearly 1,800 animals (Riedman, 1987; Riedman and Estes, 1990). The population then began declining, due to increased mortality from entanglement in set nets (Wendell et al., 1985), reaching an estimated low of fewer than 1,400 animals in 1984. A series of restrictions on nearshore net fisheries culminated in 1991, when the State of California closed waters less than 30 fathoms deep to fishing with nets. Soon thereafter, sea otter numbers began increasing, and a peak spring count of 2,377 was recorded in 1995 (FWS, 2003).

However, following that survey the number of otters seen during the annual spring surveys declined steadily until 1999, when 2,090 sea otters were counted, representing a 12% decrease over the preceding four years (FWS, 2003). Numbers increased again in May 2000, when 2,317 sea otters were counted, an almost 11% increase over the previous year.

Sea otter surveys coordinated by the Biological Resources discipline of the U.S. Geological Survey (USGS) off the coast of California have shown increases in the otter population. For example, spring sea otter counts offshore California ranged between 2,377 in 1995 to 3,026 in 2007 (USGS, 2007). As individual year counts may be highly influenced by survey conditions, the final revised recovery plan for the southern sea otter recommends using the 3-year running average as the official benchmark of the sea otter population status (FWS 2003). The 3-year running average for 2007 was 2,818 animals.

Range expansion to the south has brought an increasing number of otters into the project area. In spring of 2005, close to 200 otters were observed in the region extending from Point Purisima to Point Conception during the semi-annual census. Additionally, during this same survey, a large raft of over 88 otters was observed to the east of Point Conception. As such, otters seen south of Point Purisima comprised approximately 10% of the total 2005 population of 2,735 (USGS 2007).

Since 1997, the annual spring sea otter counts east of Point Conception have steadily increased. During the spring 1997 survey, 60 independent sea otters were counted east of Point Conception. By 2000, this number had increased to 79. More recently, during the 2007 spring survey, around 106 independent sea otters (and zero pups) were spotted east of Point Conception (USGS 2007). One recent hypothesis for the increasing seasonal presence of otters at the southern end of their range is that it is a response to density pressures occurring near the middle of the otters' range (Tinker et al., 2008). In 2007, the southern-most otter sighting occurred at Santa Barbara Point, Santa Barbara County, just east of Santa Barbara Harbor (USGS 2007).

Between August 1987 and July 1990, the U.S. Fish and Wildlife Service translocated 140 sea otters from the central California range to San Nicolas Island (FWS, 2003). Of these, 36 are known to have returned to the parent population range, 10 were captured in the management zone and returned to the parent range, 15 are known to have died, and the fate of the remaining animals is unknown. In 2002, the translocated colony at San Nicolas Island contained approximately 27 individuals, including pups. Approximately 38 sea otters were present at San Nicolas Island in 2007.

4.3 BIRDS

The following birds are considered in this evaluation:

4.3.1 Brown Pelican (Endangered)

Status. The California brown pelican (*Pelecanus occidentalis*) was listed as endangered on October 13, 1970 (35 FR 8320). To date, no critical habitat has been designated for this species. A recovery plan for this species was finalized in 1983 (FWS, 1983). The main reasons for listing this species were low reproductivity due to pesticide effects and food scarcity. A petition to delist the brown pelican was received by FWS in December 2005. A status review by FWS has determined that delisting of the species is warranted.

Range. The overall range of the California subspecies of the brown pelican extends from British Columbia to the coast of southwest Mexico, but the species' current breeding range is much more restricted. Most pelicans nest on islands in the Gulf of California (Baja California) and on the Tres Marias Islands off mainland Mexico near the city of Nayarit (FWS, 1983). In the U.S., pelicans historically nested in several locations including Anacapa Island, Santa Barbara Island, Prince Island, Scorpion Rock, and even as far north as Point Lobos near Monterey. However, they currently nest only on Anacapa and Santa Barbara Islands in the Southern California Bight. Although a few pairs nested on Scorpion Rock during the 1970s, this site is considered unlikely to be used in the future due to high levels of human activity in the area. Listing of the California brown pelican was based primarily on serious declines observed in the Southern California Bight population of this subspecies. Other populations of brown pelicans (those nesting in the Gulf of California and along the west coast of southern Baja California and mainland Mexico) did not suffered colony-wide reproductive failures to the degree that the southern California population did, although human disturbance has been an increasing source of concern in these areas (FWS, 1983).

Habitat. Most pelicans seen foraging off the coast of California have been sighted within 20 km (11 nm) of the coast; however, a few individuals have been recorded over waters deeper than 3,000 m (1,640 fm) and at distances of 88 km (48 nm) off the coast of central California (Briggs et al., 1987). The preferred nesting habitat is on offshore islands, although some individuals nest in mangroves along the Mexican coast.

Roosting Sites. Because brown pelicans have wettable plumage, as is typical for many other members of the order Pelecaniformes, they must have terrestrial roost sites for drying their plumage after feeding or swimming, and for resting and preening. Roost sites, therefore, are considered essential habitat for this species. Roosting habitat includes offshore rocks and islands, river mouths with sand bars, breakwaters, pilings, jetties, and estuaries (FWS, 1983). Pelicans usually return to specific coastal roosts each day (usually by late afternoon, but sometimes not until several hours after sunset) and do not normally remain at sea overnight. Night roosts are usually in regions with high oceanic productivity and isolated from predation pressure and human disturbance. Pelicans may also periodically return to land during the day to rest, but requirements for daytime roosts are less restrictive, and these roosts are more numerous and usually much smaller than night roosts (Briggs et al., 1983; Jacques and Anderson, 1987).

Based on Jaques and Anderson's research (1987), pelican roosts are widespread and abundant in the general area of concern for the Rocky Point Unit. Important pelican roost areas include the area between Morro Bay and Point Sal (especially the Pismo Beach and Diablo Canyon areas and the Santa Maria River mouth), where offshore rocks, estuaries, and beaches are used primarily. Very few offshore rocks exist to the south, and along the southern coast primary roost sites include breakwaters, jetties, and other man-made structures. Undisturbed coastal stretches of Vandenberg AFB have also become a roosting area for pelicans. One of the most important roosting areas along the southern coast is the breakwater at the Long Beach Harbor, which is located outside the general area of concern for this analysis. Other, less regularly used roost sites include Pt. Mugu Lagoon, the Santa Clara River mouth, and the Marina del Rey breakwater. The greatest number of pelicans, however, uses the Channel Islands (especially Santa Cruz Island) and the many offshore rocks in that area for roosting.

Reproduction. The breeding season for brown pelicans off California is generally from March through early August, although breeding may begin as early as January in some years (FWS, 1983). Mexican colonies are frequently active several weeks or even months before those in California, with egg laying at some beginning as early as November. Pelicans generally do not breed until they are three to five years old. They mainly lay clutches of three eggs, with incubation estimated to last for about 30 days; young birds are able to fly by about 9 weeks of age

Diet. The northern anchovy (*Engraulis mordax*) is the primary prey species of the brown pelican (FWS, 1983). Estimates of the portion of the pelican's diet consisting of anchovies range as high as 90–95% (FWS, 1981). Other prey species include Pacific sardine (*Sardinops sagax*) and Pacific mackerel (*Scomber japonicus*) (Thelander and Crabtree, 1994).

Migration. After the breeding season, pelicans begin to disperse along the Pacific coast to as far north as British Columbia, and as far south as the southwestern coast of Mexico (FWS, 1983). Since the breeding season for pelicans nesting in Mexico may begin and end earlier than for those in California, large numbers of pelicans may begin moving northward into the Southern California Bight as early as May. Pelicans usually begin appearing north of Point Conception by July, with numbers increasing through September and October. Although the intensity and extent of the northward movement of post-breeding pelicans depends largely on oceanographic conditions that influence prey availability (Anderson and Anderson, 1976), relatively large numbers of pelicans have become a regular late summer to early autumn feature along the coast of southern Oregon in recent years as the population has expanded. Since 1985, as many as a few thousand birds may be present at the period of peak abundance in late summer. Currently, several hundred pelicans may also occur in southern Washington during the peak period. Pelicans begin to disappear from the northern portions of their range in November. From December through March, when pelicans are nesting to the south, fewer than 500 remain north of Point Conception (Briggs et al., 1987).

Reasons for Decline. The history of the California brown pelican's decline due to pesticides and scarcity of food (i.e., anchovies) is well documented in the literature (Schreiber and DeLong, 1969; Jehl, 1973; Gress, 1970; Risebrough et al., 1971; Anderson, 1977; Keith et al., 1971; Anderson et al., 1975; Anderson and Gress, 1983) and is summarized in the Brown Pelican Recovery Plan (FWS, 1983). These reports identified the drastic decline in abundance of brown pelicans observed in the mid-1960s and early 1970s to be primarily due to bioaccumulation of chlorinated hydrocarbon pesticides (DDT, DDE, dieldrin, and endrin) in the pelican's food chain. Bioaccumulation of these pesticides resulted in serious eggshell thinning and poor reproductive success (Schreiber and Risebrough, 1972). Food scarcity (primarily anchovies) on the west coast also contributed to the species' decline (Keith et al., 1971). Although the effects of pesticides linger, pelicans are now successfully breeding on Anacapa and Santa Barbara Islands, as well as on the small islet of Prince Island, in the Southern California Bight. A colony also occurs on the Mexican Islas Los Coronados, but this colony has not been surveyed since 1993.

Food Scarcity. Prey availability (i.e., northern anchovy availability) remains an ongoing problem for the brown pelican. Anchovy abundance and distribution may fluctuate widely from year to year, and a well-documented relationship exists between anchovy abundance and pelican reproductive success (FWS, 1983). Anchovies are found from British Columbia to the tip of Baja California and in the Gulf of California, but they are most abundant from Pt. Conception south. They can be found from the surface to depths over 1,000 feet and from the surf zone out to at least 300 miles. Adult anchovies are pelagic schooling fish, generally found offshore in fall and winter and moving inshore in spring, and generally occur well below the surface during the day and nearer the surface at night (see Ganssle, 1973). Adults rarely live more than four years. The eggs are planktonic in the upper water layers, and hatch at two to four days of age. Most spawning occurs within 60 miles of shore in all seasons, but is heaviest in late winter and spring. The larvae are planktonic in the upper water layers. Young fish move into very shallow water where they transform into juveniles in about 70 days. Warm water years slow the growth rates of northern anchovies, perhaps due to low food supply.

Biomass of northern anchovy in the central subpopulation, which supports most of the U.S. fisheries, averaged 400,000 metric tons (t) from 1964 to 1970, increased rapidly to 1,800,000 t in 1974, and then declined to 490,000 t in 1978. Since 1978, biomass levels have tended to decline slowly. The biomass in

1989 was 261,000 t. The decline is believed to be due to warm water conditions since the mid-70's and recent increases in sardine biomass (Love, 1996). However, biomass appears to be on the increase in recent years. The most recent stock estimate of spawning biomass of northern anchovy is 388,000 t during February 1995 (Jacobson et al., 1995). Although the stock has not been reassessed since 1995, the abundance and biomass of northern anchovy in February 1997 was at least as high as in 1995 based on a qualitative assessment of existing data (Jacobson, et al., 1997).

Northern anchovy fisheries are managed under the Coastal Pelagic Species Fishery Management Plan. Historically, anchovy were harvested for reduction into fishmeal, oil, and soluble protein products. Other uses include human consumption (fresh, frozen, canned, and paste), and as bait (live and frozen for recreational fisheries). Landings by the United States have varied from less than 10,000 t to nearly 140,000 t (see NMFS, 1999). Since 1983, U.S. landings have been low (less than 10,000 t), and they have been used mostly for live bait and other nonreduction uses.

Population Status. Currently, California Brown Pelicans have an estimated population of approximately 200,000 birds. A petition to delist the brown pelican was received by FWS in December 2005. A status review by FWS to determine if the proposed delisting is warranted is currently under way; the decision is expected in December 2006.

Historical accounts of pelican abundance on Anacapa Island and/or the Southern California Bight are sketchy at best, but indicate that at least a few thousand pelicans nested on Anacapa during the first half of the twentieth century (FWS, 1983). Beginning in the 1950s, the breeding population on Anacapa went through a slow decline, and the maximum number of pairs during the 1950s and 1960s was about 1,000 (Anderson and Anderson, 1976). By 1968, however, the Anacapa breeding population had crashed, and a survey conducted that year found no more than 100 pairs (FWS, 1983). During the 1969 breeding season, no more than four young were successfully fledged on Anacapa due to eggshell thinning from DDT. With the banning of DDT in 1972, the number of nesting pairs and reproductive success increased. In 1981, on Anacapa, there was an average of 2,946 breeding attempts, which produced 1805 young that survived to fledging. However, the number of nesting pairs and productivity remain highly variable from year to year probably due to fluctuations in the abundance of northern anchovy. Based mainly on the work of Gress, the number of nests on Anacapa between 1981 and 1992, ranged from 628 in 1984 to 6,326 in 1987 (nesting attempts and productivity data are summarized in Ingram and Carter, 1997). In 1991, Carter et al. (1992) working jointly with Gress (1992) estimated the number of breeding pairs on West Anacapa Island at 5,340. The number of nests continued to be highly variable throughout the 1990s. In 1998 there were only about 2,500 nesting attempts on West Anacapa, while in 1999 there were about 5,300 nesting attempts. At least some of the variation observed in the 1990s was due to El Niño effects.

Although most of the breeding population (4,000 to 6,000 pairs) still nests on West Anacapa Island, smaller populations have become established on several of the other islands. In 2005, the first-known nesting at Middle Anacapa Island occurred, small numbers were found breeding on East Anacapa Island (only the second time since 1928), and an expanded distribution of pelican nesting was observed at Santa Barbara Island. Most recently, in May 2006, 43 pelican nests were found on Prince Island, a small islet off San Miguel Island. These are the first nests seen in this location since 1939.

Prior to the 1980s, nesting pelicans used Santa Barbara Island only sporadically. However, beginning in 1985, when there were 1,046 nests on the island, pelicans have nested every year (nesting attempts and productivity data are summarized in Ingram and Carter, 1997). Currently, the pelican population on Santa Barbara Island averages between 400-700 nests each year (CINPS 2006), and remains second in size only to that found on West Anacapa Island. Estimates of the breeding population size for the pelican were around 6,000 pairs in 1991. The breeding season for brown pelicans extends from March through early August.

Another historically important Southern California Bight colony is located in the Mexican Islas Los Coronados, located about 27 km (17 mi) south of San Diego. From the late 1880s until 1920, about 500-1,000 pairs nested predominately on the northern island (FWS, 1983). Peak abundance probably occurred in the 1930s when somewhat more than 5,000 pelicans nested on the islands. The colony declined throughout the 1950s and 1960s to as few as 300 pairs by about 1970. In 1993, the last time the colony was surveyed, there were only about 600 pairs on the islands.

The FWS has recently completed a five-year review of the status of the brown pelican. As a result, FWS has proposed to delist the species throughout its range.

4.3.2 California Least Tern (Endangered)

Status. The California least tern (*Sterna antillarum browni*) was listed as endangered on October 13, 1970 (35 FR 16047). A recovery plan for the species was published in 1980 (FWS, 1980b), but critical habitat has not been designated. The main reasons for listing this species were loss of habitat, human disturbance, and predation. Recently, on October 2, 2006, the FWS announced the completion of a 5-year review of the status of the California least tern, wherein they recommended it for downlisting from endangered to threatened.

Range. The breeding range of the California least tern, which the population occupies from about April to September each year, extends from San Francisco Bay south to northern Baja California, Mexico. The winter range of the California least tern is somewhat unknown, but probably extends from the Pacific coast of southern Mexico south to Central America, and possibly South America.

During the last 20-25 years, about 50 sites in California have been occupied by nesting least terns at some time (Fancher, 1992; Caffrey, 1995). These range from Pittsburg in northern California to the Tijuana River mouth at the south end of the state. However, the number of sites actually used fluctuates from year to year, as potential nesting areas become available naturally or through site preparation efforts, or unavailable due to natural or human disturbance and/or predation. Fewer sites have been used in recent years; for example, only 35 sites were used in 1996 (Caffrey, 1998). Furthermore, the number of nesting pairs is concentrated at only a few locations. In 1996, 7 of the 35 sites used that year accounted for 58% of the breeding pairs (Caffrey, 1998). These seven sites were NAS Alameda, Venice Beach, Huntington Beach, Santa Margarita River/North Beach, Mission Bay/FAA Island and Mariner's Point, and Delta Beach/North.

Habitat. Nesting colonies are usually located on open expanses of sand, dirt, or dried mud, typically in areas with sparse or no vegetation. Colonies are also usually in close proximity to a lagoon or estuary where they obtain most of the small fish they consume, although they may also forage up to 3-5 km (2-3 miles) offshore. Least terns are fairly faithful to breeding sites and return year after year regardless of past nesting success.

Reproduction. Least terns usually begin arriving in southern California in April. Nests consist of a shallow scrape in the sand, sometimes surrounded by shell fragments. Eggs (usually two per clutch) are laid from mid-May to early August. Incubation takes 20-28 days, and young fledge in about 20 days (FWS, 1980b). Least terns breed after their second year, and first-time breeders are more likely to nest later in the breeding season (Massey and Atwood, 1981). For a detailed account of least tern reproductive biology, see Thompson et al. (1997).

Diet. Least terns are opportunistic feeders known to capture more than 50 species of fish. Prey species include the northern anchovy (*Engraulis mordax*), deepbody anchovy (*Anchoa compressa*), jacksmelt *(Atherinopsis californiensis)*, topsmelt *(Atherinopsis affinis)*, California grunion *(Leuresthes tenuis)*, shiner surfperch *(Cymatogaster aggregata),* California killifish *(Fundulus parvipinnis)*, and mosquitofish *(Gambusia affinis)*.

Migration. As mentioned above, least terns arrive in California in April. Early arrival dates include April 8, 1978 for San Diego (Garrett and Dunn, 1981) and April 27, 1976 for Santa Barbara (Lehman, 1994). The southward migration of least terns may begin as early as August and few, if any, terns remain in California after late September (Garrett and Dunn, 1981). The migration route and winter distribution of these birds remains mostly unknown, although they probably winter along the Pacific coast of southern Mexico and Central America.

Reasons for Decline. Although loss of habitat and human disturbance were the primary reasons for the decline of least terns in California, predation continues to be an ongoing problem for the species. Least tern chicks are preyed on by several mammalian and avian species, including coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), domestic cats (*Felis domesticus*), American kestrels (*Falco sparverius*), northern harriers (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis*), and western gulls (*Larus occidentalis*). One predator, the American crow (*Corvus brachyrynchus*), has become a major problem in recent years. With the ever-increasing urbanization of American crows, this species is now occupying many coastal areas of southern California where they are preying on least tern nestlings. During the 1999 breeding season, all the nests at the important Venice Beach colony were lost to crows.

Population Status. In 1970, when California least terns were listed as endangered by the federal government and California, their population in California was estimated at 600 breeding pairs. Population growth rates have increased, especially since the mid-1980s, when active management for least terns was initiated. Management of California least tern colonies has included intensive monitoring of nesting colonies, site preparation to reduce vegetative cover, protection of sites by means of reduced access to humans, and predator management. Although the increase in the breeding population has not been consistent from year to year (there were only about 2,598 pairs in 1995 vs. 2,792 in 1994; Caffrey 1995, 1997, 1998; Keane 2000), the long-term trends have shown steady population growth. This, despite a decline of more than 10% occurred from the 1998 to 1999 when the population dropped from a peak of 4,141-4,182 pairs down to only 3,493-3,711 pairs. By 2004, however, the population was back up, with an estimated 6354-6805 pairs establishing nests (Marschalek 2005). Fluctuations in the least tern population are thought to be attributable to a combination of high levels of predation and low prey availability.

In the general area of concern for the Tranquillon Ridge field, from 1994 onward, as many as 12 sites have been used for nesting by least terns, depending to some degree on how some sites have been lumped or split in different years (Caffrey 1995, 1997, 1998; Keane 1998, 2000; Marschalek 2005). However, nesting site fidelity among least terns appears to be patchy, and may depend heavily on local prey availability. Only 7-9 of these sites were in use in any one year, again depending on how they were tabulated. The general locations of these sites are: Oceano Dunes, Guadalupe Dunes, Mussel Rock Dunes, Vandenberg AFB (Beach 2 and Purisima Point), Santa Clara River mouth, Ormond Beach (3 sites), Pt. Mugu, and Venice Beach. The number of pairs at most of these locations has generally been low (<50); however, both Venice Beach and Pt. Mugu have periodically hosted large numbers of nesting terns. Venice Beach is often one of the largest colonies in California, and had 383 pairs in 1998 (Keane, 2000). In 2004, however, although several hundred terns were observed at Venice early in the season, a food (anchovy) shortage was believed fingered as the culprit for why only 17 pairs attempted nesting at this location (Marschalek 2005). In contrast, Pt. Mugu had 490 pairs in 2004, while for the last several years, neither of the two Vandenberg sites has produced more than one or two successful nestings (Marschalek 2005).

The implementation of protected beach areas for the Western Snowy Plover at Coal Oil Point Reserve in Goleta has had the added benefit of increasing the appeal of this location for least tern nesting. Beginning in 2004, small numbers of terns have begun to attempt to nest there. Most recently, in 2006, five chicks were successfully hatched at this location.

4.3.3 Bald Eagle (Threatened)

Status. In 1978 (43 FR 6233), the bald eagle (*Haliaeetus leucocephalus*) was listed as endangered throughout the lower 48 states except Washington, Oregon, Minnesota, Wisconsin, and Michigan, where it was listed as threatened. The main reasons for listing this species were the harmful effects of pesticides, especially DDT, and habitat loss. A recovery plan for the Pacific recovery region was approved in 1986 (FWS, 1986). The bald eagle was reclassified in 1995 from endangered to threatened throughout the lower 48 states as a result of the significant increase in numbers of nesting pairs, increased productivity, and expanded distribution (60 FR 36000). Critical habitat has not been designated for this species. The bald eagle was proposed for delisting in 1999 (50 FR 36453). The delisting review process is still ongoing at this time.

Range. The bald eagle occurred historically throughout North America except extreme northern Alaska and Canada and central and southern Mexico. Bald eagles nest on both coasts from Florida to Baja California, in the south, and from Labrador to the western Aleutian Islands, Alaska, in the north.

Habitat. Although the nesting habitat of bald eagles varies somewhat from area to area, one important characteristic shared by most eagles is proximity to water; most eagles nest within 0.8 km (0.5 miles) of a coastal area, bay, river, lake, or other body of water. In winter, bald eagles often congregate at specific wintering sites that are generally close to open water and that offer good perch trees and night roosts.

Diet. Fish, whether scavenged or live, is the primary food of most bald eagles (Bent, 1937; Stalmaster, 1987), which often steal from other species. Carrion can make up a large portion of their diet, but they also prey on birds and mammals (Bent, 1937; Retfalvi, 1970; Dunstan and Harper 1975; Sherrod et al., 1977; DeGange and Nelson, 1982; Grubb and Hensel, 1978; Stalmaster, 1987). On Santa Catalina Island in the Southern California Bight, the main prey (Garcelon 1994a) consists of fish (86%), followed by birds (10%), and sea lions (2%).

Reproduction. The bald eagle nests in tall trees located near coastal areas, lakes, and rivers. The same nest may be used for several years in the absence of disturbance (McVey et al., 1993). Bald eagles mature slowly; most probably do not breed until they are 4-5 years of age. Eagles usually lay 1-3 eggs per year, although they do not necessarily nest every year. Bald eagles are relatively long-lived, and adult mortality is believed to be only 5-10% per year (Sherrod et al., 1977; Grier, 1980). However, as with most birds of prey, immature and sub-adult mortality is thought to be very high, and over 90% do not survive.

Reasons for Decline. The status of the bald eagle has been a concern since at least the late 1800s, and the bald eagle was one of the first species to be listed as endangered under the original Endangered Species Preservation Act of 1966 (16 U.S.C. 668aa-668cc). Several historic accounts mention that noticeable population declines occurred prior to 1900, and widespread shooting for feathers and trophies led to extirpation of eagles in some areas. Shooting also reduced part of the bald eagle's prey base. Big game animals like American bison (*Bison bison*), which were seasonally important to eagles as carrion, were decimated. Waterfowl, shorebirds and small mammals were also reduced in numbers. Loss of nesting habitat from forest clearing and development also contributed to the species' decline. By 1940, declines had been mentioned in articles describing nesting populations in at least 12 states, including California (Green, 1985). Based on these declines, Congress passed the Bald Eagle Protection Act of 1940 (16 U.S.C. 668-668d); at that time, the major problems affecting the species were habitat loss and shooting. The effect of DDT on avian reproduction is well known, and, beginning in 1947 (although the cause was unknown then), its effect on bald eagles could be seen by the dramatic decline in reproductive success that occurred in several nesting areas. Bald eagle reproductive success remained at extremely low levels through at least the early 1970s, when the use of DDT was banned in the U.S. Other human-related mortality factors that have contributed to the decline or extirpation of historic nesting populations include electrocution, poisoning (especially lead poisoning acquired through ingestion of lead shot), and disturbance from various activities such as logging, mining, and recreation. However, the two most important factors besides DDT are probably shooting and habitat loss. Although mortality from shooting has been reduced extensively, habitat loss continues to be a problem throughout the species' range, affecting both nesting and wintering populations.

Population Status. An estimated quarter to a half million bald eagles lived on the North American continent before the first Europeans arrived. A partial survey conducted by the National Audubon Society in 1963 reported 417 active nests in the lower 48 States, with an average of 0.59 young produced per nest. Surveys coordinated by the Fish and Wildlife Service in 1974 (see 50 FR 36453) resulted in a population estimate of 791 occupied breeding areas for the lower 48 States. Since that time, the bald eagle population has increased significantly, essentially doubling every 7 to 8 years during the past 30 years. Currently, around 7,066 breeding pairs are thought to exist, with 160 nesting pairs found in California. Additionally, in the spring of 2006, two bald eagle chicks hatched from separate nests on Santa Cruz Island. This was the first time bald eagles have successfully reproduced on the Channel Islands without human help since 1949.

In 1998, the estimated breeding population of bald eagles exceeded 5,748 occupied breeding areas (see 50 FR 36453). In the recovery plan for the Pacific Recovery Region (FWS, 1986) the goals for delisting bald eagles included a minimum of 800 nesting pairs with an average reproductive rate of 1.0 fledged young per occupied breeding area, and an average success rate for occupied breeding areas of not less than 65% over a 5 year period. These goals have mostly been met since 1995, and in 1999, the FWS proposed the bald eagle for delisting (50 FR 36453).

Historically, the bald eagle was found throughout the Channel Islands (Grinnell and Miller, 1944). Historic nesting sites along the mainland coast include the Goleta and Carpinteria areas of Santa Barbara County, La Jolla Canyon near Pt. Mugu in Ventura County, and Zuma Canyon west of Malibu in Los Angeles County (Garrett and Dunn, 1981). The bald eagle disappeared as a breeding bird from the Channel Islands in the late 1950s (Garrett and Dunn, 1981). Although the eagles are again actively nesting on the islands, they still suffer from the effects DDE, which remains in the nearby waters. This is particularly true for birds residing to the south, on Catalina island (Garcelon, 1994b; Sharpe and Garcelon, 1999). Since 2002, more than 49 bald eagles have been hacked on the northern Channel Islands with approximately 25 still living on the islands (Anacapa, Santa Cruz, Santa Rosa , and San Miguel).

Bald eagles also occur at Lake Cachuma in Santa Barbara County. Several birds winter there, and bald eagles have nested there since the late 1980s (Lehman, 1994). A few transients may also occur along the mainland coast and the Channel Islands during migration.

4.3.4 Western Snowy Plover (Threatened)

Status. The coastal population of the western snowy plover (*Charadrius alexandrinus nivosus*) was listed as threatened in the Federal Register on March 5, 1993 (58 FR 12864). The main reasons for listing this population were loss and degradation of habitat from human disturbance. On December 7, 1999, a designation of critical habitat was published in the Federal Register (64 FR 68507). This designation was updated on September 9, 2005 (70 FR 56970). A Draft Recovery Plan for this species was published in the Federal Register on August 14, 2001 (66 FR 42676); a Final Recovery Plan is still under development at this time.

Two petitions to delist the plover were submitted in July, 2002, and June, 2003, respectively. The petitions contended that the Pacific Coast population of the plover is genetically indistinguishable from the inland population, and therefore does not qualify for listing as a distinct population, and that the population is in a state of flux rather than decline. On April 21, 2006, the FWS published a 12-month finding on the original petition addressing these arguments (50 CRF 20607). In its finding, the FWS upheld the threatened status of the plover, while acknowledging that significant progress had been made toward the species' recovery of over the past decade. Concurrently, the FWS published a proposed rule that will exempt those counties which have met population recovery goals from the existing general prohibition on take as long as populations remain above recovery goals. The current population of this species is estimated at 2,300 birds throughout California, Oregon, and Washington states.

Range. Western snowy plovers are found in several western states including Washington, Oregon, California, Nevada, Utah, and Arizona as well as Baja California and mainland Mexico. However the range of the threatened Pacific coast population is much more limited. This population is defined as those individuals that nest adjacent to tidal waters, and includes all nesting birds on the mainland coast, peninsulas, offshore islands, adjacent bays, estuaries, and coastal rivers (58 FR 12864). The breeding range of the threatened population extends along Pacific coast of North America from southern Washington to southern Baja California, Mexico. The winter range is somewhat broader and may extend to Central America (Page et al., 1995); most plovers winter from California south, however.

Habitat. The nesting habitat of the coastal population is mainly dune-backed beaches, barrier beaches, salt flats, and salt evaporation ponds (Page and Stenzel, 1981; Palacios and Alfaro, 1994). Habitat of wintering birds includes beaches where nesting is not known to occur. In the U.S., over 150 currently used or historical nesting and/or wintering areas have been identified (64 FR 68507), most of which (about 85%) are found in California. Additionally, at least four major nesting areas are known to exist in Baja, California. In coastal California, plovers historically nested at 53 locations prior to 1970 (Page and Stenzel, 1981). Currently, 44 of these sites are no longer used by nesting plovers (50 CFR 20607). Declines in the overall number of nesting sites have also occurred in Oregon and Washington (see 35 FR 16047).

The largest number of breeding birds occurs from south San Francisco Bay to southern Baja California. Major breeding areas within the project area include Morro Bay, the Callendar-Mussel Rock Dunes area, the Point Sal to Point Conception area, and the Oxnard Lowlands. Most of these areas and many others have been designated as critical habitat for the western snowy plover (70 FR 56970). Designated critical habitat in the general area of concern for the Tranquillon Ridge field is shown in Table 4.1.

Table 4.1 Designated Critical Habitat for the Western Snowy Plover in the Vicinity of the Tranquillon Ridge Field (70 FR 56970)

Site No.	Name	County	Plover Population	
			Nesting	Winter
CA-15	Estero Beaches			
Unit A	Villa Creek Beach	San Luis Obispo	21-31	30
CA-18	Deveareaux Beach	Santa Barbara	Up to 18	up to 60
CA-19	Oxnard Lowlands			
Unit A	Mandalay to Santa Clara River	Ventura	9-70	up to 33
Unit B	Ormond Beach	Ventura	20-34	up to 123
Unit D	Mugu Lagoon S.	Ventura	40-80	up to 62
CA-20	Zuma Beach	Los Angeles	NA	130

Reproduction. Snowy plovers breed in loose colonies where colony size can range up to 150 pairs. Site fidelity is high, and they often nest in the exact same location as the previous year (Warriner et al., 1986). The breeding season for western snowy plovers extends from early March to late September, with birds at more southerly locations beginning to nest earlier in the season than birds at more northerly locations (64 FR 68507). In most years, the earliest nests on the California coast generally occur during the first to third week of March. Peak nesting in California occurs from mid-April to mid-June, while hatching lasts from early April through mid-August.

During courtship, males defend territories and usually make multiple scrapes (slight depressions) in flat, open areas with sandy or saline substrates. The male constructs the scrapes by leaning forward on his breast and scratching his feet while rotating his body. Females choose which scrape becomes the nest site by laying eggs in one of them. Coastal plovers lay usually three eggs (range = 2-6, Page et al. 1995) in a nest. The nest is increasingly lined with beach debris (e.g. small pebbles, shell fragments, plant debris, and mud chips) as incubation progresses. Both sexes incubate the eggs, with the female tending to incubate during the day and the male at night. Nest initiation and egg laying occur from mid-March through mid-July (Wilson, 1980; Warriner et al., 1986).

Snowy plover chicks are precocial, leaving the nest within hours after hatching to search for food. Adult plovers do not feed their chicks, but lead them to suitable feeding areas. Females generally desert both mates and broods by the sixth day after hatching, leaving the males to continue rearing the brood, while the females obtain new mates and initiate new nests. The chicks reach fledging age approximately one month after hatching; however, broods rarely remain in the nesting area throughout this time. Plover broods may travel along the beach as far as 6.4 kilometers (4 miles) from their natal area.

Diet. Snowy plovers are primarily visual foragers. They forage for invertebrates across sandy beaches from the swash zone to the macrophyte wrack line of the dry upper beach. They also forage in dry sandy areas above the high tide, on salt flats, and along the edges of salt marshes and salt ponds (58 FR 12864). They may also sometimes probe for prey in the sand and pick insects from low-growing plants. Their diet consists primarily of molluscs, worms, crabs, sandhoppers, and insects (Soothill and Soothill, 1982; Page et al., 1995).

Migration. The coastal population consists of both resident and migratory birds. Some birds winter in the breeding areas, while others migrate north or south to wintering areas (Page et al., 1986; Warriner et al., 1986). The majority of birds winter south of Bodega Bay, California (Page et al., 1986).

Reasons for Decline. The primary reasons for the decline in the coastal population of the western snowy plover are habitat loss, human disturbance, and predation. Habitat loss has resulted from both the urbanization (construction of residential, commercial, and recreation facilities, harbors, roads, campgrounds, etc.) of the Pacific coast, especially the coast of southern California, and the spread of introduced beach grasses (e.g., marram grass) used for the stabilization of coastal sand dunes. Introduced grasses are particularly a problem in the northern portion of the plover's range.

Plovers are highly susceptible to human disturbance, and human activity (walking, jogging, dog walking, off-road vehicle use, beach raking, etc.) has also played an important role in the decline of the coastal population. The breeding season of the western snowy plover (mid-March to mid-September) coincides with the time of greatest beach use by people, and Page et al. (1977) found that snowy plovers were disturbed more than twice as often by human activities than all other natural causes combined. If the level of disturbance is sufficiently high, plovers may abandon their nests, and eggs have been stepped on and run over by vehicles. Chicks that become separated from adults through human disturbance may die of exposure. At one site in coastal California, humans were directly responsible for the loss of at least 14% of nests over a 6-year period (Warriner et al., 1986).

Loss of eggs, chicks, and adults to a variety of predators including gulls (*Larus* spp.), American crows (*Corvus brachyrynchus*), common raven (*Corvus corax*), red fox (*Vulpes vulpes*), skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*) is a major concern at a number of nesting sites. Accumulation of trash at beaches attracts these as well as other predators (Stern et al., 1990; Hogan, 1991).

Population Status. The first reliable information on the abundance of snowy plovers along the California coast came from surveys conducted during the 1977 to 1980 breeding seasons by Point Reyes Bird Observatory (PRBO). The surveys suggested that the snowy plover had disappeared from significant parts of its coastal California breeding range by 1980. When these surveys were initially conducted, the breeding population had been estimated at 1,565 birds (Page and Stenzel, 1981). However, based on the number of historical nesting sites that are no longer occupied, the number of plovers nesting along the coast was likely much higher.

The breeding population continued to decline after the 1981 surveys, and subsequent surveys estimated the number of breeding birds at 1,386 in 1989 (Page et al., 1991), 1,180 in 1991, and 967 in 1995 (G. Page, Point Reyes Bird Observatory, Stinson Beach, California, unpublished data). Based on Christmas Bird Counts from 1962 to 1984, the number of wintering birds had also declined, at least in southern California (Page et al, 1986). The current population estimate for the U.S. portion of the Pacific Coast Western Snowy Plover is approximately 2,300 based on the 2005 breeding window survey (71 FR 20625).

Within the project area, the snowy plover populations have fluctuated substantially over the years. One of the largest plover currently active breeding areas is located on Vandenberg AFB in northern Santa Barbara County where the western snowy plover occupies 12.5 miles (20 km) of beach and dune habitat. Formerly, Vandenberg AFB supported approximately 20% of the entire Pacific coast population of western snowy plovers. However, declines in nesting plovers at this location were so severe during the late 1990s that a beach closure was put into effect beginning in spring 2000 for all but about 2 miles of beach. In 1997, the breeding population on the base was estimated at 240 birds, but by 1999 the count had declined to only 78. Fortunately, the western snowy plover population has rebounded significantly following the institution of the beach closure, with breeding populations of 259 and 245 birds in 2005 and 2006 respectively.

Declines have also recently occurred on the nearby islands of Santa Rosa and San Miguel in the Channel Islands National Park. A total of 72 snowy plovers were counted on eastern end of Santa Rosa Island (Skunk Point) during the 1998 breeding season, but only 41 the following year. In 2005, 37 birds were counted, however, during the latest breeding season (2006) only 19 birds were counted on the island. Although the breeding population has declined, SRI island still supports a substantial wintering population, with over 200 birds counted in 2006. A limited breeding population was known to occur on San Miguel Island in the early 1990s; however, no breeding plovers have been observed at this island in the last six years.

In contrast to Vandenberg AFB and the northern Channel Islands, the last several years have seen increases in nesting at two other nearby mainland colonies: Coal Oil Point and Ormond Beach. Although plovers historically bred at University of California, Santa Barbara (UCSB)'s Coal Oil Point Reserve, the site produced no snowy plover chicks from the time it opened to the public in 1970 until the summer of 2001. Implementation of an aggressive management plan including predator management, public outreach, and protective fencing resulted in re-establishment of a small, but viable plover breeding population beginning in 2002. Over the last four years, this location has supported a small number of breeding plovers, culminating in 2006 with a total of 39. Coal Oil Point also supports a substantial population of wintering snowy plovers. In December 2003, 361 western snowy plovers were counted at this location, while during the survey conducted in January 2006, 325 wintering plovers were observed.

Since 2000, the breeding population at Ormond Beach has remained between 10 and 35 birds. In 2005, a total of 22 nesting attempts resulted in 15 hatchings at this location. This number increased in 2006, when 24 hatchings took place from a total of 28 nests.

4.3.5 Light-footed Clapper Rail (Endangered)

Status. The light-footed clapper rail (*Rallus longirostris levipes*) was listed as endangered on October 13, 1970 (35 FR 8320). There are currently believed to be only 250-350 pairs left in California, with most found in Upper Newport Bay and the Tijuana Marsh. A recovery plan was approved in 1979 (FWS, 1979). Critical habitat has not been designated for this subspecies. Habitat loss was the primary reason for listing this species.

Range. The current and historic range of the light-footed clapper rail extends from Bahia de San Quintin, Baja California, Mexico to Santa Barbara County, California where they are restricted to coastal salt marshes. Although, historically, most of the salt marshes in this region were probably occupied by rails, no more than 24 marshes have been occupied since about 1980 (Zembal and Hoffman, 1999). Only a portion of these marshes are used each year. For example, from 1997 to 1999, 16, 17, and 14 marshes were occupied, respectively (Zembal and Hoffman, 1999). The vast majority (more than 95%) of the remaining rails are in Orange and San Diego counties. For example, of the 222 pairs recorded in 1998, 189 (85%) of these occurred at only three sites: Upper Newport Bay and Seal Beach and Tijuana marsh National Wildlife Refuges. In the general area of concern for the Tranquillon Ridge field, there are presently only two marshes that are, or have the potential to be, occupied by rails. These are Carpinteria Marsh in Santa Barbara County and Mugu Lagoon in Ventura County. The next closest location for rails is the Seal Beach National Wildlife Refuge in Orange County.

Habitat. The light-footed clapper rail is normally found in estuarine habitats, particularly salt marshes with well-developed tidal channels. Dense growths of cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia* sp.) are conspicuous components of rail habitat, and nests are located most frequently in cordgrass. In a radio-telemetry study conducted in Newport Back Bay, radio-tagged rails spent about 90%

of their time in cordgrass, in the lower marsh (Zembal et al., 1989). At low tides they also hunted along creek banks. When water covered the lower marsh, radio-tagged rails foraged on higher ground in sparser vegetation.

Reproduction. Clapper rails construct loose nests of plant stems, either directly on the ground when in pickleweed or somewhat elevated when in cordgrass (FWS, 1979). Although nests are usually located in the higher portions of the marsh, they are buoyant and will float up with the tide. Eggs are laid from mid-March to the end of June, but most are laid from early April to early May. Clutch size ranges from 3-11, with clutches of 5-9 most common. The incubation period is about 23 days, and young can swim soon after hatching.

Diet. Clapper rails forage mainly by shallow probing of sediment or surface gleaning. Their diet includes small crabs, other crustaceans, slugs, insects, small fish, and eggs (Edelman and Conway, 1998).

Reasons for Decline. Rails may have suffered declines originally in the early 1900s due to overhunting. By far, however, the main reason for the decline has been habitat destruction and degradation. Of the approximate 26,000 acres of historic coastal wetlands, less than 8,500 acres remain (Speth, 1971), and only a fraction of the remaining acreage provides suitable habitat for the light-footed clapper rail. Also, the remaining coastal wetlands often lack important "buffers" where species can retreat during high water and where pollutants and sediments can be filtered before entering the wetland itself, as well as good connections to uplands and to the ocean. Predation has also played a role in the decline of the species. With the implementation of active management, there is hope for improving the health of this species. Ongoing management efforts include habitat restoration through the reestablishment or enhancement of tidal action to historic habitat; predator management, research, and control; nest site enhancement; captive breeding; translocation; and continuing research into the life history of the species.

Population Status. Based on the first statewide survey, the California population was estimated at about 500 birds (Wilbur, 1974), although this estimate is believed to be somewhat high (FWS, 1979). Since 1980, the California population has ranged from a low of 284 birds in 1985 to a high of 816 in 2006 (Zembal and Hoffman 1999; Zembal et al 2006). The number of marshes occupied has also varied from a low of 8 in 1989 to a high of 19 in 1984. In 2006, a total of 408 pairs of light-footed clapper rails exhibited breeding behavior in 18 marshes in southern California (Zembal et al 2006). This is the largest statewide breeding population detected since the counts began in 1980, and represents a 13.3% increase over the 2005 count. It also represents the third successive year of record-breaking high counts. Although surveys have not been conducted in Baja California for several years, the Baja population is thought to consist of at least 400-500 pairs.

Upper Newport Bay currently comprises the largest subpopulation in California, with 158 pairs (38.7% of the state population) in 2006. Together with the subpopulation in the Tijuana Marsh, these two marshes contain a total of 260 pairs, comprising 63% of the breeding population in California.

In the general area of concern for the Tranquillon Ridge field, two marshes that have historically been occupied by clapper rails, Carpinteria Marsh and Mugu Lagoon (Zembal et al 2006). These wetlands represent the northernmost habitat for the light-footed clapper rail. Although as many as 26 pairs have been known to occur at Carpinteria Marsh, the rail population of the marsh declined sharply in 1985, and no rails were found during annual surveys from 1989 to about 1994. From 1995 to 2002, there were approximately 1-5 nesting pairs, along with a few apparently unmated birds. However, the last know clapper rail call from Carpinteria Marsh was heard from an unmated female in 2003. In April 2004, two males were released in the marsh in the hope they would find and mate with the previously heard female; however, recent surveys have not detected the presence of rails at this marsh (Zembal et al 2006). The chances for a viable subpopulation of light-footed clapper rail to become re-established in Carpinteria Marsh are currently considered non-existent without improvements in predator and habitat management at this location (Zembal et al 2006).

The rail subpopulation at Mugu Lagoon fluctuated between 3 and 7 pairs for nearly 20 years until recent augmentations fostered its growth. A captive breeding program for the light-footed clapper rail was first established in 1998. Although the first several years of the program were unproductive, since 2000, over 100 rails have been released into the wild, including several at Mugu Lagoon. Additionally, there have been occasional re-sightings of banded rails at Point Mugu, indicating that some of the captive-bred rails remained local after being released into the marsh (Zembal et al 2006). The increased population at this location appears to have led to an expansion of habitat use within the lagoon. For example, in 2004, a pair of rails was observed attempting to breed in the eastern arm of the lagoon for the first time in many years (Zembal et al 2006).

4.4 REPTILES

Sea turtles typically inhabit tropical and subtropical seas and are uncommon in eastern North Pacific waters north of Mexico. Historically, four species of sea turtles have been recorded in the eastern North Pacific: the leatherback sea turtle (*Dermochelys coriacea*), the green sea turtle *(Chelonia mydas*), the Pacific (or olive) ridley sea turtle (*Lepidochelys olivacea*), and the loggerhead sea turtle (*Caretta caretta*) (Caldwell, 1962; Márquez, 1969; Hubbs, 1977). Sea turtle populations have been greatly reduced by overharvesting, incidental bycatch by the fishing industry, and, to a lesser extent, coastal development of nesting beaches in developed countries (Ross, 1982). Three of these species (leatherback, green, and Pacific ridley) are listed as endangered, the fourth (loggerhead) as threatened under the U.S. Endangered Species Act. The leatherback was listed on June 2, 1970 (35 FR 8495), the other three species on July 28, 1978 (43 FR 32808). No critical habitat has been designated for these species in the Pacific. The recovery plans for the Pacific populations of all four species were finalized in 1998 (NMFS and FWS, 1998a-d).

In the eastern Pacific, most sea turtles probably nest on the Pacific coasts of Mexico and Central America. Sea turtles reach sexual maturity at about 4 to 9 years, depending on the species (Mager, 1984). They breed at sea, and the females instinctively return to their natal beaches to lay eggs (although leatherbacks are not such strict remigrators). The nesting season varies with species (Mager, 1984). Females typically nest four to seven times during the nesting season (again depending upon the species) with clutch sizes of 80 to 150 eggs. About 2 months after being laid in the sand, eggs hatch, and the young instinctively make for the sea. Once at sea the males very rarely, if ever, return to land (Mager, 1984).

While marine turtles are seldom seen at sea locally, strandings do occur. Nineteen marine turtle strandings were reported on Santa Barbara County beaches between 1983 and 2006. Of the 19 strandings, 10 were leatherbacks, 4 were Pacific ridleys, 2 were loggerheads, and 2 were green sea turtles (NMFS, 2006e).

The following sea turtles are considered in this evaluation:

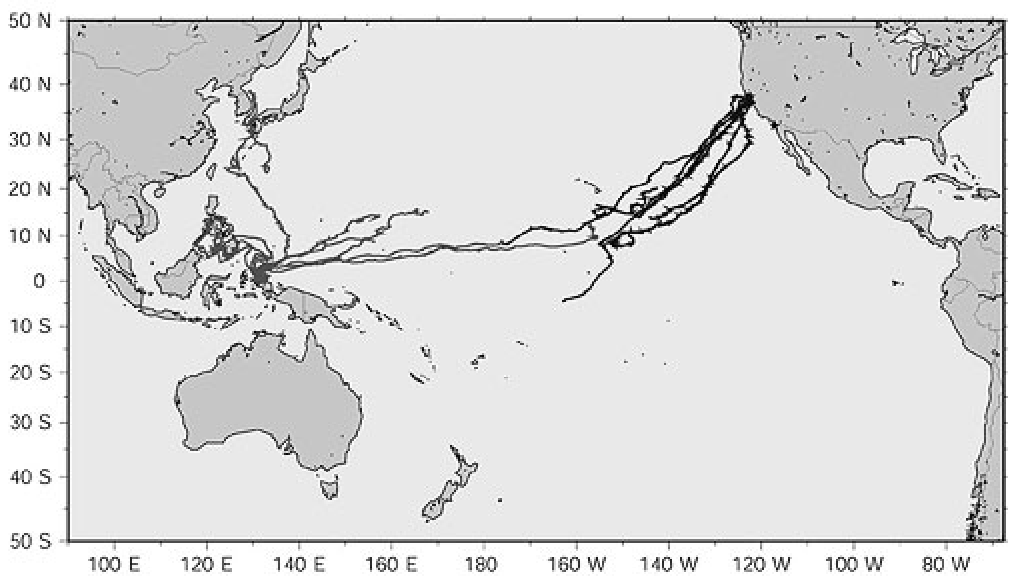
4.4.1 Leatherback Sea Turtle (Endangered)

Leatherback sea turtles, the largest of the sea turtles, occur in the Atlantic, Indian, and Pacific Oceans (Mager, 1984). Full-grown specimens reach average lengths of 7 feet, have a span of 8.9 feet from flipper to flipper, and can weigh as much as 650 to 1200 lbs (Eckert, 1997). Leatherbacks commonly range farther north than other sea turtles, probably because of their ability to maintain warmer body temperatures over longer time periods (Frair et al., 1972). They have been sighted in the eastern north Pacific as far north as Alaska (Mager, 1984).

Leatherbacks nest at beaches in tropical latitudes, and it was long thought that the local visitors observed off the Pacific coast of the United States originated from the western Mexico, Central America, and northern Peru breeding population (Mager, 1984). However, genetic analyses of individuals sampled off Monterey, California, and from turtles stranded on California beaches, indicate that the majority of these animals originate from western Pacific nesting stocks, most likely North Papua, Papua New Guinea, or the Solomon Islands (Dutton et al 2001). Satellite telemetry studies, shown in Figure 4-1, support the revised interpretation of the leatherbacks' origins (MBNMS 2002).

Additional tagging efforts have revealed that leatherbacks in the western Pacific region, although considered a single genetic stock, comprise multiple foraging populations. Turtles that nest during the winter months undertake migrations to the south, while those that nest during summer months move to northern foraging grounds, including the North American West Coast. Leatherbacks originating from the eastern Pacific nesting grounds off Mexico and Costa Rica tend to migrate south from their nesting beaches to forage areas located off South America and the Galapagos Islands (Morreale et al. 1996, Eckert and Sarti 1997). Female leatherbacks migrate between foraging and breeding grounds at 2 to 3-year intervals (NMFS and FWS, 1998a).

Figure 4-1 Satellite-Tracked Leatherback Movements from Nesting Beaches in Papua, Indonesia and from Foraging Areas off the California Coast in 2003-2004.



Source: http://www.montereybay.noaa.gov/reports/2005/eco/openocean.html

Pritchard (1971) estimated that there were at least 8,000 nesting females in the eastern Pacific; on the basis of additional information, he later estimated a total world population of 115,000 mature females (Pritchard, 1982). However, by 1995 the worldwide population estimate had dropped to between 26,200 and 42,900 adult females (Spotila et al. 1996). The Pacific portion of the population, in particular, continued to undergo dramatic decline. Between 1996 and 2000, the number of female leatherbacks in the eastern Pacific population dropped from 4,638 to about 1,690. Meanwhile, the western Pacific population also underwent substantial declines. The entire Pacific Ocean is currently thought to contain perhaps as few as 2,300 breeding females.

Leatherbacks are the most common sea turtle in U.S. waters north of Mexico (Dohl et al., 1983; Green et al., 1989; NMFS and FWS, 1998a). Inshore waters off California, between Pt. Conception and Pt. Arena, are visited annually by approximately 150 to 170 leatherback turtles, with the greatest numbers occurring during early fall (Benson et al. 2003). On aerial surveys of Washington and Oregon waters conducted in 1989 and 1990, Green et al. (1992) recorded 16 sightings of leatherbacks (no other sea turtles were seen); all sightings were made between June and September, when sea surface temperatures were highest, in waters over the slope and shelf. Most (83%) of the sea turtles sighted off northern and central California by Dohl et al. (1983) during their 3-year survey were leatherbacks, and nearly 90% of these sightings were made during the summer and fall. Sightings were widely distributed from 10 to 185 km offshore, and most were recorded in waters over the continental slope.

Although considered omnivorous (feeding on sea urchins, crustaceans, fish, and floating seaweed), leatherbacks feed principally on soft foods such as jellyfish (scyphomedusae) and tunicates (salps, pyrosomas) (Mager, 1984; NMFS and FWS, 1998a). Dense swarms of jellyfish can contain nearly 80% as much carbon as the densest copepod populations (Shenker 1985), providing a rich food source for predators such as the leatherback. Leatherbacks also may forage nocturnally at depth on siphonophores and salps in the deep scattering layer (Eckert et al., 1989; NMFS and FWS, 1998a).

4.4.2 Green Sea Turtle (Endangered)

Green sea turtles are distributed worldwide in waters that remain above 20°C during the coldest month. No reliable population estimates are available for the green sea turtle in the Pacific (Mager, 1984). Prior to commercial exploitation, green turtles were abundant in the eastern Pacific from Baja California south to Peru and west to the Galapagos Islands (NMFS and FWS, 1998b). Off the Pacific coast, sightings have been recorded as far north as British Columbia, although most have been reported from northern Baja California and southern California (Mager, 1984; NMFS and FWS, 1998b). Green turtles have stranded in northern California and on the Washington and Oregon coasts in recent decades (Smith and Houck, 1984; Green et al., 1992).

Green sea turtles were once common in San Diego Bay, but now appear limited to a single channel in the southern part of the bay (Hubbs, 1977), where they seem to be year-round residents (NMFS and FWS, 1998b). Regular sightings of small juveniles suggest that turtles are continuing to migrate into the bay (NMFS and FWS, 1998b).

At present, the main nesting sites for eastern Pacific green turtles are located along the Pacific coast of Mexico (State of Michoacán) and in the Galapagos Islands (Mager, 1984; NMFS and FWS, 1998b). There are also smaller nesting grounds along the Central American Pacific coastline (NMFS and FWS, 1998b).

Green sea turtles are primarily herbivorous, feeding on sea grasses and algae, although they may feed on a variety of marine animals in some areas (Mager, 1984; NMFS and FWS, 1998b). Identified animal food items include molluscs, crustaceans, bryozoans, sponges, jellyfish, polychaetes, echinoderms, fish and fish eggs (NMFS and FWS, 1998b).

4.4.3 Pacific Ridley Sea Turtle (Endangered)

Pacific, or olive, ridley sea turtles are the smallest of the sea turtles (Mager, 1984). Olive ridleys occur worldwide in tropical to warm temperate waters and are considered to be the most abundant sea turtle in the world (NMFS and FWS, 1998c). In the eastern North Pacific, the species' main foraging areas extend between Colombia and Mexico. Major nesting beaches are, as with many other eastern Pacific sea turtles, on the Pacific coasts of Mexico and Costa Rica, although a few may nest as far north as Baja California (Mager, 1984; NMFS and FWS, 1998c). Currently, as many as 200,000 females are estimated to nest in Mexico each year (Márquez, 1990; NMFS and FWS, 1998c).

These sea turtles are infrequent visitors to waters north of Mexico. According to Green et al. (1991) Pacific ridleys have stranded on the Washington and Oregon coasts during the past decade, and strandings have also been recorded from northern California (Houck and Joseph, 1958; Smith and Houck, 1984). Hubbs (1977) observed a pair of Pacific ridleys mating in the water off La Jolla, San Diego County, California, in August 1973.

In the eastern Pacific, ridleys nest throughout the year, with peaks occurring from September through December (NMFS and FWS, 1998c).

They are considered omnivorous, feeding on a variety of benthic and some pelagic items (NMFS and FWS, 1998c). Identified prey include fish, crabs, shrimp, snails, oysters, sea urchins, jellyfish, salps, fish eggs, and vegetation (Ernst and Barbour, 1972; NMFS and FWS, 1998c). Pacific ridleys may also scavenge (NMFS and FWS, 1998c).

4.4.4 Loggerhead Sea Turtle (Threatened)

Loggerhead sea turtles inhabit subtropical to temperate waters worldwide, and are generally found in waters over the continental shelf (Carr, 1952; Mager, 1984). In the Pacific, loggerheads nest only in the western region, primarily at and near Japan and Australia (NMFS and FWS, 1998d). There are no reliable population estimates for the loggerhead sea turtle in the Pacific (Mager, 1984).

Stebbins (1966) listed southern California as the northern limit of the loggerhead range. In recent years, most sightings of this species have been reported from southern California and Baja California waters, generally during the summer (Guess, 1982; NMFS and FWS, 1998d). Although Smith and Houck (1984) reported no sightings of this species for northern California, Green et al. (1991) state that this species has stranded on the Washington and Oregon coasts during the past two decades.

Loggerhead sea turtles are omnivorous, feeding on a variety of benthic prey including shellfish, crabs, barnacles, oysters, jellyfish, squid, sea urchins, and occasionally on fish, algae, and seaweed (Carr, 1952; Mager, 1984; NMFS and FWS, 1998d).

4.5 MARINE INVERTEBRATES

The following marine invertebrates are considered in this evaluation:

4.5.1 White Abalone (Endangered)

Status. The white abalone (*Haliotis sorenseni*) was listed by NMFS as an endangered species on May 29, 2001, effective June 28, 2001, after a comprehensive status review of the species was completed (66

FR 29054). A draft recovery plan for the species was published on November 2, 2006 (NMFS 2006c). This comprehensive document is the primary source of information from which the following subsections were drawn. No critical habitat has been designated for this species due to concerns that identifying critical habitat areas would increase the threat of poaching (66 FR 29048).

Range. The historic range of white abalone extended from Point Conception, California, USA to Punta Abreojos, Baja California, Mexico with the historical population center located at the California Channel Islands (NMFS 2006c). In the northern part of the California range, white abalone were reported as being more common along the mainland coast, while in the middle portion of the California range, they were noted to occur more frequently at the offshore islands (especially San Clemente and Santa Catalina Islands). At the southern end of the range, in Baja California, Mexico, white abalone were reported to occur more commonly along the mainland coast, but were also found at a number of islands. It remains unknown whether this distribution pattern resulted because of lack of suitable habitat along the mainland coast in the middle portion of the range, or was due to overfishing in the more accessible mainland regions (NMFS 2006c).

Since the mid-1990s, extremely low numbers of isolated survivors have been identified along the mainland coast in Santa Barbara County and at some of the offshore islands and banks in the middle portion of the range. This information indicates that the current range of white abalone in California may be similar to what it was historically. No recent information on current range is available for Baja California.

Habitat. Adult white abalone occur in open, low relief rocky reefs or boulder habitat surrounded by sand. They are usually found between 20-60 m depths, but were most common historically between 25-30m deep. A recent survey found the highest densities of white abalone at 40-50m depth. Suitable habitat for the white abalone is inherently patchy, thus, the distribution of white abalone is likewise patchy.

Factors controlling the depth distribution of white abalone are poorly known. Biological factors, such as competition and predation, have been implicated as factors controlling the upper limit, while water temperature and food availability have been implicated as factors controlling the lower limit. Speculation has also occurred over whether white abalone may have been restricted to deeper waters (> 25 m) as a result of sea otter predation or competition from pink abalone. There is also some evidence that abalone may shift to increasing depths as they age.

Reproduction. White abalone are dioecious, with separate sexes occurring in approximately a 1:1 ratio. They reproduce through broadcast spawning (i.e. directly releasing gametes into the water column for external fertilization). Factors known to affect fecundity in abalone include organism size and food availability.

Synchronization of gonadal maturation and spawning are critical to successful fertilization in abalone. Gonads of white abalone mature on an annual cycle, and the spawning season of white abalone is of limited duration. Spawning in white abalone occurs in winter months, but sometimes extends into the spring. The duration of an individual spawning event is unknown. Experimental evidence suggests that fertilization rates are maximized when substantially more than one sperm contacts an egg, and the probability of this occurring decreases significantly with increasing distance between individuals (Leighton 2000). Adult abalone of intermediate size are capable of spawning over two million viable eggs. In the laboratory, fertilization success rates of 96-100% have been achieved. Fertilized white abalone eggs are about 190-200 microns in diameter and are negatively buoyant.

Diet. The specific dietary preferences of white abalone are not well established. Like other abalone species, white abalone are herbivorous. Small individuals generally scrape bacteria and diatoms from the rocky bottom using their radula, while larger abalone depend on drift algae, especially deteriorating kelp. Laminaria and Macrocystis (brown algae) are believed to make up a large portion of the diet. The reddish brown color of the shell indicates that white abalone also consume some type of red algae throughout their life (NMFS 2006c).

Reasons for listing. Overexploitation leading to a lack of reproductive success was the most significant factor in the listing of this species. White abalone in California were subject to serial depletion by the commercial fishery during the early 1970s. Due to their life history characteristics as long-lived, slow moving bottom dwellers with external fertilization, abalone are particularly susceptible to local and subsequent serial depletion. If male and female abalone are not within a few meters of one another when they both spawn, the sperm will be too diluted by diffusion to fertilize the eggs. As local abalone densities declined with overfishing, the probability of successful fertilization and subsequent recruitment also declined. Regulatory measures instituted at the time also proved inadequate to conserve the species.

Population Status. At least a 99% reduction in white abalone density has occurred between the 1970s, when the last successful white abalone recruitment is thought to have occurred, and today. Current information on white abalone population size structure suggests that no evidence of recent recruitment exists, and that any ongoing recruitment is negligible throughout most of its former range. Data on density from areas where they have been located suggest that the remaining abalone are not close enough together to spawn (85% of the animals identified in 2002 were separated by linear distances that exceeded 10 m).

During the 1990s the combined estimate for both California and Mexico was approximately 2,600 animals. A 1999 survey of white abalone habitat in U.S. waters found only 157 live white abalone, an average density of only 2.7 abalone per hectare of habitat. However ROV and multi-beam sonar surveys of two shallow banks off of the southern California coast conducted since 2000 have revealed that the white abalone population may be higher (approximately 12,820 for Tanner Bank and approximately 7,360 for Cortes Bank) than previously thought. Regardless, the viability of animals in the wild remains uncertain because mostly large (>13 cm in shell length) animals were detected on the two offshore banks, and most animals observed were >2 m apart from their nearest neighbor (NMFS 2006c).

4.6 AMPHIBIANS

The following amphibians are considered in this evaluation:

4.6.1 California Red-legged Frog (Threatened)

Status. The California red-legged frog (*Rana aurora draytonii*) was listed as threatened on May 23, 1996 (61 FR 25813). A final recovery plan for the species was published in September 2002, and on April 13, 2006, the U.S. Fish and Wildlife Service issued its final designation of critical habitat for this species (FWS 2002, FWS 2006). This final designation includes 450,288 acres in 20 California counties. The California red-legged frog has been extirpated from 70% of its former range and is threatened in its remaining range by a wide variety of human impacts, including urban encroachment, construction of reservoirs and water diversions, introduction of exotic predators and competitors, livestock grazing, and habitat fragmentation.

Range. The historical range of the California red-legged frog extended coastally from the vicinity of Point Reyes National Seashore, Marin County, and inland from the vicinity of Redding, Shasta County, southward to northwestern Baja California, Mexico (Jennings and Hayes, 1985; Hayes and Krempels, 1986).

The following recovery units within the historical range of the California red-legged frog have been established: (1) the western foothills and Sierran foothills to 5,000 feet in elevation in the Central Valley Hydrographic Basin; (2) the central coast ranges from San Mateo and Santa Clara counties south to Ventura and Los Angeles counties; (3) the San Francisco Bay/Suisun Bay hydrologic basin; (4) southern California, south of the Tehachapi Mountains; and (5) the northern coast range in Marin and Sonoma counties. These five units are essential to the survival and recovery of the California red-legged frog. Designation of recovery units assists the FWS and other agencies in identifying priority areas for conservation planning under the consultation (Section 7) and recovery (Section 4) programs.

Habitat. The California red-legged frog occupies a fairly distinct habitat, combining both specific aquatic and riparian components (Hayes and Jennings, 1988; Jennings, 1988). Adults require dense, shrubby or emergent riparian vegetation closely associated with deep (>0.7 m) still or slow moving water (Hayes and Jennings, 1988). The largest densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings, 1988). Well-vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during winter. Adult frogs may be found seasonally in the coastal lagoons of the central California coast. They move upstream to freshwater when sand berms are breached by seawater from storms or high tides.

California red-legged frogs disperse upstream and downstream of their breeding habitat to forage and seek estivation habitat. Estivation habitat is essential for the survival of California red-legged frogs within a watershed. Estivation habitat and the ability to reach estivation habitat can be limiting factors in California red-legged frog population numbers and survival.

Estivation habitat for the California red-legged frog is potentially all aquatic and riparian areas within the range of the species and includes any landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area. This could include boulders or rocks and organic debris such as downed trees or logs; industrial debris; and agricultural features, such as drains, watering troughs, spring boxes, abandoned sheds, or hay-ricks. Incised stream channels with portions narrower than 18 inches and depths greater than 18 inches may also provide estivation habitat.

Two designated critical habitat units exist in the general project area. At Jalama Creek, about 4.4 miles south of the City of Lompoc, 7,662 acres along the coast were designated, while at Gaviota Creek 11,328 acres were designated (FWS, 2006).

Reproduction. California red-legged frogs breed from November through March, with earlier breeding records occurring in southern localities (Storer, 1925). Egg masses that contain about 2,000-5,000 eggs are typically attached to vertical emergent vegetation, such as bulrushes or cattails. California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto, 1984). Eggs hatch in 6-14 days (Jennings, 1988). Larvae undergo metamorphosis 3.5 to 7 months after hatching (Storer, 1925; Wright and Wright, 1949). Sexual maturity normally is reached at 3-4 years of age (Storer, 1925; Jennings and Hayes, 1985).

Diet. The diet of California red-legged frogs is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food items of adult frogs. Vertebrates, such as Pacific tree frogs

(*Hyla regilla*) and California mice (*Peromyscus californicus*), represented over half of the prey mass eaten by larger frogs (Hayes and Tennant, 1985). Hayes and Tennant (1985) found juvenile frogs to be active diurnally and nocturnally, whereas adult frogs were largely nocturnal. Feeding activity likely occurs along the shoreline and on the surface of the water (Hayes and Tennant, 1985).

Reasons for listing. The California red-legged frog has sustained a 70% reduction in its geographic range in California as a result of several factors acting singly or in combination (Jennings et al., 1993). Habitat loss and alteration, overexploitation, and introduction of exotic predators were significant factors in the California red-legged frog's decline in the early to mid 1900s. It is estimated that California red-legged frogs were extirpated from the Central Valley floor before 1960. Remaining aggregations (assemblages of one or more individuals, not necessarily a viable population) of California red-legged frogs in the Sierran foothills became fragmented and were later eliminated by reservoir construction, continued expansion of exotic predators, grazing, and prolonged drought. Within the Central Valley hydrographic basin, only 14 drainages on the Coast Ranges slope of the San Joaquin Valley and one drainage in the Sierran foothills are actually known to support or may support California red-legged frogs, compared to over 60 historic locality records for this basin (a 77% reduction). The pattern of disappearance of California red-legged frogs in southern California is similar to that in the Central Valley, except that urbanization and associated roadway, large reservoir (introduction of exotic predators), and stream channelization projects were the primary factors causing population declines. In southern Mountains, compared to over 80 historic locality records for this region (a reduction of 94%).

Population Status. California red-legged frogs are known to occur in 243 streams or drainages in 22 counties, primarily in the central coastal region of California. The term "drainage" is used to describe named streams, creeks, and tributaries from which California red-legged frogs have been observed. A single occurrence of California red-legged frog is sufficient to designate a drainage as occupied by, or supporting California red-legged frogs. Monterey (32), San Luis Obispo (36), and Santa Barbara (36) counties support the greatest number of currently occupied drainages. Historically the California red-legged frog was known from 46 counties, but is now extirpated from 24 of those counties (a 52% reduction in county occurrences). In seven of the 22 occupied counties (32%), California red-legged frogs are known from a single occurrence. The most secure aggregations of California red-legged frogs are found in aquatic sites that support substantial riparian and aquatic vegetation and lack exotic predators (e.g., bullfrogs (*Rana catesbeiana*), bass (*Micropterus* spp.), and sunfish (*Lepomis* spp.)). Only three areas within the entire historic range of the California red-legged frog may currently support more than 350 adults, Pescadero Marsh Nature Preserve (San Mateo County), Point Reyes National Seashore (Marin County), and Rancho San Carlos (Monterey County). The San Francisco Airport drainage population, identified in the originally proposed rule as containing over 350 individuals, is now thought to be nearly extirpated. Threats, such as expansion of exotic predators, proposed residential development, and water storage projects, occur in the majority of drainages known to support California red-legged frogs.

4.7 FISH

The following fish are considered in this evaluation:

4.7.1 Tidewater Goby (Endangered)

Status. The tidewater goby (*Eucyclogobius newberryi*) was listed by FWS as endangered on February 4, 1994 (59 FR 5498). On June 24, 1999, FWS published a proposed rule to remove the northern populations of the tidewater goby from the endangered species list; the proposed rule was withdrawn on November 7, 2002. Critical habitat for this species was designated on November 20, 2000 (65 FR 69693), and a final recovery plan was published on December 7, 2005 (FWS 2005). The following discussion is derived primarily from the recently published recovery plan. The tidewater goby is threatened primarily by modification and loss of habitat as a result of coastal development, channelization of habitat, diversions of water flows, groundwater overdrafting, and alteration of water flows..

Range. The tidewater goby ranges from Del Norte County (near the Oregon border) south to Agua Hedionda Lagoon in northern San Diego County. Most are found very close to the coast, though a few have been found as much as 8 km (5 mi) inland. Gobies are mostly coastal lagoon fishes that prefer shallow, usually brackish water (Love, 1996).

Habitat. Primary tidewater goby habitat is found in small, shallow coastal lagoons that are separated from the ocean most of the year by beach barriers. They are typically found in water less than 1 meter (3.3 feet) deep (FWS 2005). This includes shallow areas of bays and areas near stream mouths in uppermost brackish portions of larger bays. Tidewater gobies are absent from areas where the coastline is steep and streams do not form lagoons or estuaries. Although tidewater gobies can tolerate full seawater, they are most common in waters with salinities of less than 12 parts per thousand. Adults are benthic, and larvae are briefly pelagic (Love, 1996).

Feeding Ecology. At all sizes examined, tidewater gobies feed on small invertebrates, usually mysids, amphipods, ostracods, snails, and aquatic insect larvae, particularly dipterans. The food items of the smallest tidewater gobies (4-8 mm) have not been examined, but these gobies, like many other early stage larval fishes, probably feed on unicellular phytoplankton or zooplankton (64 FR 33816).

Life history. Tidewater goby populations may fluctuate seasonally. In Aliso Creek Lagoon in Orange County, the winter-early spring population was estimated at 1,000-1,500 fish; after the summer-fall spawning, the population rose to 10,000-15,000 individuals. They are found in small groups or in aggregations of hundreds. The tidewater goby is typically an annual species, with few individuals living longer than a year.

Reproduction in the tidewater goby occurs year-round, although distinct peaks in spawning, often in early spring and late summer, do occur. They exhibit a female-dominant breeding system that is unusual in vertebrates, whereby female tidewater gobies aggressively spar with each other for access to males with burrows for laying their eggs. Females are oviparous and generally produce between about 300 to 500 eggs per clutch, and between 6 to 12 clutches per year. After the male goby has excavated a vertical burrow in coarse sand, a female will lay the eggs on the roof and sides of the burrow, suspending them one at a time. The males guard the eggs until they hatch in 9-10 days (Love, 1996).

Population Status. It is a small fish that inhabits coastal areas ranging from Del Norte County (near the Oregon border) south to Agua Hedionda Lagoon in northern San Diego County. At the time of listing in 1994, tidewater gobies were known to have occurred in at least 87 of California's coastal lagoons, but were considered extirpated in approximately half of these (FWS 2005). These assessments, however, followed a prolonged period of drought, when conditions in many habitats were at extremely low levels. Subsequent surveys found that populations in several locations had become re-established, or had been overlooked in the initial surveys. Additionally, new populations continue to be discovered, increasing the number of known historic populations to 134. As a result, presently only 23 (17%) of the known historic populations are considered extirpated. However, 55 to 70 (41 to 52%) of the localities are naturally so small, or have been degraded over time, that their long-term persistence is uncertain. Currently, the goby is found in approximately 46 localities within the general project area (San Luis Obispo, Santa Barbara, and Ventura counties).

4.7.2 Steelhead Trout (Endangered)

Status. The effective date for listing the Southern California Evolutionarily Significant Unit (ESU) of west coast steelhead (*Oncorhynchus mykiss*) as endangered and the South-Central California Coast ESU as threatened is October 17, 1997 (63 FR 32996). Critical habitat for this species was designated in September 2005 (70 FR-52488). Steelhead from the Southern California ESU have already been extirpated from much of their historical range. There is a strong concern about the widespread degradation, destruction, and blockage of freshwater habitats within the region, and the potential results of continuing habitat destruction and water allocation problems. There is also concern about the genetic effects of widespread stocking of rainbow trout. Total abundance of steelhead in the South-Central Coast ESU is extremely low and declining. Risk factors for this ESU are habitat deterioration due to sedimentation, and flooding related to land management practices and potential genetic interaction with hatchery rainbow trout.

Range. Southern California--This coastal steelhead ESU occupies rivers from the Santa Maria River to the southern extent of the species range. Historically, *O. mykiss* occurred at least as far south as Rio del Presidio in Mexico (Behnke, 1992; Burgner et al., 1992), and in years of substantial rainfall, spawning steelhead were found as far south as the Santa Margarita River in San Diego County (Barnhart, 1986). , at the time of listing, however, the southernmost stream used by steelhead for spawning was generally thought to be Malibu Creek (Behnke, 1992; Burgner et al., 1992). In 1999 and 2000, new information became available which indicated that steelhead or their progeny occurred in at least two coastal streams south of Malibu Creek (Topanga Creek and San Mateo Creek). This new information included observations of juvenile O. mykiss in Topanga Creek and field and laboratory investigations conducted by the CDFG which demonstrated the presence and spawning of anadromous *O. mykiss* in San Mateo Creek (67 FR 21586). In 2002, NMFS published a notification of this extension of the known range, south to the U.S. - Mexico Border (67 FR 21586).

South-Central California Coast--This coastal steelhead ESU occupies rivers from the Pajaro River, Santa Cruz County, to, but not including, the Santa Maria River. Most rivers of this region drain the Santa Lucia Range, the southernmost unit of the California Coast Ranges. The climate is drier and warmer than in the north, which is reflected in the vegetational change from coniferous forest to chaparral and coastal scrub. Another biological transition at the north end of this area is the southern limit of the distribution of coho salmon (*O. kisutch*). The mouths of many rivers and streams in this area are seasonally closed by sand berms that form during periods of low flow in the summer. The southern boundary of this ESU is near Point Conception, a well-recognized transition area for the distribution and abundance of marine flora and fauna.

Life history. Migration and life history patterns of southern California steelhead depend more strongly on rainfall and streamflow than is the case for steelhead populations farther north (Moore, 1980; Titus et al., 2000). Average rainfall is substantially lower and more variable in southern California than in regions to the north, resulting in increased duration of sand berms across the mouths of streams and rivers and, in some cases, complete dewatering of the lower reaches of these streams from late spring through fall. Young steelhead remain in fresh water anywhere from less than 1 year to 3 years. Juveniles migrate to sea usually in spring, but throughout their range steelhead are entering the ocean during every month, where they spend 1-4 years before maturing and ascending streams for the first time. Only winter steelhead are found in southern and south-central California. Winter steelhead enter their home streams from about November to April. Spawning takes place from March to early May. Some steelhead, primarily females, do not die after spawning, and may spawn as many as four times throughout their lives. Females produce 200-12,000 eggs, which hatch in about 50 days (Love, 1996).

Population status. Southern California--Estimates of historical (pre-1960s) abundance are available for several rivers in this ESU: Santa Ynez River, before 1950, 20,000-30,000; Ventura River, pre-1960, 4,000-6,000; Santa Clara River, pre-1960, 7,000-9,000; Malibu Creek, pre-1960, 1,000. In the mid-1960s, the California Department of Fish and Game (CDFG) estimated steelhead spawning populations for smaller tributaries in San Luis Obispo County to be 20,000, but they provided no estimates for streams farther south.

The present total run sizes for six streams in this ESU were summarized by Titus et al. (2000); all were less than 200 adults. Titus et al. (2000) concluded that populations have been extirpated from all streams south of Ventura County, with the exception of Malibu Creek in Los Angeles County. However, steelhead are still occasionally reported in streams where stocks were identified by these authors as extirpated. This includes the rediscovery of the presence of *O. mykiss* in Topanga and San Mateo Creeks in 1999 and 2000 (67 FR 21586).

South-Central California Coast--Historical estimates of steelhead abundance are available for a few streams in this region. The California Advisory Committee on Salmon and Steelhead (CACSS, 1988) cited an estimate of 20,000 steelhead in the Carmel River in 1928. In the mid-1960s, CDFG estimated 27,750 steelhead spawning in many rivers of this ESU. However, comparisons with recent estimates for these rivers show a substantial decline during the past 30 years. In contrast to the CDFG estimates, McEwan and Jackson (1996) reported runs ranging from 1,000 to 2,000 in the Pajaro River in the early 1960s, and escapement of about 3,200 steelhead for the Carmel River for the 1964-75 period.

While there are no recent estimates of total run size for this ESU, recent run-size estimates are available for five streams. The total of these estimates is less than 500, compared with a total of 4,750 for the same streams in 1965, indicating a substantial decline for the entire ESU from 1965 levels.

Minor habitat blockages (smaller dams, impassable culverts, etc.) are likely throughout the region. Titus et al (2000) reported blockages on 28 of 66 tributaries in this ESU, and some passage impairments on most other tributaries. Streams in this region probably suffer from a variety of habitat factors similar to those affecting neighboring ESUs. Forest practices have contributed to incremental degradation of stream habitats (McEwan and Jackson, 1996), and dewatering due to irrigation and urban water diversions is also a problem. Titus et al. (2000) have documented some of these problems for specific tributaries in the southern portion of this ESU.

Habitat. Steelhead, like all salmon, need clean, cool water with plenty of oxygen and low amounts of suspended solids and contaminants. They also need gravel and rocks to spawn. Fine sediment is lethal to steelhead. It clogs the spaces between the rocks and gravel, buries the eggs, and prevents oxygen and flowing water from reaching the eggs. Sediment can also damage the gills of adult steelhead. Steelhead also require large, woody debris and deep pools in the river, which provide refuge from predators and resting places during storms. Deep pools give steelhead cool water when shallow areas warm up in the summer.

Critical habitat. Critical habitat is designated to include all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Santa Maria River to Malibu Creek (inclusive). Also included are adjacent riparian zones. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 3,967 square miles in California. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Los Angeles, San Luis Obispo, Santa Barbara, and Ventura.

4.8 TERRESTRIAL PLANTS

The following plants are considered in this evaluation:

4.8.1 Salt Marsh Bird’s-Beak (Endangered)

Status. The salt marsh bird's-beak (*Cordylanthus maritimus* ssp.*maritimus*), an annual semi-parasitic herb in the figwort family (Scrophulariaceae), was listed as endangered on September 28, 1978 (43 FR 44812). A recovery plan for this species was approved in 1984 (FWS, 1984a). Critical habitat has not been designated. The main reason for listing this species was habitat loss.

Range. This plant is generally restricted to coastal salt marshes. Although there has been some confusion in the past over the range of this subspecies and the similar Pt. Reyes bird’s-beak (*Cordylanthus maritimus* ssp. *palustris*), this plant occurs in salt marshes from Morro Bay in San Luis Obispo County south to San Diego County and Northern Baja California, Mexico. Herbarium records indicate that it was found in at least 10 marshes in California (FWS, 1984a), and in as many as 5 in Baja. The current distribution of this species includes Carpinteria Marsh, Ormond Beach, the Ventura County Game Preserve, Mugu Lagoon, Anaheim Bay, Upper Newport Bay, Sweetwater Marsh, and the Tijuana River estuary (FWS, 1984a). Based on a query of the California National Diversity Database, salt marsh bird’s-beak is currently known to occur at Ormond Beach and Mugu Lagoon in Ventura County, at Carpinteria Salt Marsh in Santa Barbara County, and at Morro Bay in San Luis Obispo County.

Habitat. The primary habitat for this plant is the upper salt marsh that is inundated by tides on a regular basis, but above areas that receive daily salt flooding. Plants may also occur behind barrier dunes, on dunes, mounds, and occasionally in areas with no tidal influence. The plant forms root connections with other plant species such as salt grass (*Distichlis* sp.), pickleweed (*Salicornia* sp.), and cattail (*Typha latifolia*), which may be especially important for plants growing on drier sites (FWS, 1984a).

Reasons for Listing. Destruction and modification of the coastal marshes is the primary reason for this plant’s decline. The plants have been directly affected by a host of man-caused activities, including off-road vehicles, construction equipment, cattle grazing, and flood control levees. Even minor alterations of the marsh that result in permanent changes in the natural tidal dynamics can make previously suitable habitat unsuitable. Changes in tidal inundation have affected plants by: smothering them with increased debris deposited by high tide, encouraging other marsh vegetation which shades out plants, or decreasing germination of seeds by lowering or increasing soil salinity (FWS, 1984a).

Population Status. Population data are not available for most of the salt marsh bird’s-beak sites.

4.8.2 California Sea-Blite (Endangered)

Status. The California sea-blite (*Suaeda californica*), a succulent-leaved perennial plant of the goosefoot family (Chenopodiaceae), was listed as endangered on December 15, 1994 (59 FR 64623). A recovery plan is not available for this species, and critical habitat has not been designated. The main reason for listing this species was habitat loss.

Range. Some confusion has occurred over the historical range of this plant. Munz (1959) described the range as extending from San Francisco Bay south to southern Baja California, Mexico. However, Ferren and Whitmore (1983) separated the plant into two species. The plant they separated out, *Suaeda esteroa*, occurs from Santa Barbara County south to Baja. The historical range of the California sea-blite, therefore, includes the San Francisco Bay area and Morro Bay. The only remaining, naturally existing population of this species is along the perimeter of Morro Bay. The distribution of California sea-blite around Morro Bay was mapped in the early 1990s (see 59 FR 64623). On the east side of the bay, colonies occur adjacent to the communities of Morro Bay, Baywood Park, and Cuesta by-the-Sea, although it apparently is absent from the more interior portion of the marshlands created by Chorro Creek runoff. On the west side of the bay, it is found along most of the spit, excepting the northern flank adjacent to the mouth of the bay.

Current re-introduction projects are on-going in Golden Gate National Recreation Area. A small population was re-established in 2003 at the Crissy Field marsh at San Francisco Bay, near Pier 98.

Habitat. California sea-blite is restricted to the coastal marsh habitat of Morro Bay, where it occurs in a very narrow band in the upper intertidal zone. Sea-blite occurs in association with other marsh plants including *Salicornia* sp. (pickleweed), *Distichlis spicata* (saltgrass), *Juncus acutus* (rush), *Jaumea carnosa* (Jaumea), and *Frankenia salina* (Frankenia) and the federally endangered *Cordylanthus maritimus* ssp. *maritimus* (salt marsh birds-beak) (59 FR 64623).

Reasons for Listing. Because the California sea-blite occupies such a narrow band in the intertidal zone, it is threatened by any natural processes or human activities that even slightly alter this habitat. Such threats include: increased sedimentation of Morro Bay, the encroachment of sand on the east side of the spit, and dredging projects within the channel of the bay (59 FR 64623).

Population Status. The sea-blite's colonial habits make it difficult to estimate the population. One estimate places the number of individuals at no more than 500 (see 59 FR 64623).

5.0 POTENTIAL IMPACT SOURCES

The primary impact-producing activities associated with the proposed project include drilling and production operations with associated support activities. The major impact agents expected from these proposed activities are noise and disturbance, platform discharges, and potential oil spills. The following sections describe the sources and types of these potential impacts.

5.1 NOISE AND DISTURBANCE

The proposed activities associated with the Tranquillon Ridge field project, including drilling and transportation, are among the most common sources of man-made, low frequency noise that could affect protected species (and marine mammals in particular). The source level of a sound produced by activities such as these is described as the amount of radiated sound at a particular frequency and distance, usually 1 m from the source, and is commonly expressed in dB re 1 μPa. Much of the following discussion is derived from the detailed review of the sounds produced by offshore activities in Richardson et al. (1995).

5.1.1 Vessel Traffic

Current Levels of Activity. Crew and supply boats are used daily to transport personnel and supplies to platforms offshore southern California. Support vessels for activities in the Santa Barbara Channel and Santa Maria Basin operate out of bases in the Santa Barbara Channel; support vessels traveling to and from the four platforms in San Pedro Bay operate out of Long Beach. During the past decade, support vessels in the Pacific Region, including both crew and supply boats, have averaged approximately 16 trips per week per platform (Bornholdt and Lear, 1995). However, actual vessel traffic in the Region varies among units, the Point Arguello platforms average as few as 6 supply trips per month, while crew and supply boat trips in the eastern Santa Barbara Channel are much more frequent.

The Santa Barbara Channel/Santa Maria Basin Oil Service Vessel Traffic Corridor Program is intended to minimize interactions between oil industry operations and commercial fishing operations. It was developed cooperatively by the two industries through the Joint Oil/Fisheries Liaison Office. In addition to providing transit corridors in and out of area ports, the program routes support traffic along the Channel seaward of an outer boundary line. East of Gaviota, the outer boundary is defined by the 30-fathom line; west of Gaviota, and north of Point Conception as far as Pedernales Point, it follows the 50-fathom line. In the area west of Gaviota, the 50-fathom line is 4 km (2 nm) or more offshore.

Potential Impact Sources. Vessels are the major contributors to overall background noise in the sea (Richardson et al., 1995). Sound levels and frequency characteristics are roughly related to ship size and speed. The dominant sound source is propeller cavitation, although propeller “singing,” propulsion machinery, and other sources (auxiliary, flow noise, wake bubbles) also contribute. Vessel noise is a combination of narrowband tones at specific frequencies and broadband noise. For vessels the approximate size of crew and supply boats, tones dominate up to about 50 Hz. Broadband components may extend up to 100 kHz, but they peak much lower, at 50-150 Hz.

Richardson et al. (1995) give estimated source levels of 156 dB for a 16-m crew boat (with a 90-Hz dominant tone) and 159 dB for a 34-m twin diesel (630 Hz, 1/3 octave). Broadband source levels for small, supply boat-sized ships (55-85 m) are about 170-180 dB. Most of the sound energy produced by vessels of this size is at frequencies below 500 Hz. Many of the larger commercial fishing vessels that operate off southern California fall into this class.

5.1.2 Aircraft

Current Levels of Activity. Offshore southern California, helicopters are a primary means of crew transport on and off platforms, and helicopter traffic is a daily occurrence in the Point Conception area. OCS helicopter traffic in the Pacific Region operates primarily out of Santa Maria, Lompoc, and Santa Barbara airports. During the past decade, helicopters have averaged approximately 3 to 5 trips per week per platform (Bornholdt and Lear, 1995). Most of this traffic is to and from platforms in the western Santa Barbara Channel and Santa Maria Basin.

Beginning in the 1980s, a standard Information to Lessees (ITL) issued in conjunction with OCS lease sales off southern California provided offshore operators with guidelines for protecting marine mammals and birds from aircraft (Bornholdt and Lear, 1995). The ITL stated that,

> “Aircraft should operate to reduce effects of aircraft disturbances on seabird colonies and marine mammals, including migrating gray whales, consistent with aircraft safety, at distances from the coastline and at altitudes for specific areas identified by the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), and California Department of Fish and Game (CDFG). A minimum altitude of 1,000 feet is recommended near the Channel Islands Marine Sanctuary to minimize potential disturbances. The CDFG and FWS recommend minimum altitude restrictions over many of the colonies and rookeries.”

More recently, the 1,000-foot minimum altitude restriction was extended to air traffic passing the vicinity of the Santa Maria River mouth, to address concerns over possible disturbance of marine bird nesting habitat. Although the original ITL is no longer in force, operators in the southern Santa Maria Basin still comply with these restrictions.

<u>Potential Impact Sources</u>. Air-to-water transmission of sound is very complex (Richardson et al., 1995). An understanding of underwater sound from any aircraft depends on 1) the receiver depth, and 2) the altitude, aspect, and strength of the source.

The concept of a one-meter sound source means very little when discussing aircraft sound production, and an altitude of 300 m is the usual reference distance (Richardson et al., 1995). The angle of incidence at the water surface is very important—much incident sound is reflected at angles greater than 13 degrees from the vertical. This 26-degree "cone" of sound is defined physically by Snell's Law and influenced by sea conditions. Water depth and bottom conditions also strongly influence the propagation and levels of underwater sound from passing aircraft; propagation is attenuated in shallow water, especially when the bottom is reflective (Richardson et al., 1995).

The rotors are the primary sources of sound from helicopters (Richardson et al., 1995). The rotation rate and the number of blades determine the fundamental frequencies. Fundamental frequencies are usually below 100 Hz, with most dominant tones below 500Hz. These are primarily harmonics of the main and tail rotor blade rates, although other tones associated with engines and other rotating parts may also be present.

Richardson et al. (1995) present an estimated source level for a Bell 212 helicopter of about 150 dB at altitudes of 150-600 m, with the dominant frequency a 22-Hz tone with harmonics. Elsewhere a source level of 165 dB is presented for broadband helicopter noise (frequencies 45-7070 Hz).

Generally, peak received levels occur as the aircraft passes directly overhead and are directly related to altitude and depth. However, when the aircraft is not passing directly overhead, received levels may be stronger at "midwater" depths. Helicopters tend to radiate more sound forward. Duration is variable. For example, a Bell 214 was audible in air for 4 minutes before passing, for 38 seconds at 3-m depth, and for 11 seconds at 18 m.

5.1.3 Offshore Drilling

<u>Current Levels of Activity</u>. As of December 2007, more than 1,300 wells had been drilled in the Pacific OCS Region. This number includes 1,013 oil and gas development wells drilled from platforms and 326 exploratory wells drilled from a variety of rigs, including mobile offshore drilling units (MODUs), jack-ups, barges, and drill ships. Based on data accrued from 2001 through 2007, slightly more than 2 development wells per month are begun (spudded) from Region platforms.

<u>Potential Impact Sources</u>. Richardson et al. (1995) cite only a single source of information on the levels of noise produced by platform-based drilling activities. Gales (1982) recorded noise produced by one drilling and three drilling and production platforms off California. The noises produced were so weak that they were nearly undetectable "even alongside the platform" in sea states of Beaufort 3 or better. No source levels were computed, but the strongest received tones were very low frequency, about 5 Hz, at 119-127 dB re 1 μPa. The highest frequencies recorded were at about 1.2 kHz.

5.1.4 Offshore Production

<u>Current Levels of Activity</u>. There currently are 23 offshore platforms in the Pacific OCS Region. Of these, 4 are in the Santa Maria Basin, 15 are in the Santa Barbara Channel, and 4 are in San Pedro Bay.

Potential Impact Sources. Noise produced by metal production platforms is expected to be relatively weak, because a small surface area is actually in contact with the water and because the machinery is placed on decks well above the water line (Richardson et al., 1995). Gales (1982) measured noise from 11 production platforms off California. Sounds recorded from four platforms were very low in frequency, about 4.5-38 Hz measured 9-61 m. Platforms powered by gas turbines produced more tones than platforms with at least partial shore power. Peak recorded sound spectra were between 50-200 or 100-500 Hz.

5.2 EFFLUENT DISCHARGES

Platform discharges with the potential to affect protected species include drilling muds and cuttings, produced waters, and sanitary effluents. All platform effluents are regulated by the requirements of the U.S. EPA's National Pollution Discharge Elimination System (NPDES) General Permit (EPA 2000a and b). The biological assessment prepared for the General Permit evaluates 22 types of discharges resulting from normal OCS oil and gas operations (SAIC, 2000a and b). There are specific permit requirements for five of the discharge types: drilling fluids and cuttings; produced water; well treatment, completion, and workover fluids; deck drainage; and domestic and sanitary waste. The requirements for the remaining discharges are combined. Monitoring is conducted in accordance with 40 CFR Part 136, unless other procedures are specified. Monitoring results are summarized monthly on Discharge Monitoring Report (DMR) forms and reported to the EPA quarterly.

5.2.1 Drilling Fluids

The discharge of drilling muds to be used for the proposed Tranquillon Ridge field drilling program will comply with the General Permit requirements. Under the permit, Platform Irene is authorized to discharge up to 30,000 bbls of cuttings and 105,000 bbl of drilling muds/fluid per year. The PXP estimates that 42,812 bbls of cuttings and 180,737 bbls of drilling muds/fluid will be discharged during the multi-year, 17-well drilling program for the proposed project. Oil based muds will likely be used for drilling the longer, more horizontal portions of the wells. Any oil based muds or muds containing additives not approved by EPA, or containing additives in concentrations above EPA limits will be transported ashore for disposal or they may be reinjected down disposal wells, subject to approval by MMS.

The dispersion of drill muds and cuttings depends on the depth of the discharge (shunt depth), the prevailing flow field, and the physical characteristics of the drill muds and the receiving waters. On Platform Irene, spent drill muds and cuttings would be discharged 150 ft (46 m) below the sea surface. The temperature and density of drill muds generally increase with increasing drilling depth. Even after dilution with seawater at the shale shaker, the discharged material would be a few degrees warmer than ambient seawater temperatures. Because of the shunt depth, most of the heavier muds aggregates are deposited on the seafloor directly below and within 500 m of the discharge point. The heavier rock cuttings are not expected to be transported more than 200 m beyond the discharge point (de Margerie, 1989; MMS, 1996). Approximately 80% of the particulates are removed by these near-field depositional processes (CSA, 1985). Lightweight floccules formed from the remaining suspended particulates would be carried upward toward the sea surface by the buoyant plume of warm water associated with the discharge. They can be carried over four miles from the platform before being deposited on the seafloor (Coats 1994; Pickens 1992).

5.2.2 Produced Water

Produced water from generated by the Tranquillon Ridge field development would also be discharged in accordance with the existing NPDES General Permit. Under the permit, Platform Irene is authorized to discharge up to 55,845,000 bbl of produced water per year, which equates to an average of 50,000 barrels per day. Approximately 1.26 million gallons (40,000 barrels) per day (MGD) of water produced from Point Pedernales and Tranquillon Ridge combined will be shipped from the LOGP to Platform Irene for discharge. A part of the produced water that will be shipped to Platform Irene may still be injected into Point Pedernales reservoir wells, as is currently the operation. Offshore water injection will be conducted as authorized by the MMS.

Initial mixing and dispersion govern the fate of produced water discharged into the marine environment. Initial mixing occurs immediately after discharge. It is driven by the turbulence caused by the momentum of the discharge jet and instability of the buoyant effluent plume as it rises through the water column. EPA's allowed mixing zone for produced water discharges (not applied to oil and grease) is the larger of 100 m measured laterally around the discharge point from the sea surface to the sea floor, or to the boundary of the zone of initial dilution as calculated by a plume model. Produced water discharged off the California coast is generally less saline and warmer than ambient seawater. This results in a buoyant discharge plume that aids in the initial mixing of the effluent. Modeling suggests that initial mixing occurs rapidly and results in dilutions of 30- to 100-fold within a few tens of meters from the outfall (Neff, 2005). Slower-paced dispersion further reduces the concentration of contaminants as the oceanic flow field transports the produced water plume. However, for Platform Irene, the produced water salinity and temperature are close to the ambient values, and the plume would be nearly neutrally buoyant at discharge depth. Consequently, it would not receive the additional benefit of buoyancy-induced mixing.

As part of the General Permit requirements, permittees generated a detailed quantitative assessment of potential impacts from produced water discharges on federally managed fish species from each of the California OCS dischargers, including Platform Irene (MRS 2005). The study focused on the toxicity and bioaccumulation potential of produced water discharges to the fish populations that reside within the 100-m mixing zone beneath the platforms. These fish populations consist mostly of rockfish that utilize the platform as habitat, rarely venturing far from the protection of the structure. Consequently, contaminant concentrations at locations 100-m from the platform have little bearing on the potential impacts experienced by these fish.

Nevertheless, the quantitative exposure assessment found a general absence of impacts from most of the major produced water constituents. Many of the produced water constituents that are normally of concern for the protection of marine organisms were below biological effects levels prior to discharge. Four constituents had end-of-pipe concentrations that were slightly elevated in produced water compared to thresholds of potential effects in finfish. However, because of rapid dispersion, the plume volume containing concentrations of potential biological significance were exceedingly small compared to the volume of habitat contained within the mixing zone. In contrast to the other constituents, the quantitative assessment could not rule out the possibility of potential chronic effects on federally managed finfish due to exposure to undissociated sulfide in produced water discharged at Platform Irene. However, the likelihood of an actual substantive adverse impact on federally managed finfish was thought to be minimal because there were several significant limitations associated with the sulfide assessment, which resulted in an unduly conservative evaluation of finfish exposure.

In particular, the screening study included:

1) an unrealistically low effects threshold for sulfide,

2) a low predicted dilution rate for the original conceptual design of a produced water diffuser on Platform Irene,
3) high variability among sulfide concentrations initially measured in produced water samples,
4) contaminant concentrations in historical produced water samples from Platform Irene that did not reflect potential benefits from future enhanced treatment,
5) no consideration of physicochemical degradation in sulfide introduced into oxygenated seawater, and
6) no consideration of potential finfish avoidance arising from the sulfide astringency.

Currently, produced water discharges from all the California OCS platforms are being evaluated as part of the reasonable potential phase of the General Permit. As part of this analysis, contaminant concentrations measured in produced water samples from individual platforms are being evaluated for their potential to exceed receiving water limitations at the edge of the 100-m mixing zone. A number of the limitations in Platform Irene's sulfide analysis are being resolved as part of the reasonable potential analysis. This includes consideration of significantly enhanced dilution resulting from a new diffuser design and a more realistic threshold for sulfide effects.

Depending on the outcome of the reasonable potential analysis, produced water from Platform Irene could also receive additional treatment to reduce contaminant concentrations prior to discharge. Produced water is not currently discharged from Platform Irene, and, because it is normally reinjected, it receives little or no additional treatment to reduce contaminant concentrations. Before discharge on a regular basis, its quality could be improved by extensive treatment within upgraded treatment facilities both on the platform and within an onshore treatment facility. Upgrades to the onshore treatment facilities have been approved but have yet to be installed. Consequently, the sulfide concentrations historically measured in the Platform-Irene samples are not representative of future marine discharges,

Insofar as limitations in the sulfide effects threshold, an extensive series of bioassay analyses recently established a revised criterion for undissociated sulfide that is applicable to marine organisms near Platform Irene (Weston Solutions Inc. and MRS 2006). The threshold determined in this updated analysis was six-times higher than the EPA National Standard that is currently promulgated in the General Permit. The original criterion was developed using an extremely limited number of dated bioassay studies, conducted primarily on freshwater organisms, or on organisms exposed to sulfides in a complex chemical mixture. Because sulfide toxicity is closely related to the physicochemical properties of water, particularly pH and salinity, the freshwater data can greatly overestimate toxicity.

Thus, even without additional treatment of produced water, potential impacts to marine organisms around Platform Irene are not likely to affect species at a population level. The indeterminacy in potential sulfide impacts that was identified in the original screening study can be largely eliminated through consideration of the increased dilution rate achieved by a redesigned diffuser, and consideration of the higher effects threshold. With a dilution rate comparable to most other California OCS platforms, the computed contaminant concentrations will be well below the sulfide effects threshold within approximately 8 m of the discharge point, and would affect only a small fraction of the receiving water habitat around Platform Irene. It is highly unlikely that motile marine organisms would encounter this limited area on a regular basis, especially considering that most organisms exhibit a strong avoidance reaction to sulfide (EPA 1976, 1986).

5.3 OIL SPILLS

5.3.1 Oil Spill Risk Assessment

A major environmental concern with offshore oil and gas activities is the potential for oil spills and the resulting effects on the human and marine environments. The largest oil spill in the Pacific OCS Region occurred in 1969, when a loss of well control occurred on Platform A off Santa Barbara which spilled an estimated 80,000 bbl into the Channel (Van Horn et al., 1988). Since that time, a number of measures have been initiated including more stringent regulations covering OCS operational and environmental safety, a rigorous MMS inspection program in the Pacific Region, continuous evaluation and improvement in OCS facilities' oil spill response, and the development of a highly organized oil spill response structure (Bornholdt and Lear, 1997). No spill of the magnitude of the 1969 event has occurred anywhere on the U.S. OCS since then, and the measures listed above make a reoccurrence a highly unlikely event.

Table 5.1 lists the hydrocarbon spills that occurred in the Pacific OCS Region from 1969 through 2007. During that period, 1,152 oil spills were recorded. Obviously, the total volume of oil spilled in the Region is dominated by the Santa Barbara spill. Since 1969, these spills have ranged in size from less than 1 bbl to 163 bbl, for a total of slightly more than 844 bbl. For comparison, natural oil seeps at Coal Oil Point in the Santa Barbara Channel are estimated to discharge approximately 150-170 bbl of oil per day (Hornafius et al., 1999).

In the course of normal, day-to-day platform operations, occasional accidental discharges of hydrocarbons may occur. Such accidents are typically limited to discharges of quantities of less than 1 bbl of crude oil. As shown in Table 5.1, 1,146 of the 1,152 total recorded spills of less than 50 bbl (99.5% of the total) occurred on the Pacific OCS between 1970 and 2007, resulting in slightly more than 331 bbl of oil being discharged into the ocean. In the same timeframe, there has been a total of 379 reported spills of less than one barrel totaling 8.2 bbl (about 0.02 bbl or 0.8 gal per spills) and three spills totaling 20.2 barrels (about 6.7 bbl or 282 gals per spill). Due to the infrequency and small volumes of these accidental discharges and the location (generally away from sensitive species), spills of less than 50 bbl are not considered an impact-producing agent for the protected species discussed in this biological evaluation.

Larger oil spills may occur from loss of well control (if wells are free flowing), pipeline breaks, operational errors, or vessel-platform allisions. Only 5 of the 42 spills of greater than 1 bbl measured 50 bbl or more in volume (Table 5.1); the largest of these was the September 1997, 163 bbl, Torch pipeline spill. In the intervening 11 years since the Torch pipeline spill, there been no spills of 50 bbl or more anywhere in the Pacific Region.

For the purposes of this biological evaluation, MMS has estimated the number of oil spills in two size ranges: 1,000 barrels (bbl) or greater and 50 to 999 bbl. that could occur as a result of the proposed action (Table 5.2). Using the method of Anderson and LaBelle (2000), it was calculated that a mean of 0.195 spills greater than 1,000 bbl could occur over the lifetime of the Tranquillon Ridge project with a probability of occurrence of 17.7%. This is compared to the spill number and percent occurrence calculated in the original 1985 EIS/EIS for Point Pedernales of 0.351 and 29.6%, respectively (ADL, 1985).

The 1985 EIR/EIS assumed that 135 MMbbls would be produced from the Point Pedernales field while DPP revision assumed that 129 MMbbls would be produced from both the remaining oil from the Point

Pedernales field and that anticipated to be produced from the Tranquillon Ridge field. While these total volumes are similar, the risk of a spill greater than or equal to 1,000 bbls is different between the two projects because the oil spill rates for the 1985 EIR/EIS were higher than are the current rates (ADL, 1985) (see the 3rd, 4th, and 5th columns of Table 5.3)

Table 5.1 Crude, diesel, or other hydrocarbon spills recorded in the MMS's Pacific OCS Region, 1969 through 2007 (volumes in barrels).

Year	Less than or equal to 1 bbl		Greater than 1 bbl less than 50 bbl		Equal to or more than 50 bbl		Total	
	No	Volume	No	Volume	No	Volume	No	Volume
1969	0	0	0	0	2	80,900	2	80,900.0
1970	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0
1975	1	0.1	0	0	0	0	1	0.1
1976	3	1.1	1	2.0	0	0	4	3.1
1977	11	2.2	1	4.0	0	0	12	6.2
1978	4	1.2	0	0	0	0	4	1.2
1979	5	1.7	1	2.0	0	0	6	3.7
1980	11	4.9	2	7.0	0	0	13	11.9
1981	21	6.0	10	75.0	0	0	31	81.0
1982	24	3.2	1	3.0	0	0	25	6.2
1983	56	7.7	3	6.0	0	0	59	13.7
1984	65	4.7	3	36.0	0	0	68	40.7
1985	55	9.3	3	9.0	0	0	58	18.3
1986	39	5.5	3	12.0	0	0	42	17.5
1987	67	7.5	2	11.0	0	0	69	18.5
1988	47	3.7	1	2.0	0	0	48	5.7
1989	69	4.1	3	8.0	0	0	72	12.1
1990	43	3.6	0	0	1	100.0	44	103.6
1991	51	5.8	1	10.0	1	50.0	53	65.8
1992	39	1.2	0	0	0	0	39	1.2
1993	32	0.7	0	0	0	0	32	0.7
1994	18	0.4	2	33.0	1	50.0	21	83.4
1995	25	0.9	1	1.4	0	0	26	2.3
1996	39	0.9	1	5.0	1	150.0	41	155.9
1997	20	2.5	0	0	1	163.0	21	165.5
1998	25	0.5	0	0	0	0	25	0.5
1999	31	1.2	1	10.0	0	0	32	11.2
2000	31	0.2	0	0	0	0	31	0.2
2001	43	0.4	0	0	0	0	43	0.4
2002	46	0.1	1	9.0	0	0	46	9.1
2003	39	0.1	0	0	0	0	39	0.1
2004	31	0.5	0	0	0	0	31	0.5
2005	42	1.3	0	0	0	0	42	1.3
2006	37	1.1	0	0	0	0	37	1.1
2007	34	0.3	1	1.2	0	0	35	1.5
Totals	**1104**	**84.6**	**42**	**246.6**	**7**	**81,413.0**	**1152**	**81,751.7**
Totals w/out 1969 spill	**1104**	**84.6**	**42**	**246.6**	**5**	**513.6**	**1150**	**844.2**

Table 5.2 Estimated Means and Spill Occurrence Probabilities Point Pedernales and Tranquillon Ridge Analyses for Spills of 1,000 bbl or greater.

		Mean Number of Spills			Percent Probability of One or More Spills		
		Platforms	**Pipelines**	**Total**	**Platforms**	**Pipelines**	**Total**
Project	**Spill Rates (1985*)**	**1**	**1.6**	**2.6**			
1985 EIR/EIS	Anticipated Production – 0.135 Bbbl	0.135	0.216	0.351	12.6%	19.4%	29.6%
	Spill Rates (current)**	**0.132**	**1.38**	**1.51**			
Revised DPP	Anticipated Production – 0.129 Bbbl	0.017	0.178	0.195	1.7%	16.3%	17.7%

Bbbl = billions of barrels.
***Source: Lanfear & Amstutz, 1983**
**** Source: Anderson & LaBelle, 2000**

Table 5.3 Estimated Means and Spill Occurrence Probabilities Point Pedernales and Tranquillon Ridge Analyses for Spills of 50 to 999 bbl.

		Mean Number of Spills			Percent Probability of One or More Spills		
		Platforms	**Pipelines**	**Total**	**Platforms**	**Pipelines**	**Total**
Project	**Spill Rates (current)****	**5.164**	**1.721**	**6.885**			
1985 EIR/EIS	Anticipated Production – 0.135 Bbbl	0.697	0.232	0.929	50.2%	20.7%	60.5%
Revised DPP	Anticipated Production – 0.129 Bbbl	0.666	0.222	0.888	48.6%	19.9%	58.9%

Bbbl = billions of barrels
**** Source: Anderson & LaBelle, 2000**

Formulae used in the Oil Spill Occurrence and Probability Calculations:
Estimated Mean Number of Spills = spill rate λ (number of spills per Bbbl) x volume handled t (Bbbl) = λ t
Probability [n spills over future exposure t] = $[(\lambda t)^n e^{-\lambda t}] / n!$
Probability of Zero Spills = $[(\lambda t)^0 e^{-\lambda t}] / 0! = [1 \times e^{-\lambda t}] / 1 = e^{-\lambda t} = 1 / e^{\lambda t}$
Probability of One or More Spills = 1- Probability[zero spills] = $1 - 1 / e^{\lambda t}$

Based on the MMS's U.S. Oil Spill Database and the experience in the Pacific Region over the last 30 years, the most likely spill volume from the Tranquillon Ridge field facilities would probably be less than 200 bbl in volume. Table 5.3 shows the spill rates, mean number of spills, and percent probability of a spill occurring for the size range of 50 to 999 bbl for both the original 1985 EIS/EIS for Point Pedernales and the Revised DPP. Because the probability of one or more spills for the 50-999 bbl size range was not calculated in the 1985 era, the current spill rates for this size range was applied to both the 1985 Point Pedernales data and the information given in the Revised DPP. Thus, the percent probability of one or more spills between both projects (60.5 and 58.9%, respectively) is similar due to the similar volumes of oil that was anticipated to be produced.

The MMS estimates that the most likely maximum size of a major oil spill from the Tranquillon Ridge field development is the maximum volume of oil calculated to be spilled from a break in the Irene to shore oil emulsion pipeline about 0.25 miles seaward of the shoreline. This is estimated to be 6,718 bbl of oil (MRS 2002 FEIR). However, the most likely scenario, as discussed above, is that one or more oil spills in the 50-1,000-bbl range would occur over the life of the proposed project (with an approximately 59% chance of occurrence), and that such a spill would be less than 200 bbl in volume. Regardless, there exists a 17.7% probability that a spill equal to or greater than 1,000 bbl could occur as a result of the proposed Tranquillon Ridge field development activities.

The level of impacts from such spills will depend on many factors, including the type, rate, and volume of oil spilled and the weather and oceanographic conditions at the time of the spill. These parameters would determine the quantity of oil that is dispersed into the water column; the degree of weathering, evaporation, and dispersion of the oil before it contacts a shoreline; the actual amount, concentration, and composition of the oil at the time of shoreline or habitat contact; and a measure of the toxicity of the oil.

Oil Spill Risk Analysis

The analyses described below provide possibilities of oil spill trajectory and landfall or resource impact. They include an Oil Spill Risk Analysis (OSRA) model calculation and a General National Oceanic and Atmospheric Administration Modeling Environment (GNOME) analysis that simulates oil movement due to winds, currents, tides, and spreading. The OSRA model analysis is the traditional MMS method of determining probabilities of oil spill landfall and impacts to resources. It calculates numerous trajectories from a pre-designated launch point by varying the wind over a static, seasonally-averaged ocean current field and applying the deep ocean 3.5% wind rule to project the assumed movement of oil over the surface layer of the water. Shoreline segments are partitioned into their USGS Quad maps, and probabilities of oil spill landfall for each shoreline segment are calculated. The probabilities of oil spill intrusion into defined offshore regions are also presented.

GNOME analysis provides a slightly different picture of possible oil spill trajectory by including variables that account for weatherization of released materials, specific ocean current regimes, and meteorological conditions. GNOME was developed by the Hazardous Material Response Division (HAZMAT) of the NOAA OR&R.

Although the GNOME results differ slightly from OSRA model calculations, both analyses provide important insights that help present a more complete picture of what may occur when oil is spilled. Together, these analyses represent the best available information the MMS currently has to offer on possible oil spill trajectories in the Santa Barbara Channel-Santa Maria Basin area.

Oil Spill Risk Assessment (OSRA) Model

In order to determine the areas that might be contacted by proposal-generated oil spills, MMS has generated conditional oil spill probability data. Conditional oil spill probabilities are independent of both the accident spill rates and resource estimates; they are based solely on the MMS Oil Spill Risk

Assessment (OSRA) model simulation trajectories and assume that a spill has occurred. Appendix B describes the OSRA model and provides graphical depictions of the results of the conditional model runs for southern California. Two launch points were included in the analysis for the proposed Tranquillon Ridge field project: Platform Irene, and the Irene-to-shore oil/emulsion pipeline.

The following paragraphs present seasonal synopses of the conditional OSRA model runs conducted for the Tranquillon Ridge field. For each season, the OSRA model calculated probabilities of contact to shoreline segments and offshore blocks for spills from each of the launch points over 3-, and 10-day periods. The results of each of these conditional model runs are included in Appendix B. Although the OSRA model can also be used to calculate probabilities over a 30-day period, the effects of weathering on oil make the first 10 days of the oil spill trajectory the most important in a risk analysis and have been focused on here. Additionally, containment measures are generally in place well before 30 days have elapsed. Therefore, a 30-day period was not utilized in the modeling analysis.

Spring (March-May). Based on the spring OSRA model runs, the probabilities that oil spilled from the Tranquillon Ridge field would contact San Miguel and Santa Rosa Islands range from less than 0.1% to 13.3% by the third day, and increase only slightly thereafter. By day 10, a small chance (less than 0.1%) of contact to San Nicolas Island appears. However, the model runs predict a 15.3% chance of mainland contact at Point Arguello within 3 days.

Conditional probabilities for offshore blocks also indicate a predominantly south to southeast movement of oil spilled from Tranquillon Ridge field (Appendix B). By day 3, contact probabilities of 50% or greater are recorded for waters southwest of San Miguel Island. From this point, spreading appears to continue southward, primarily over waters to the west of the Santa Rosa Ridge. Contact probabilities of 50% or greater occur in waters to the west of San Nicolas Island by day 10.

Summer (June-August). The OSRA model runs for summer (Appendix B) indicate an even smaller probability of contact to the northern Channel Islands than in spring. Contact probabilities for San Miguel and Santa Rosa Islands range from less than 0.1 to 1.1% by the third day and do not change over the 10-day period. As was the case for spring, a very slight (less than 0.1%) probability of contact to San Nicolas Island appears by day 10. Additionally, the model runs predict an 11.9% chance of mainland contact at Point Arguello within 3 days.

The summer conditional runs for the offshore blocks show predominantly southward movement, with little probability of contact to areas north of Point Arguello (Appendix B). However, the probability of contact to waters west of San Miguel Island reaches about 60% after 3 days. By day 10, a contact probability of about 50% is recorded in waters as far south as San Nicolas Island.

Fall (September-November). The fall OSRA model runs (Appendix B) indicates relatively low probabilities of contact, from less than 0.1 to 1.7%, to the western portions of San Miguel Island after 3 days. By day 10, this probability has increased only slightly, up to 1.9%. The chance of contact to San Nicolas Island, however, remains very slight, at less than 0.1%.

The fall model runs indicate the possibility that an oil spill from the Tranquillon Ridge field would contact the mainland shore at, and north of, Point Arguello. There is up to an 8.9% probability that the Point Arguello area would be contacted within 3 days. Additionally, low shoreline contact probabilities (around 1%) are recorded as far north as Point Sal. These probabilities increase marginally through the full 10-day model period. Very slight (less than 0.1%) probabilities of contact to the mainland as far north as Point Buchon appear by day 3, and expand northward by day 10 to include Point Piedras Blancas.

For the offshore blocks, the fall runs indicate movement to both north and south and considerable spreading throughout the 10-day model period (Appendix B). By day 3, low contact probabilities (about 10-20%) are recorded offshore as far north as Point Sal; probabilities of contact to waters west of San Miguel Island range up to 30%. After 10 days, there is a slight chance (less than 10%) of contact as far north as Piedras Blancas. Relatively greater movement to the south results in a contact probability up to 60% in areas approximately 10 km south-southwest of San Miguel Island by the end of the 10-day period. However, contact probabilities remain low, at less than 20%, in the offshore waters approximately 50 km west of San Nicolas Island.

Winter (December-February). The conditional OSRA model runs for winter (Appendix B) give probabilities of only 2.5% that an oil spill from the Tranquillon Ridge field would contact San Miguel Island within 3 days. By the end of the 10-day period, these probabilities increase only slightly, to 3.3%. Chances of contact to other Channel Islands also remain slight, reaching 0.8% for Santa Rosa Island and less than 0.6% for San Nicolas Island, respectively, by day 10.

North of Point Conception, the model runs show probabilities of up to 13.6% that the Point Arguello area would be contacted by a spill within 3 days. Thereafter, overall probabilities that a spill would affect the mainland north of Point Conception increase only slightly, to about 14.4%. However, slight (less than 1%) probabilities of shoreline contact appear almost as far north as Cape San Martin.

At 3 days, the winter runs for the offshore blocks indicate some spreading to the north and northwest, with low probabilities of contact (less than 10%) recorded in waters off Morro Bay (Appendix B). Movement to the south appears comparable to that of the fall season, with contact probabilities of about 30% observed west of San Miguel Island. By day 10, up to 10% contact probabilities are seen in offshore waters near Cape San Martin in the north; at the same time, probabilities of contact ranging up to 60% occur just west of San Miguel Island.

Oil Spill Risk Information Based on GNOME Modeling

This GNOME modeling analysis is presented along with the MMS OSRA model results as part of the best available information regarding oil spill risk analysis for the Tranquillon Ridge field Project. An expanded version of this analysis, including relevant study methods, and the tables and figures referred to in the analysis presented here are found in Appendix B.

Releases were modeled over 3- and 10-day periods for three locations: Platform Irene, the midpoint of the pipeline, and the pipeline shoreline location about 0.25 miles from the shoreline. Additionally, releases were modeled for three wind directions (northwest, neutral, and southwest) correlated with prevailing ocean current flow regimes (upwelling, convergent, and relaxation).

Landfall contacts generated under the GNOME modeling (for all conditions) suggest that the northernmost extent any release would reach would be off of Point Buchon, and that such northward dispersion would only occur during a relaxation flow regime. The GNOME modeling also provides insight into the behavior of the spill with regard to the release site; a release at the shoreline will predominately impact the mainland from Pt. Sal to Pt. Conception, while releases at the pipeline midpoint or Platform Irene are more likely to make contact with San Miguel and Santa Rosa Islands (Appendix B).

5.3.2 Oil Spill Prevention and Response

Platform Inspections and Drills

The MMS is the federal agency that oversees the safe and environmentally sound exploration and production of oil and gas on the outer continental shelf (OCS). In the Pacific OCS Region, MMS inspectors and engineers visit the offshore platforms 365 days a year to ensure that safety, maintenance, and operational standards are being maintained and to prevent oil spills from occurring**.** Unannounced, partial production and drilling inspections of every offshore facility in the Region are conducted at least once per month, in addition to thorough annual inspections of each facility. Three times a year the MMS also conducts intensive, multi-day inspections known as Focused Facility Reviews (FFRs), rotating among the offshore facilities.

In order to test offshore operators' states of readiness and response capabilities, as well as their knowledge and understanding of their individual oil spill response plans (OSRPs), the MMS also conducts frequent unannounced oil spill response exercises at OCS facilities. Appropriate federal, state, and local agencies are notified of, and frequently take part in, these exercises. Most exercises entail the deployment of primary response equipment and test the operators' ability to initially respond to a spill. If, for some reason (e.g., weather or safety issues), equipment is not able to be deployed, a table-top exercise can be conducted which would also test an operator's ability to respond to the initial events of a spill, however without the benefit of equipment deployment.

Minor exercises are conducted at every OCS platform once during the year. A major exercise is conducted at one OCS facility once during the year, rotating amongst the facilities. A minor exercise requires the successful deployment and operation of primary response equipment at the platform. A major exercise requires the establishment of an onshore incident command center, as well as the successful deployment and operation of primary and, to some degree, secondary response equipment.

When MMS inspectors conduct drills at the OCS facilities, the operators are judged, in part, by their ability to show containment of the simulated spill within 1 hour and skimming operations within 2 hours. If these guidelines are not met, the MMS inspector can issue an Incident of Non-Compliance (INC) that will indicate how the operator failed in the drill and give them some time to remedy the failure. A retest will be conducted at some later time to ensure that the operator has corrected the fault. During a drill, various records, including training certifications and equipment inspections, are also checked. INCs may also be issued for failure in these areas.

<u>Pipeline Inspection</u>
The Pacific OCS Region also has a rigorous offshore pipeline inspection policy. The policy specifies several types of regular inspections. The operator is required to conduct weekly inspection by boat or aircraft of the ocean surface along the pipeline route for leakage. The records of these inspections must be submitted annually to the MMS.

External and internal inspections of all oil and gas pipelines by a third party are also required in alternating years. Plans for these inspections must be submitted to the MMS at least 30 days before the survey; inspection results must be submitted within 60 days of survey completion. The external inspections, which must be conducted using ROV or side-scan sonar, are intended to identify burial and spanning conditions, protrusions, structural integrity, damage, and corrosion to the pipeline. The internal inspections involve the use of internal survey tools to identify corrosion and/or damage.

If an inspection reveals a potential problem with a pipeline, the MMS requires the operator to develop a remediation plan to address the problem. The plan is submitted to the MMS for review and approval. If the MMS is unsatisfied with the plan, or if an inspection has identified a problem requiring immediate action, the MMS will normally work with the operator to resolve the problem. This is accomplished, most often, by requiring the operator to fix the pipeline through the use of a clamp, inserting a new section of pipe, or by some other engineered solution. MMS can also de-rate the pipeline to a lower maximum operating pressure which also lowers the maximum volume that can be transported. Rarely is a pipeline shut-in or the operator's ability to transport OCS oil through the pipeline suspended.

MMS regulations state that operators may be required to equip oil pipelines with a metering system to provide a continuous volumetric comparison between the input to the line at the structure(s) and the deliveries onshore. Such a system must include an alarm system and be sensitive enough to detect variations between input and discharge volumes. Alternately, an operator may, with approval from the MMS, install a system capable of detecting leaks in the pipeline. The majority of the oil pipelines in the Pacific OCS Region have continuous volumetric comparison-type leak detection systems. All oil pipeline leak detection systems must be installed and tested to demonstrate indicated design performance levels.

Oil Spill Response

MMS regulations at 30 CFR Part 254 require that each OCS facility have a comprehensive Oil Spill Response Plan (OSRP). Operators of oil handling, storage, or transportation facilities must submit an OSRP to the MMS to demonstrate their ability to respond quickly and effectively whenever oil is discharged from their facility. Response plans consist of an emergency response action plan, and supporting information that includes an equipment inventory, contractual agreements with subcontractors, a worst-case discharge scenario, a dispersant use plan, an in-situ burning plan, and details on training and drills. Each response plan must be reviewed by the operator at least every 2 years and submitted with modifications to the MMS for review and approval.

Operators must include in their OSRP a calculation of a worst-case discharge volume using the criteria specified in 30 CFR §254.47. The intent is to ensure that an operator has the capacity to respond to the largest quantity of oil that could be spilled from a facility simultaneously. Worse case discharge volumes include 1) the maximum capacity of all oil storage tanks and flow lines on the facility, 2) the volume of oil calculated to leak from a break in any pipelines connected to the facility, and 3) the daily production volume from an uncontrolled blowout of the highest capacity well associated with the facility. Once these calculations are made, MMS determines if the operator's OSRP indeed lists the equipment that would be deployed if a spill occurred and if it would be able to contain this maximum amount of oil.

Since 1970, oil companies operating in the Santa Barbara Channel and Santa Maria Basin have funded and operated a non-profit oil spill response cooperative called Clean Seas. Clean Seas acts as a resource to its member companies by providing an inventory of state-of-the-art oil spill response equipment, trained personnel, training, and expertise in planning and executing response techniques. Clean Seas personnel and equipment are on standby, ready to respond to an oil spill, 24 hours a day, 365 days a year.

Clean Seas' area of responsibility stretches from Point Dume north to approximately Cape San Martin, and includes the northern Channel Islands. To provide spill response coverage in the area, Clean Seas maintains two large Oil Spill Response Vessels (OSRVs), several smaller response vessels, and pre-positioned equipment at strategic locations.

In conjunction with the Ventura County Commercial Fishermen's Association, Clean Seas founded the Fishermen's Oil-spill Response Team (FORT) in 1990. More than 300 area fishermen have been trained to respond to spill situations as members of FORT. FORT vessels have acted in support of Clean Seas' response efforts both in drills and at a number of offshore spills, where they have deployed boom, assisted logistics, and served as wildlife rescue platforms.

The primary oil spill response for the Platform Irene is provided by Clean Seas' OSRV *Mr. Clean III*. *Mr. Clean III* normally is moored adjacent to Platform Harvest or in Cojo Anchorage near Point Conception. Response time from Cojo Anchorage to Platform Irene is estimated to be approximately two hours. *Mr. Clean III* is equipped with two Lori Five Brush advancing skimmer units, one stationary skimmer, and one DOP 250 Skimmer, plus accessory equipment; 1500 feet of 70-inch Expandi Boom on a hydraulic reel and 1500 feet of 43-inch containment boom; a fast response boom boat, a dispersant application system, an 18-ton crane, 10 bags each of absorbent boom and pads, and an onboard oil storage capacity of 1400 bbl.

Secondary oil spill response from an OSRV would come from *Mr. Clean*, moored outside Santa Barbara harbor along with Clean Seas' oil-recovery barge. *Mr. Clean* could arrive at Platform Irene in about 6 to 7 hours. This vessel would be used in the case of a spill that was larger than the primary OSRV could handle.

In addition to the OSRVs, Clean Seas maintains smaller response vessels, including two 32-foot Spill Response Vessels (SRVs), Fast Response Support Boats (FRSB), and miscellaneous small boats. These vessels are based in Santa Barbara Harbor and at Clean Seas' Carpinteria facility. If needed in support of *Mr. Clean III*, they could reach the Tranquillon Ridge facilities in 4 to 5 hours.

Clean Seas also is equipped and prepared to respond to oil spill threats to sensitive shoreline areas within its area of responsibility. Detailed and up-to-date information on sensitive areas and response strategies in the Clean Seas' area is provided in the Northern Sector, Los Angeles/Long Beach Area Contingency Plan prepared by the U.S. Coast Guard and the California Office of Oil Spill Prevention and Response, and in the Clean Seas Regional Response Manual. Based on Clean Seas cascadable agreements, additional levels of oil spill response to a spill area are provided by Marine Spill Response Corporation (MSRC), and Advanced Cleanup Technology, Inc.

The Marine Spill Response Corporation (MSRC) is a nation-wide spill response cooperative, established by the oil industry in the wake of the *Exxon Valdez* spill. Founded in 1990, it is the largest dedicated standby oil spill response organization in the United States. MSRC operates four OSRVs in Southern California and two in the San Francisco Bay. The OSRVs are approximately 210 feet long, have temporary storage for 4,000 barrels of recovered oil, and have the ability to separate oil and water aboard ship using two oil-water separation systems. To enable the OSRV to sustain cleanup operations, recovered oil is transferred into other vessels or barges. The MSRC's southern California response vessel is the OSRV *California Responder*, which is currently based in Long Beach, California, approximately 12 hours response time from the Platform Irene. MSRC also maintains a 32,000 bbl capacity barge at Port Hueneme. Originally, it was intended that the *California Responder* only be deployed in response to oil spills of 1,200 bbl or greater. However, due to the superior operating record and lack of large spills in this region, the *Responder* now responds to smaller spills on an on-call basis.

Advanced Cleanup Technologies, Inc. (ACTI) is a primary contractor for onshore and shoreline cleanup. ACTI has sufficient resources and trained personnel to satisfy all federal and state shoreline response planning requirements. In the event an onshore or shoreline response is required, ACTI personnel and equipment can respond in under a few hours.

The MMS also routinely inspects and can write INCs to the oil spill cooperatives and ACTI.

6.0 IMPACTS TO THREATENED AND ENDANGERED SPECIES

6.1 MARINE MAMMALS

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on marine mammals. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on threatened and endangered marine mammal species in the project area.

Noise and Disturbance

Aircraft**.** There have been few systematic studies on the reactions of pinnipeds to aircraft (Richardson et al., 1995). Most documented observations of the reactions of pinnipeds to aircraft noise related to animals hauled out on land. Under these circumstances, recorded reactions range from increased alertness to headlong rushes into the water. In open water, pinnipeds sometimes respond to low-flying aircraft by diving (Richardson et al., 1995).

There are no data on the received levels at which toothed whales, or odontocetes, react to aircraft (Richardson et al., 1995). Observed reactions include diving, slapping the water with flukes or flippers, and swimming away. Information on the reactions of sperm whales to aircraft has been mixed. Sperm whales have not been observed to exhibit obvious reactions to low-flying helicopters (Richardson et al., 1995). However, sperm whales have been observed to dive immediately in response to a Twin Otter passing 150-230 m overhead (Mullin et al., 1991).

Baleen whales vary in their responses to the approach of aircraft. Richardson et al. (1995; pp. 249-252) review the recorded behavior of several baleen whale species, including bowhead, right, gray, humpback, and minke whales. They conclude that response depends on the whales' activities and situations, with foraging or socializing groups less likely to react to the approach of aircraft than individual animals. Observed responses include hasty dives, turns, and other changes in behavior. To date, there is no evidence that aircraft disturbance has resulted in long-term displacement of baleen whales.

Vessels. In general, seals often show considerable tolerance of vessels. Sea lions, in particular, are known to tolerate close and frequent approaches by boats (Richardson et al., 1995).

Odontocetes also often tolerate vessel traffic, but may react at long distances if confined (e.g., in shallow water) or previously harassed (Richardson et al., 1995). Depending on the circumstances, reactions may vary greatly, even within species. Although the avoidance of vessels by odontocetes has been demonstrated to result in temporary displacement, there is no evidence that long-term or permanent abandonment of areas has occurred. Sperm whales may react to the approach of vessels with course changes and shallow dives (Reeves, 1992), and startle reactions have been observed (Whitehead et al., 1990; Richardson et al., 1995).

There have been specific studies of reactions to vessels by several species of baleen whales, including gray (e.g., Wyrick, 1954; Dahlheim et al., 1984; Jones and Swartz, 1987), humpback (e.g., Bauer and Herman, 1986; Watkins, 1986; Baker and Herman, 1989), bowhead (e.g., Richardson and Malme, 1993), and right whales (e.g., Robinson, 1979; Payne et al., 1983). There is limited information on other species.

Low-level sounds from distant or stationary vessels often seem to be ignored by baleen whales (Richardson et al., 1995). The level of avoidance exhibited appears related to the speed and direction of the approaching vessel. Observed reactions range from slow and inconspicuous avoidance maneuvers to instantaneous and rapid evasive movements. Baleen whales have been observed to travel several kilometers from their original position in response to a straight-line pass by a vessel (Richardson et al., 1995).

Off California, collisions between vessels and whales have occurred frequently. Between 1975 and 1980, twelve collisions occurred off southern California, resulting in the deaths of six gray whales. Young gray whales, especially, are more likely to be hit by moving vessels (Laist et al. 2001).

A gray whale calf was severely injured offshore Morro Bay, California during installation of a trans-Pacific cable. The injury consisted of a severely cut tail stock and flukes completely severed off the animal. The extent of the injury (severing of the caudal peduncle) was consistent with a propeller strike

(Burton and Harvey, 2001). Although the carcass of the calf was never recovered, it is unlikely that the injured calf traveled far from the location where it was observed (Burton and Harvey, 2001).

Offshore Drilling and Production. As discussed in Section 5.1.3, the sound levels produced by drilling from conventional, bottom-founded platforms are relatively low and are similar to levels generated by production activities (Gales, 1982). Richardson et al. (1995) predict that the radii of audibility for baleen whales for production platform noise would be about 2½ km in nearshore waters and 2 km near the shelf break.

For gray whales off the coast of central California, Malme et al. (1984) recorded a 50% response threshold to playbacks at 123 dB re 1 μPa (and about 117 dB re 1 μPa in the 1/3-octave band). This is well within 100 m in both nearshore and shelf-break waters; therefore, the predicted radius of response for grays, and probably other baleen whales as well, would also be less than 100 m. Richardson et al. (1995) predicted similar radii of response for odontocetes and pinnipeds.

Effluent Discharges

The potential effects of OCS platform discharges on marine mammals include 1) direct toxicity (acute or sublethal), through exposure in the waters or ingestion of prey that have bioaccumulated pollutants; and 2) a reduction in prey through direct or indirect mortality or habitat alteration caused by the deposition of muds and cuttings (SAIC, 2000a, b). However, there is no toxicity information on the effects of muds and cuttings and produced water discharges on marine mammals. Comprehensive reviews by the National Academy of Sciences (1983) and the Environmental Protection Agency do not address the potential effects of routine OCS discharges on these groups of animals. Impacts from routine OCS discharges have not been associated with marine mammals, because they are highly mobile and capable of avoiding such discharges, and their ranges far exceed the extent of the discharge plumes.

The EPA biological assessment for the proposed reissuance of its general NPDES permit for offshore OCS facilities in southern California waters concludes that direct toxicity to listed marine mammals, or their food base, should be minimal (SAIC, 2000a, b). All such discharges are required to meet NPDES water quality criteria, which were established to protect biological resources outside the mixing zone. Therefore, any contact with OCS discharges likely would be extremely limited. Potential impacts to listed marine mammals would most likely occur through the bioaccumulation of toxins in prey, or through the displacement or reduction of prey species (MMS, 1996; SAIC, 2000a, b). The potential impacts of OCS effluents on individual listed species are discussed below.

Oil Spills

Marine mammals vary in their susceptibility to the effects of oiling (Geraci and St. Aubin, 1990; Williams, 1990; Loughlin, 1994a). Oil may affect marine mammals through various pathways: surface contact, oil inhalation, oil ingestion, and baleen fouling (Geraci and St. Aubin, 1990). Cetaceans risk a number of toxic effects from accidental oil spills at sea (Geraci, 1990). Since cetaceans (like most adult pinnipeds) rely on layers of body fat and vascular control rather than pelage to retain body heat, they are generally resistant to the thermal stresses associated with oil contact. However, exposure to oil can cause damage to skin, mucous, and eye tissues. The membranes of the eyes, mouth, and respiratory tract can be irritated and damaged by light oil fractions and the resulting vapors. If oil compounds are absorbed into the circulatory system, they attack the liver, nervous system, and blood-forming tissues. Oil can collect in baleen plates, temporarily obstructing the flow of water between the plates and thereby reducing feeding efficiency. Reduction of food sources from acute or chronic hydrocarbon pollution could be an indirect effect of oil and gas activities.

It has been suggested that cetaceans could consume damaging quantities of oil while feeding, although Geraci (1990) believes it is unlikely that a whale or dolphin would ingest much floating oil. However, during the *Exxon Valdez* oil spill in 1989, killer whales were not observed to avoid oiled sections of Prince William Sound, and the potential existed for them to consume oil or oiled prey (Matkin et al., 1994). Fourteen whales disappeared from one of the resident pods in 1989-90, and although there was spatial and temporal correlation between the loss of whales and the spill, no clear cause-and-effect relationship was established (Dahlheim and Matkin, 1994). Fin, humpback, and gray whales were observed entering areas of the Sound and nearby waters with oil and swimming and behaving normally; no mortality involving these species was documented (Loughlin, 1994b; von Ziegesar et al., 1994; Loughlin et al., 1996).

Baleen whales in the vicinity of a spill may ingest oil-contaminated food (especially zooplankters, which actively consume oil particles) (Geraci, 1990). However, since the principal prey of most baleen whales (euphausiids and copepods) have a patchy distribution and a high turnover rate, an oil spill would have to persist over a very large area to have more than a local, temporary effect.

Since oil can destroy the insulating qualities of hair or fur, resulting in hypothermia, marine mammals that depend on hair or fur for insulation are most likely to suffer mortality from exposure (Geraci and St. Aubin, 1990). Among the pinnipeds, fur seals and newborn pups are the most vulnerable to the direct effects of oiling. Frost et al. (1995) estimated that more than 300 harbor seals died in Prince William Sound as a result of the *Exxon Valdez* oil spill and concluded that pup production and survival were also affected. In contrast, although Steller sea lions and their rookeries in the area were exposed to oil, none of the data collected provided conclusive evidence of an effect on their population (Calkins et al., 1994).

Sea otters, which rely almost entirely on maintaining a layer of warm, dry air in their dense underfur as insulation against the cold, are among the most sensitive marine mammals to the effects of oil contamination (Kooyman et al., 1977; Geraci and St. Aubin, 1980; Geraci and Williams, 1990; Williams and Davis, 1995). Even a partial fouling of an otter's fur, equivalent to about 30% of the total body surface, can result in death (Kooyman and Costa, 1979). This was clearly demonstrated by the *Exxon Valdez* oil spill (Davis, 1990; Ballachey et al., 1994; Lipscomb et al., 1994). Earlier experimental studies had indicated that sea otters would not avoid oil (Barabash-Nikiforov, 1947; Kenyon, 1969; Williams, 1978; Siniff et al., 1982), and many otters were fouled by oil during the Alaskan spill. Approximately 360 oiled otters were captured and taken to treatment centers over a 4-month period, and more than 1,000 dead sea otters were recovered (Geraci and Williams, 1990; Zimmerman et al., 1994). Ballachey et al. (1994) concluded that several thousand otters died within months of the spill, and that there was evidence of chronic effects occurring for at least 3 years.

The critical factors involved in sea otter mortality in Alaska, as identified by Williams (1990), were:
1) hypothermia, directly due to the decrease in insulation resulting from fouling of the pelage; 2) pulmonary emphysema, which was thought to be due to the inhalation of toxic fumes and was more or less limited to the first 2 weeks; 3) hypoglycemia, which was possibly due to poor gastrointestinal function; and 4) lesions in other organs (liver, heart, spleen, kidney, brain), which were probably due to ingestion of oil, as well as to stress. Williams felt that stress due to the effects of captivity contributed to tissue damage in otters brought into the treatment centers for cleaning, and that pulmonary emphysema was probably the most serious problem, since it was untreatable.

Potential indirect effects on sea otters resulting from an oil spill include a reduction in available food resources due to mortality or unpalatability of prey organisms and the loss of appropriate habitat available to sea otters as kelp forest communities become contaminated (Riedman, 1987).

Impacts of Past and Present OCS Activities
OCS oil and gas activities began off southern California in the late 1960s (Galloway, 1997). Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995, 1997; MMS, 1996).

Noise and disturbance associated with OCS activities in the Pacific Region have resulted in few documented impacts to marine mammals. Van Horn et al. (1988) concluded that seismic surveys and support vessel traffic had resulted in temporary, localized disturbances to some marine mammals, primarily gray whales. However, despite hypothesizing that increased vessel traffic off southern California might be causing greater numbers of gray whales to migrate farther offshore (Wolman and Rice, 1979; MBC Applied Environmental Services, 1989), the gray whale population does not appear to have been unduly affected by such activity as no alterations have been observed in their migration routes. There is no evidence that increased vessel traffic (of which oil and gas support vessels are a very small part) has resulted in adverse impacts on endangered cetacean populations.

Based on experiences in southern California, the MMS believes that accidental collisions between endangered whales and support vessel traffic are unlikely events. Although large cetaceans have occasionally been struck by freighters or tankers, and sometimes by small recreational boats, no such incidents have been reported with crew or supply boats off California (MMS, unpubl. data). The same is true for southern sea otters.

Pinnipeds are very nimble and considered very unlikely to be struck by vessels. However, the single documented instance of a collision between a marine mammal and a support vessel involved a pinniped—an adult male elephant seal struck and presumably killed by a supply vessel in the Santa Barbara Channel in June 1999.

The only OCS-related spill in the Pacific Region known to have contacted marine mammals was the 1969 Santa Barbara Channel spill. Although the entire northward migration of California gray whales passed through the Santa Barbara Channel while it was contaminated, Brownell (1971) found no evidence that any cetacean mortality had occurred due to the spill. Similarly, studies of elephant seals and California sea lions contacted by the 1969 spill reported no evidence of pinniped mortality from this event (Brownell and Le Boeuf, 1971; Le Boeuf, 1971). Since 1971, when formal tracking of all OCS spills was initiated, 841 OCS-related oil spills have occurred in the Pacific Region (see Section 5.3.1). However, almost all of these (99%) have been very small (less than 50 bbl), although five ranged in size from 50 to 163 bbl. No impacts to marine mammals have been reported from these spills. Although one OCS oil spill, the September 1997, 163 bbl, Torch pipeline spill off Point Pedernales, did contact the shoreline at the southern end of the sea otter range, no otters are known to have been contacted by oil.

6.1.1 Blue Whale (Endangered)

As described in Section 3.2, the proposed Tranquillon Ridge field drilling operations on Platform Irene would result in an increase in supply boat traffic from the current average of one one-way trip every 3 to 4 days to an average of one one-way trip every 3 days. This traffic would be relatively close to shore and would remain in the established traffic corridors. At the end of the drilling period, vessel traffic would be expected to return to approximately current levels for the duration of the Tranquillon Ridge field production activities. Development of the Tranquillon Ridge field will almost double the number of daily helicopter flights to Platform Irene (increasing from a current average of 3.2 up to 6.0 one-way flights per day) during drilling. During normal operations, however, although the total annual number of helicopter trips will increase, there would be no daily increase.

There have been few detailed studies of the reactions to vessels by rorqual species other than humpback whales (Richardson et al., 1995). Blue and fin whales summering in the St. Lawrence Estuary have been observed to react most strongly to rapid or erratic approaches by vessels (Edds and McFarlane, 1987). As discussed in Section 6.1 above, blue whales would be likely to react to the close approach of crew or supply boats, and some temporary displacement could occur under these circumstances. However, the increase in surface traffic to and from Platform Irene associated with the proposed project is unlikely to have a detectable effect on blue whales during their summer and fall presence in southern California waters.

Similarly, neither the minor and temporary increases in sound levels produced during the drilling activities on Platform Irene, nor the continuing noises produced by production activities, are likely to affect blue whale movements through the project area waters. Blue whales are frequently sighted from Platform Irene, during the summer and fall months.

Although blue whales do swim past Platform Irene on their way to and from foraging areas in the Santa Barbara Channel, they are unlikely to swim near enough to pass through platform effluent mixing zones. In addition, the zooplankton that form the blue whales primary prey would be unlikely to remain in the vicinity of the platform long enough to bioaccumulate toxins. Based on limited data, the impacts of effluents, particularly muds, cuttings, and produced water, on plankton generally appear to be limited to the several hundred to several thousand meters extent of the discharge plume for the brief period (perhaps several hours) that the organisms are in the plume (Raimondi and Schmitt, 1992; MMS, 1996). This could result in some mortality in the immediate vicinity (tens of meters) of the discharge and perhaps some reduced productivity farther away, to the extent of the plume. However, given their short generation time, on the order of hours or days, populations of plankton over broader areas should remain unaffected. For these reasons, the EPA’s biological assessment for Section 7 consultation on the reissuance of their general NPDES permit for OCS facilities (SAIC, 2000a) concluded that blue whales off southern California would not be impacted by OCS platform discharges. Thus, no impacts on blue whales are expected from the effluent discharges associated with the proposed action.

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region’s 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl. This level of spillage would be unlikely to have a detectable effect on the California blue whale population.

The probability that an oil spill of equal to or greater than 1,000 bbl would occur as a result of the proposed project is about 17.7%. However, if a spill of this size did occur, oil from Tranquillon Ridge would be likely to contact the waters at the western end of the Santa Barbara Channel. Therefore, if a spill were to occur during summer or fall, when blue whales were in southern California waters to feed, at least part of their local foraging area could be affected (see Section 4.2.1). However, based on experiences from past spills, it is unlikely that any direct blue whale mortality would result from such a spill, and there is no evidence that blue whales would avoid oiled areas. However, blue whales could be temporarily displaced from a portion of their foraging area by the cleanup activities associated with the response to a spill of this size. Such displacement could be a source of physical stress for whales in the affected area and might also increase population congestion in areas unaffected by the spill. These effects would not, in themselves, represent a serious threat to the portion of the California blue whale stock that feeds seasonally in the Southern California Bight.

In conclusion, considering all impact sources, only oil spills are likely to have an effect on blue whales in the project area. However, given the likelihood that a spill occurring as a result of the proposed project would likely be less than 200 bbl in volume, no adverse impacts on the blue whale population is expected from the proposed Tranquillon Ridge field development project.

6.1.2 Fin Whale (Endangered)

As discussed in Section 4.2.2, fin whales are present in greatest numbers off southern California in summer and fall (Dohl et al., 1981, 1983; Barlow, 1995; Forney et al., 1995). Fins are sighted in the Santa Barbara Channel, although they generally occur farther offshore and in waters south of the northern Channel Island chain (Leatherwood et al. 1987; Bonnell and Dailey, 1993; MMS, unpubl. data). They are less common than blue or humpback whales in the project area and, therefore, unlikely to be affected by any of the routine activities associated with the proposed Tranquillon Ridge field development.

Similarly, fin whales are unlikely to be affected by an accidental oil spill from Tranquillon Ridge facilities, were one to occur. No adverse impacts to fin whales are expected.

6.1.3 Sei Whale (Endangered)

Due to the low numbers of sei whales estimated to frequent California waters—possibly tens to a few hundreds of animals (Bonnell and Dailey, 1993; Barlow et al., 1997; Reeves et al., 1998)—neither routine activities nor accidental events associated with the proposed Tranquillon Ridge field development project are expected to affect this species. No impacts to sei whales are expected.

6.1.4 Humpback Whale (Endangered)

The reactions of humpback whales to vessels vary considerably. Humpbacks often move away when vessels are within several kilometers, (Baker and Herman, 1989; Baker et al., 1992), but may show little or no reaction when much closer (Richardson et al., 1995). They appear less likely to react overtly when feeding. As discussed for blue whales, humpbacks would be likely to react to the close approach of crew or supply boats, resulting in some temporary displacement and, possibly, disruption of feeding activity. However, the modest increase in surface traffic to and from Platform Irene associated with the proposed project is unlikely to have a detectable effect on humpback whales during their summer and fall presence in southern California waters.

Also, like blue whales, humpbacks are frequently sighted from area platforms during the summer and fall. The sound levels produced by the drilling and production activities associated with the Tranquillon Ridge field development project are not expected to affect humpback whales in the project area.

Although humpback whales do occur near Platform Irene, they are unlikely to swim near enough to pass through platform effluent mixing zones. In addition, as was discussed for blue whales, the zooplankton and small schooling fishes that form their primary prey would be unlikely to remain in the vicinity of the platforms long enough to bioaccumulate toxins. For these reasons, the EPA's biological assessment for Section 7 consultation on the reissuance of their general NPDES permit for OCS facilities (SAIC, 2000a) concluded that humpback whales off southern California would not be impacted by OCS platform discharges. Thus, no impacts on humpback whales are expected from the effluent discharges associated with the proposed action.

However, in Prince William Sound following the 1989 *Exxon Valdez* oil spill, humpbacks were observed feeding in areas that had been heavily oiled, although none were observed feeding in oil (von Ziegesar et al., 1994). The whales did not appear to favor areas that had not been oiled. No humpback whale deaths or strandings were observed in Prince William Sound in 1989-1990 (Loughlin et al., 1996).

As discussed for the blue whale in Section 6.1.1, the one oil spill of about 200 bbl that could occur during the life of the Tranquillon Ridge project is unlikely to affect humpback whales. Additionally, with a probability of occurrence of only 17.7%, the chance of an oil spill of greater than 1,000 bbl is unlikely. However, if a spill of this size were to occur from the Tranquillon Ridge field offshore facilities during the summer or fall, it would be likely to contact part of the area used for feeding by humpback whales in the Santa Barbara Channel and, to a lesser extent, in the southern Santa Maria Basin (see Section 4.2.4). Such an event would be unlikely to result in any humpback whale mortality, but could result in the temporary displacement of some animals from local foraging areas, primarily as the result of clean-up activities.

In conclusion, considering all impact sources, only oil spills are likely to have an effect on humpback whales in the project area. However, given the likelihood that a spill occurring as a result of the proposed project would be less than 200 bbl in volume, and that the oil spill prevention and response capabilities are in place, no adverse impacts on the humpback whale population is expected from the proposed Tranquillon Ridge development project.

6.1.5 Northern Right Whale (Endangered)

Right whales are often approachable by a slowly moving boat, but will move away from a rapidly moving vessel (Watkins, 1986). In waters off the Atlantic coast, ship strikes are a major source of mortality for these slow-moving whales (Kenney and Kraus, 1993). However, as discussed in Section 4.2.5, the right whale population in the North Pacific is very small (NMFS, 1991b), and right whales are very rarely seen off southern California (Carretta et al., 1994). Therefore, the probability a northern right whale would be affected by vessel (or helicopter) traffic associated with the proposed Tranquillon Ridge development project is extremely low.

It is also highly unlikely that effluent discharges or oil spills from the offshore Tranquillon Ridge facilities would ever have an effect on right whales. No impacts on the northern right whale from the proposed action are expected.

6.1.6 Sperm Whale (Endangered)

As discussed in Section 4.2.6, sperm whales are a pelagic species with a preference for deep waters (Watkins, 1977; Gosho et al., 1984). Although they are occasionally sighted in the Southern California Bight, they are generally found farther offshore (Dohl et al., 1981, 1983; Bonnell and Dailey, 1993). Thus, sperm whales are unlikely to be present near enough to Platform Irene or traffic corridors to be disturbed by routine activities from these sources.

They also are unlikely to approach near enough to the facilities to be directly affected by effluent discharge plumes. In addition, the squid that comprise their primary prey are deep-water species not known to be abundant near OCS platforms.

Finally, sperm whales do not frequent the areas that potentially could be contacted by an oil spill from the Tranquillon Ridge field. No impacts on sperm whales from the proposed action are expected.

6.1.7 Steller Sea Lion (Threatened)

As discussed in Section 4.2.7, Steller sea lions are now uncommon in southern California waters; their southernmost active rookery, Año Nuevo Island, is approximately 400 km north of the project area. They would not be affected by routine activities or discharges associated with the proposed action, and it is very unlikely that any Steller sea lions would come in contact with the one spill of about 200 bbl that could occur during the life of the Tranquillon Ridge field development. Therefore, no impacts on Steller sea lions from the proposed project are expected.

6.1.8 Guadalupe Fur Seal (Threatened)

Although a few Guadalupe fur seals appear on the Channel Islands each year (Bonnell and Dailey, 1993; DeLong and Melin, 2000), the Mexico-based population is still quite small (Gallo-Reynoso, 1994). They are almost never sighted at sea off California (Bonnell and Dailey, 1993). As is the case with the Steller sea lion, it is extremely unlikely that any routine activities or accidental oil spills associated with proposed Tranquillon Ridge field development would affect more than one or two individuals of this species. As such, no impacts on Guadalupe fur seals are expected from the proposed project.

6.1.9 Southern Sea Otter (Threatened)

Although no direct information is available on the potential impacts of exploratory and development drilling operations on sea otters, Riedman (1983; 1984) did observe sea otter behavior during underwater playbacks of drillship, semi-submersible, and production platform sounds and reported no changes in behavior or use of the area. Most of the otters observed by Riedman (1983) were at least 400 m from the projector; all observed by Riedman (1984) were at least 1.2 km away. Although sea otters at the surface were probably receiving little or no underwater noise, some otters continued to dive and feed below the surface during the playbacks. At 1.2 km, the received sound levels of the strongest sounds were usually at least 10 dB above the ambient noise level (Malme et al., 1983; 1984). Drilling activities associated with the proposed action would occur more than 11 km (7 mi) offshore. California sea otters, except for juvenile males, rarely move more than 2 km offshore (Riedman, 1987; Estes and Jameson, 1988; Ralls et al., 1988), and thus could be expected to be at least 9 km away from the nearest drilling activity. Because of this distance and the evidence from the playback experiments described above, no effects on sea otters from these activities are expected.

No systematic studies have been made of the reaction of sea otters to aircraft and helicopters (Richardson et al., 1995). During aerial surveys of the California sea otter range conducted at an altitude of about 90 m (Bonnell et al., 1983), no reactions to the two-engine survey aircraft were observed. The helicopter trips supporting the Tranquillon Ridge field development activities will all be out of the Santa Barbara, Lompoc, and Santa Maria airports and are expected to pass over the southernmost portion of the sea otter range. Helicopter traffic is not expected to affect sea otters.

Although sea otters will often allow close approaches by boats, they will sometimes avoid heavily disturbed areas (Richardson et al, 1995). Garshelis and Garshelis (1984) reported that sea otters in southern Alaska tend to avoid areas with frequent boat traffic, but will reoccupy those areas in seasons with less traffic. The vessel traffic corridors between Port Hueneme, the support base, and Platform Irene pass 4 km or more offshore. No effects on sea otters from service vessel traffic are expected.

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the

MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

There is a reasonable chance that a spill of 50-1,000 bbl would contact the shoreline at the southern end of the present southern sea otter range. Predicting the length of coastline affected by an oil spill that comes ashore is extremely difficult due to the complexity of the process, which depends on factors such as nearshore wind patterns and currents, coastal bathymetry, tidal movements, and turbulent flow processes. The OSRA and GNOME modeling both indicate the likelihood that the coastline area from Guadalupe south to Pt. Conception could be impacted in the event of a spill. Thus, there is a reasonable probability of sea otter contacts occurring as a result of a spill associated with the Tranquillon Ridge Project.

Ford and Bonnell (1995), in their analysis of the potential impacts of an *Exxon Valdez*-sized spill on the southern sea otter, concluded that oil spills occurring at the southern end of the otter range present the smallest risk to the population. However, since 1995, southern sea otter range expansion to the south has continued, has increased substantially. During both semiannual surveys (spring and fall) conducted in 2005, close to 200 otters were observed between Pt. Sal and Pt. Conception, comprising 5 and 7% of the total population respectively.

If a spill were to occur, the magnitude of expected sea otter mortality would vary with a number of factors, including the time of year, volume of oil spilled, wind speed and direction, current speed and direction, distance of the spill from shore, volume of oil contacting the shoreline, condition of the oil contacting the shoreline, the success of containment operations, number of animals contacted, and the effectiveness of otter cleaning and rehabilitation.

It is expected that one 50-1,000 bbl spill could occur over the lifetime of the project, and it is estimated that this spill would likely be less than 200 bbl in size. Based on the likelihood of a spill making landfall along the mainland coast and the increasing number of otters expanding into the project area, there is a reasonable probability of sea otter contacts occurring as a result of a spill. However, given the seasonal nature of the otter migration and that oil spill prevention and response capabilities are in place, the effects of an oil spill from the proposed Tranquillon Ridge field development project may occur, but will not affect the species at a population level.

6.2 BIRDS

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on birds. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on threatened and endangered bird species in the project area.

Five threatened or endangered bird species that occur in the general area of concern for the Tranquillon Ridge field are considered in this analysis. These are: California brown pelican, California least tern, bald eagle, western snowy plover, and light-footed clapper rail. The only impact-producing agent that could occur from the Tranquillon Ridge field and affect these species is an accidental oil spill. Although additional helicopter flights are proposed, noise and disturbance associated with this project are not expected to have measurable effects on the above species because all drilling activities would occur about 11 km (4 mi) from the nearest land where birds roost or breed. Platform discharges are not expected to have a measurable effect due to the high degree of dilution that would occur and the fact that bioaccumulation of associated pollutants is not expected (SAIC 2000b; Weston Solutions Inc. and MRS 2006).

Oil spills

Spilled oil may affect birds in several ways: 1) direct contact with floating or beached oil; 2) toxic reactions; 3) damage to bird habitat; and 4) damage to food organisms. Disturbance from cleanup efforts to remove spilled oil may also affect birds. Oil-related mortality is highly dependent on the life histories of the bird species involved. Birds that spend much of their time feeding or resting on the surface of the water are more vulnerable to oil spills (King and Sanger, 1979). Direct contact with even small amounts of oil can be fatal, depending on the species involved. Studies by Dr. Michael Fry (Nero and Associates, 1987) have found that exposure to as little as 3 ml of oil (which amounts to just less than a teaspoon) spread evenly on the wings and breast of Cassin's auklets caused severely matted plumage and was a lethal dose. The principal cause of mortality from oil contact in birds is from feather matting, which destroys the insulating properties of the feathers (Erasmus et al., 1981) and leads to death from hypothermia. Oiling can also result in a loss of buoyancy, which inhibits a bird's ability to rest or sleep on the water (Hawkes, 1961), and can diminish swimming and flying ability (Clark, 1984). Also, an oiled bird's natural tendency is to preen itself in an attempt to remove oil from the plumage. The acute toxicity of such ingested oil (crude or refined) depends on many factors, including the amount of weathering and amount of oil ingested. Birds that receive lethal doses succumb to a host of physiologic dysfunctions (e.g., inflammation of the digestive tract, liver dysfunction, kidney failure, lipid pneumonia and dehydration) (Hartung and Hunt, 1966). Oil that is ingested as a result of preening or eating contaminated prey can cause abnormalities in reproductive physiology, including adverse effects on egg production (Ainley et al., 1981; Holmes, 1984; Nero and Associates, 1987). In addition, the transfer of oil from adults to eggs can result in reduced hatchability, increased incidence of deformities, and reduced growth rates in young (Patten and Patten, 1977; Stickel and Dieter, 1979). Growth reduction may also be the indirect result of an oiled parent's inability to deliver sufficient food to nestlings (Trivelpiece et al., 1984).

Cleanup efforts to remove spilled oil may have impacts of their own. Oil spill response and cleanup activities may involve intrusion into sensitive areas. Human presence while booming off an area, cleaning oil off beaches, or attempting to capture oiled wildlife for rehabilitation near seabird colonies may cause flushing from nests or temporary abandonment. Additionally, many seabirds react to disturbance by leaving their roosts or nests to go sit on the water somewhere nearby. In other words, disturbance of the colony may have the effect of flushing the birds into oiled water. This potential should be evaluated on a case-by-case basis in the event of a spill, prior to a decision to approach a roost or breeding colony.

Impacts of Past and Present OCS Activities

Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995, 1997; MMS, 1996).

The level of OCS-related helicopter traffic in the Pacific Region is described in section 5.1.2. Although helicopter traffic can cause disturbances to birds, especially in largely unpopulated areas (e.g., Alaska), there is no evidence that OCS-related helicopter traffic has affected endangered birds in the Pacific Region (Bornholdt and Lear, 1995). Several international and numerous smaller airports occur along the southern California coast along with several military airports, and air traffic is a constant daily or even hourly occurrence. One of the more sensitive of the endangered birds in southern California might be the California brown pelican. However, air traffic over pelican breeding colonies is restricted to altitudes greater than 1,000 feet. Also, MMS provides OCS lessees with guidelines for protecting birds from aircraft (see section 5.1.2).

The largest OCS-related oil spill in the Pacific Region was the 1969 Santa Barbara spill, which resulted in the loss of thousands of birds (Straughn, 1971). Since 1971, when formal tracking of all OCS spills was initiated, 841 OCS-related oil spills have occurred in the Pacific Region. However, almost all of these (99%) have been very small (less than 50 bbl). No impacts to endangered birds or birds in general have been reported from these very small spills. In addition to these very small spills, five (less than 1%) OCS-related spills equal to or larger than 50 bbl have also occurred in the Pacific Region since 1971. These spills ranged in size from 50-163 bbl. Four of these spills did not contact shore, and no impacts to endangered birds or any birds were reported from them. One spill, however, did contact the shoreline and impacted an estimated 635 to 815 birds.

On September 28, 1997, a rupture in the Torch pipeline from Platform Irene to the shoreline occurred releasing an estimated 163 bbl of crude oil (SBC 2001). The rupture resulted in the oiling of approximately 40 miles (64 km) of coastline, stretching from the northern end of Minuteman Beach to Boat House in Santa Barbara County. Approximately 100 acres (40 hectares) of sandy beach were disturbed by oiling and cleanup operations. In addition, another 263 acres (106 hectares) of sandy beach were very lightly oiled (less than or equal to 10% oiling by area), but were relatively undisturbed by heavy equipment during cleaning operations (CDFG 2002).

Surveys for dead or live oiled seabirds that were beached were conducted from September 29 to October 5, 1997. Of the 140 birds that were collected during the surveys, 122 were either dead or died after sampling. However, these numbers are conservative. The surveys did not include birds that may have been missed by the surveyors, dead or oiled birds that were outside the survey area or did not reach the shoreline, or birds that reached the shoreline in the survey area but were removed by scavengers or predators, such as vultures and coyotes. Although deaths from oiling for the endangered brown pelican and snowy plover were not reported from the spill, Ford Consulting (1998) estimated that 14 brown pelicans and 13 snowy plovers were fouled by oil from the pipeline rupture.

6.2.1 Brown Pelican (Endangered)

Pelicans are at risk from oil spills because they dive into the water to catch their prey, and because they may spend part of the daylight hours on the ocean surface. However, pelicans also spend much of their time resting on land or man-made structures, where they are less vulnerable to oil. Most other seabirds spend as much as 90% of their time on the ocean surface, where they are more likely to be contacted by oil. Nevertheless, pelicans have been contacted by oil, and mortality has occurred from oil spills. For example, at least 195 pelicans were estimated to have died during the approximately 10,000 bbl American Trader spill off Huntington Beach, California in 1990 (Gorbics et al., 2000). Additionally, although no deaths were reported, Ford Consulting (1998) estimated that approximately 14 brown pelicans were fouled during the September 1997, 163 bbl, Torch pipeline spill.

The level of impact of an oil spill on brown pelicans depends on several factors, including the size of the spill, seasonal timing of the spill, and movement of the spill in relation to important pelican use areas. Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

If a spill of approximately 200 bbl were to occur from the Tranquillon Ridge facilities, at least some pelicans might be contacted. Based on OSRA results, an oil spill from this project would most likely move toward the south or west, although some northward movement is also indicated by both OSRA and GNOME data (Appendix B). Pelicans in the immediate vicinity of the project would most likely be affected, although the small San Miguel and Santa Rosa Island roosts could also be contacted.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the likelihood that no contact with either Anacapa or Santa Barbara Island will occur, and that the oil spill prevention and response capabilities are in place, the impacts of an oil spill from the Tranquillon Ridge field project on brown pelicans are expected to be limited and not affect the species on a population level.

6.2.2 California Least Tern (Endangered)

Least terns are at risk from an oil spill because they dive into the water to catch their fish prey. They also nest and roost on beaches and mud flats that may be contacted by an oil spill or are in close proximity to the ocean or an estuary. The cleanup process, if not conducted with respect to Federal and State regulations, could exacerbate the effects of an oil spill on least terns.

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

If a spill of about 200 bbl were to occur during the spring or summer and move north and contact the shoreline in the vicinity of Vandenberg AFB, impacts to terns could occur, including some mortality. The severity of these impacts would depend on the size of the spill, the length of shoreline contacted, and the number of terns present in the area. Over the last several years, tern usage of the Vandenberg AFB has declined, although this trend could shift again in time. However, there are currently relatively few terns in this area (only 2 breeding terns in 2006) and colonies are generally widely spaced so impacts would probably be limited to a single colony.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the likelihood that any oil contact would be limited to the small colonies from Point Sal to Point Conception, the relatively small size of the colony in question, and that the oil spill prevention and response capabilities are in place, impacts to least terns would be minimal and not affect the species on a population level.

6.2.3 Bald Eagle (Threatened)

Bald eagles would most likely come into contact with oil from feeding on oiled seabirds or marine mammals. Besides ingesting oil-contaminated prey, their plumage could also become oiled.

Due to its small size, the subpopulation of bald eagles reintroduced to the Channel Islands may be more vulnerable to an oil spill. In addition to the efforts begun in 1980 at Santa Catalina Island, recent attempts have focused on the eagle's reintroduction to the northern Channel Islands. Since June 2002, 62 young bald eagles have been released on Santa Cruz Island, and in spring 2006 the first successful hatchings in over 50 years occurred on Santa Cruz Island. Currently, there are between 25 and 40 bald eagles residing on the northern Channel Islands (predominately Santa Cruz).

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

If a spill were to occur, both OSRA and GNOME modeling results (see Appendix B) suggest that contact with portions of San Miguel, Santa Rosa, and Santa Cruz Island could occur under certain conditions. However, given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, and that the oil spill prevention and response capabilities are in place, no impacts to bald eagles are expected from this project.

6.2.4 Western Snowy Plover (Threatened)

Western snowy plovers are vulnerable to oil spills because they are generally restricted to sandy beaches, which can be contacted by spills. The cleanup process, if not conducted with respect to Federal and State regulations, could exacerbate the effects of an oil spill on snowy plovers.

The western snowy plover population has been declining almost since plover surveys were first conducted, and the decline may have increased in recent years. Their small population and sandy beach habitat make snowy plovers more vulnerable to an oil spill.

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

One or several important snowy plover areas might be contacted by a spill of about 200 bbl. The snowy plover areas most likely to be contacted if a spill were to occur are Vandenberg AFB, Nipomo Dunes, although areas at San Miguel (SMI) and Santa Rosa Island (SRI) may also be affected. Vandenberg AFB currently acts as a breeding area for more than 10% of the plover population.

If a spill of about 200 bbl were to contact the shoreline in the vicinity of nesting or wintering snowy plovers, impacts to plovers could occur, including some mortality. The level of impact would depend on the size of the spill, the success of containment efforts, the length of time for the spill to reach the area, and the length of shoreline contacted. Additionally, impacts to snowy plover could be exacerbated by beach cleanup efforts.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume and the likelihood of oil contacting various nesting and wintering areas, impacts on snowy plovers would probably be limited to the area between Pt. Sal and Pt. Conception, and San Miguel and Santa Rosa Islands. Impacts to the nesting populations at these locations could include loss of adults, disruption of nesting activity, and abandonment of nesting beaches. However, the island populations make up only a small part of the total population. If, instead, a spill were to contact the area between Point Sal and Point Conception, where numbers are higher, the number of plovers affected could be somewhat higher. However, given that oil spill prevention and response capabilities are in place, the overall impacts would not affect the species on a population level.

6.2.5 Light-footed Clapper Rail (Endangered)

Light-footed clapper rails are at risk from an oil spill because they are confined to coastal salt marshes that could be contacted by oil. The oil spill cleanup process, if not conducted in accordance with federal and state regulations, could exacerbate the effects of an oil spill on the rail's habitat.

The rail population has remained relatively small for many years, and an increase in the population is probably not likely for several more. Rails are also limited to only a very few marshes, and this, combined with their low population, makes them more vulnerable to an oil spill.

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

Further, based on OSRA model results (see Section 5.3.1), no contact with any occupied marsh is expected. There also was no drifter contact with occupied marshes (Appendix B). In the highly unlikely event that a large (>1,000-bbl) oil spill were to occur from this project and approach a salt marsh occupied by rails, these areas are more easily protected than the open coast, which affords the rails a greater degree of safety.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the likelihood that no contact to an occupied salt marsh will occur, and that the oil spill prevention and response capabilities are in place, no impacts to light-footed clapper rails are expected from the proposed project.

6.3 REPTILES

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on sea turtles. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on threatened and endangered sea turtle species in the project area.

Noise and Disturbance
In the Gulf of Mexico, sea turtles are known to be attracted to and feed around offshore platforms (MMS, 1996). Although no systematic studies have been conducted on the effects of manmade noise on sea turtles (MMS, 1996), noise from service-vessel traffic may elicit a startle reaction from marine turtles and produce a temporary sublethal stress (NRC, 1990). Service vessels could also collide with and injure marine turtles at the sea surface. However, sea turtles are estimated to be at the sea surface less than 4% of the time (Byles, 1989; Lohoefener et al., 1990) and are generally infrequent visitors to the area. Although vessel-related injuries have been reported in the Gulf of Mexico, only one has been known to occur in project waters. In 2004, an olive ridley was found stranded on Ellwood Beach near Santa Barbara with a cracked carapace that was consistent with injury from a boat collision.

Although marine turtles could be harmed or killed by project-related vessels, marine turtles are very rare in the project area and collisions with vessel traffic are not expected to occur.

Effluent Discharges
The potential effects of OCS platform discharges on sea turtles include 1) direct toxicity (acute or sublethal), through exposure in the waters or ingestion of prey that have bioaccumulated pollutants; and 2) a reduction in prey through direct or indirect mortality or habitat alteration caused by the deposition of muds and cuttings (SAIC, 2000a, b). However, there is no toxicity information on the effects of muds and cuttings and produced water discharges on sea turtles. Comprehensive reviews by the National Academy of Sciences (1983), the U.S. Environmental Protection Agency (1985a), and Neff (1987) do not address the potential effects of routine OCS discharges on this group of animals (MMS, 1996).

These animals are highly mobile and their range far exceeds the extent of a platform discharge plume. An indirect effect related to the localized displacement or reduction of food/prey species is more likely (MMS, 1996).

Oil Spills
If a sea turtle comes into direct contact with oil, a number of physiological effects may occur (MMS, 1996). Oil exposure has been observed to adversely affect sea turtle skin tissues, respiration, blood chemistry, and salt gland function. However, test animals exposed to sublethal doses have been observed to recover from oil contact within a month (Lutz, 1985; MMS, 1996).

Oil spills can adversely affect sea turtles by toxic external contact, toxic ingestion or blockage of the digestive tract, disruption of salt gland function, asphyxiation, and displacement from preferred habitats (Lutz and Lutcavage, 1989; Vargo et al., 1986). Sea turtles are known to ingest oil (Gramentz, 1988); this may occur during feeding (tar balls may be confused with food) or while attempting to clean oil from flippers. Oil ingestion frequently results in blockage of the respiratory system or digestive tract (Vargo et al., 1986). Some fractions of ingested oil may also be retained in the animal's tissues, as was detected in turtles collected after the *Ixtoc* spill in the Gulf of Mexico (Hall et al., 1983).

It is unclear whether adult sea turtles actively avoid spilled oil (MMS, 1996). In some instances, turtles have appeared to avoid oil by increasing dive times and swimming away (Maxwell, 1979; Vargo et al., 1986). Other observers have suggested that sea turtles actually may be attracted to some of the components found in crude oil (Kleerekoper and Bennett, 1976).

Impacts of Past and Present OCS Activities
Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995, 1997; MMS, 1996). No impacts on sea turtles from past and present OCS oil and gas activities in the Pacific Region have been identified.

6.3.1 Leatherback Sea Turtle (Endangered)

Although leatherbacks are the most commonly observed sea turtles off the west coast of the U.S. (Dohl et al., 1983; Green et al., 1989; NMFS and FWS, 1998a), densities in southern California waters are very low. Additionally, the presence of leatherbacks off California is seasonal in nature, occurring during late summer and fall. Given their limited, seasonal presence, it is very unlikely that routine activities or accidental oil spills associated with the Tranquillon Ridge field development would have a detectable effect on this species. No adverse impact on the leatherback sea turtle population from the proposed project is expected.

6.3.2 Green Sea Turtle (Endangered)

Off southern California, green sea turtles are uncommon in waters north of the San Diego area (NMFS and FWS, 1998b) and are rarely seen in the vicinity of the project area (Dohl et al., 1983). No impacts on green sea turtles from the proposed project are expected.

6.3.3 Pacific Ridley Sea Turtle (Endangered)

As discussed in Section 4.4.3, Pacific ridley sea turtles are infrequent visitors to waters north of Mexico and are unlikely to occur in the vicinity of the Tranquillon Ridge field project area. No impacts on Pacific ridleys from the proposed project are expected.

6.3.4 Loggerhead Sea Turtle (Threatened)

Like Pacific ridley turtles, loggerhead sea turtles are near the northern limit of their range off southern California and are likely to be infrequent visitors to the Tranquillon Ridge field project area (Stebbins, 1966; NMFS and FWS, 1998d). No effects on loggerhead sea turtles from the proposed project are expected.

6.4 MARINE INVERTEBRATES

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on marine invertebrates. The following section analyzes the potential impacts of activities and accidental events associated with the proposed project on the threatened white abalone in the project area.

Noise and Disturbance
No adverse impacts to abalone are expected from the daily helicopter flights, vessel traffic, or drilling and production noise associated with the proposed project.

Effluent Discharges
The drilling muds and cuttings and produced waters of OCS oil and gas facilities could potentially affect abalone through direct toxicity by exposure in the water. The EPA biological assessment for the proposed reissuance of its general NPDES permit for offshore OCS facilities in southern California waters concludes that direct toxicity to listed fish species, or their food base, should be minimal (EPA, 2000a, b). All such discharges are required to meet NPDES water quality criteria, which were established to protect biological resources outside the mixing zone. Significant impacts from routine OCS discharges generally have not been associated with fish or marine invertebrates. For example, a successful mariculture operation previously sold mussels collected from OCS platform legs to local restaurants for over a decade. The mussels consistently passed all FDA criteria for marketing shellfish.

Oil Spills
Oil may affect marine invertebrates through various pathways, including direct contact, ingestion of petroleum contaminated water, and lingering sublethal impacts due to oil becoming sequestered in sediments and persisting in some cases for years in low energy environments (NRC 1985). The level of impacts and the persistence of the oil in the environment will depend on the volume of oil that reaches the habitat and the amount of mixing and weathering the oil has undergone before reaching the habitat. An at-sea oil spill would likely disperse sufficiently prior to any deposition at depth, that it would not impact white abalone habitat.

Impacts of Past and Present OCS Activities
Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995; MMS, 1996). No impacts on threatened or endangered invertebrates from past and present OCS oil and gas activities in the Pacific Region have been identified.

6.4.1 White Abalone (Endangered)

Due to NPDES discharge permit requirements and the rapid dilution of the discharges (Section 5.2), contaminants from effluent discharges associated with OCS activities should not be measurable in the coastal waters and sediments known to harbor white abalone. Thus, no impacts on white abalone are expected from effluent discharges. Although it is unlikely that white abalones exist within the project area since it is north of Point Conception, areas where white abalone or suitable white abalone habitat exist could be affected by a spill from the project area that exhibits a southward trajectory.

The most likely oil spill scenario for the Tranquillon Ridge development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project (Section 5.3). Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume.

Given the oil spill prevention and response capabilities in place, an oil spill of this size would likely weather, mix, and break up before reaching white abalone habitat. No impacts to white abalone or its habitat would be expected from an oil spill associated with the proposed project.

6.5 AMPHIBIANS

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on amphibians. The following section analyzes the potential impacts of activities and accidental events associated with the proposed project on the threatened California red-legged frog in the project area.

Noise and Disturbance
Loud noises such as those produced by a low-flying helicopter would be expected to cause a startle response in frogs. Depending on the frequency of the flights and the altitude of the helicopter, this could disrupt feeding or breeding behavior. No vessel impacts are expected to onshore species. No impacts form offshore drilling and production are expected to onshore species.

Effluent Discharges
No impacts are expected to onshore species.

Oil Spills
Oil may affect amphibians through various pathways, including direct contact, ingestion of contaminated prey, and lingering sublethal impacts due to oil becoming sequestered in sediments and persisting in some cases for years in low energy environments (NRC 1985). The level of impacts and the persistence of the oil in the environment will depend on the volume of oil that reaches the habitat and the amount of mixing and weathering the oil has undergone before reaching the habitat.

Impacts of Past and Present OCS Activities
Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995; MMS, 1996). No impacts on threatened or endangered amphibians from past and present OCS-related oil and gas activities in the Pacific Region have been reported.

6.5.1 California Red-legged Frog (Threatened)

Helicopter traffic to the platforms that would produce the Tranquillon Ridge field currently occurs 3-5 times per week (11 round trips/week annual average), and would increase to 3 round trips per day. It is likely that flights may pass over red-legged frog habitat. Due to the altitude restrictions placed on OCS helicopter flights (Section 5.1.2); however, it is unlikely that these overflights would cause a behavioral effect on red-legged frogs. Thus, no impacts on red-legged frogs are expected from helicopter traffic.

Adult red-legged frogs move down to the brackish coastal lagoons formed seasonally behind sand berms that close the mouths of rivers and streams along the south central coast. Storms or tides may breach these natural berms, at which point the frogs move upstream to freshwater. Due to NPDES discharge permit requirements and the rapid dilution of the discharges (Section 5.2), contaminants from effluent discharges associated with OCS activities should not be measurable in the coastal waters and sediments that enter these lagoons. Thus, no impacts on red-legged frogs are expected from effluent discharges.

There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms have been breached. Red-legged frogs cannot tolerate salinities in excess of 9 ppm and leave the coastal lagoons when seawater breaches the sand berms. Although no direct oil contact with frogs is expected, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. If the sand berms reform and conditions become favorable, some red-legged frogs may return before the contaminated sediments are flushed into the ocean. The level of toxicity would be dependent on the weathering of the oil and the volume of oil that reaches the lagoon.

The most likely oil spill scenario for the Tranquillon Ridge development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project (Section 5.3). Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. An oil spill of this size would weather, mix, and break up to the point where only limited tarring would be expected to coastal lagoons in the Point Arguello area. Such a level of spillage would be unlikely to have a detectable effect on the California red-legged frog or the coastal lagoons it uses as seasonal habitat.

The coastal rivers and streams in the Point Arguello area support populations of red-legged frogs. Tadpoles have been reported in Jalama and Cañada Honda creeks, and adult frogs can be found seasonally in the coastal lagoons of the central California coast. Eggs and tadpoles are not found in the coastal lagoons. As discussed earlier, an oil spill of about 200 bbl that contacted the mainland along the central California coast would be unlikely to result in red-legged frog mortality or sub-lethal effects. However, habitat destruction could result from clean-up efforts. Proper preparation and execution of the oil spill contingency plan should protect these areas during an oil spill response, thus no impacts are expected to red-legged frog habitat.

In conclusion, given the low probability that an oil spill of about 200 bbl would contact seasonal red-legged frog habitat in the coastal lagoons, and that the oil spill prevention and response capabilities are in place, no impacts to the California red-legged frog or its habitat would be expected from an oil spill associated with the proposed project.

6.6 FISH

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills on fish. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on endangered fish species in the project area.

Noise and Disturbances
Aircraft. Richardson et al. (1985) documented that a Bell 214ST helicopter was detectable for about 38 seconds at 3m depth, and about 11 seconds at 18 m depth. The duration of audibility of passing aircraft to fish is short, localized, and declines with depth. Therefore, aircraft noise related to the proposed project is not expected to impact fish.

Vessels. Richardson et al. (1995) give estimated source levels of 156 dB for a 16-m crew boat (with a 90-Hz dominant tone) and 159 dB for a 34-m twin diesel (630 Hz, 1/3 octave). Broadband source levels for supply boats (55-85 m) are about 170-180 dB. Most of the sound energy produced by these vessels is at frequencies below 500 Hz. The level and duration of noise from supply boats to fish is limited, short, and localized. Therefore, no adverse effects to EFH are expected from the minor increase in vessel traffic that would occur with the proposed project.

Offshore Drilling and Production. Richardson et al. (1995) cite only one example of recorded noise from drilling platforms off the California coast, which resulted in auditory levels that were nearly undetectable even alongside the platforms. No sound levels were computed, but the strongest received tones were very low frequency, below approximately 5 Hz. Therefore, no impacts to EFH are expected from conventional drilling platforms.

Effluent Discharges
The drilling muds and cuttings and produced waters of OCS oil and gas facilities could potentially affect fish species through direct toxicity by exposure in the water or ingestion of prey that have bioaccumulated toxins from the discharges. The EPA biological assessment for the proposed reissuance of its general NPDES permit for offshore OCS facilities in southern California waters concludes that direct toxicity to listed fish species, or their food base, should be minimal (EPA, 2000a, b). All such discharges are required to meet NPDES water quality criteria, which were established to protect biological resources outside the mixing zone. Significant impacts from routine OCS discharges generally have not been associated with fish. In fact, Love, et al. (1999) suggests that offshore platforms may provide nursery grounds for some species of rockfish. Previously, a successful mariculture operation sold mussels collected from OCS platform legs to local restaurants for over a decade. The mussels consistently passed all FDA criteria for marketing shellfish.

Currently there are eight generic water-based muds that have been approved for use by EPA. EPA does not authorize discharge of oil-based drilling fluids into marine waters. The major toxic constituents of drilling muds are trace metals including arsenic, cadmium, chromium, lead, mercury, and zinc. The toxicity of water-based drilling mud to juvenile lobster and flounder was investigated by Neff et al. (1989). They found that both species accumulated small amounts of barium, but no detectable chromium during 99 days of exposure to sandy sediment heavily contaminated with the settleable fraction of a used water-based lignosulfonate drilling mud. There was some physiological and biochemical evidence of stress in both species, but growth was not significantly affected. The authors concluded that, for the species and life stages tested, there is little evidence for toxicity of water-based drilling mud.

Cuttings are generally not highly toxic, but depending on the subsurface formations being penetrated, they may contain toxic metals, naturally occurring radioactive elements, or petroleum. Cuttings generally do not disperse far from the discharge point, and instead accumulate on the seafloor below the platform. Several thresholds (contaminant concentrations at which ecological and toxicological effects rise to a level of concern) have been proposed for marine sediments. The most widely used thresholds for sediments are the "Effects Range-Low" and "Effects Range-Median" guidelines developed by NOAA (Long and Morgan, 1990; Long, 1992; Long et al., 1995). Effects thresholds were ranked, using laboratory and field tests, and the 90^{th} and 50^{th} percentiles were determined. The 90^{th} percentile (i.e., the contaminant concentration at which 90% of the studies found no effect) is referred to as ERL and is considered to be a concentration below which adverse impacts are unlikely. The 50^{th} percentile is referred to as ERM and is interpreted as the concentration at which effects are frequently observed. Neff and Sauer (1996) examined PAH concentrations near four petroleum production platforms in the Gulf of Mexico with large produced water discharges. Although PAH concentrations were 2- to 10-fold above background in sediments at 20 m from discharge points, and were at background by 200 m, the PAH concentrations in sediments were generally below the ERL levels determined by Long et al. (1995).

"Produced water" is the water present in the source petroleum. The major constituents are carboxylic acids and phenols, single-ring aromatics, and polycyclic aromatic hydrocarbons. Acute toxicity correlates strongly with the phenol concentration. The contaminants from produced water are rapidly diluted and removed by volatilization and biodegradation (SAIC, 2000a, b). These findings are consistent with the assessment of essential fish habitat that was prepared for the re-issuance of a NPDES General Permit for offshore oil and gas facilities in southern California (SAIC, 2000c). The overall conclusions of the assessment were that the continued discharge from the 22 platforms offshore California will not adversely affect fish outside the mixing zones. Within the 100-m radius mixing zone, discharges from oil and gas exploration, development, and production may have localized effects on water quality and resident marine organisms, including fish. The assessment further concluded that while there may be effects on fish from certain discharges such as drilling fluids and produced water within the mixing zone near an outfall, these effects should be minor and localized.

As a result of NMFS consultation, the NPDES Genera Permit required a study of the direct lethal, sublethal, and bioaccumulative effects of produced water on federally managed fish species that occupy the mixing zone of produced water discharges (MRS 2005). That study included site-specific modeling of the dispersion plumes from each platform covered by the permit, including Platform Irene. The study found that fish populations around Platform Irene consist mostly of rockfish that utilize the platform as habitat, rarely venturing far from the protection of the structure. A quantitative exposure assessment found a general absence of impacts from most of the major produced water constituents. Many of the produced water constituents that are normally of concern for the protection of marine organisms were below biological effects levels prior to discharge. Four constituents had end-of-pipe concentrations that were slightly elevated in produced water compared to thresholds of potential effects in finfish. However, because the produced water discharge achieves high dilution almost immediately upon discharge, the plume volume containing concentrations of potential biological significance were exceedingly small compared to the volume of habitat contained within the mixing zone.

In the quantitative assessment, undissociated sulfide was the only constituent in Platform Irene's produced water that could not be eliminated as a source of potential impacts to fish within the mixing zone. However, subsequent research has addressed one of the major deficiencies in the original assessment with regard to sulfide, namely, its toxic threshold in marine organisms (Weston Solutions Inc. and MRS 2006). Analysis of extensive bioassay testing found a sulfide threshold for marine species that was six-times higher than the EPA National Standard currently promulgated in the General Permit. The current standard was based on an extremely limited number of dated bioassay studies, conducted primarily on freshwater organisms, or on organisms exposed to sulfides in a complex chemical mixture. In addition, a new diffuser structure is being designed for Platform Irene that should achieve much higher dilution rates than were considered in the original study. Regardless of potential changes, it is highly unlikely that finfish would encounter this limited area on a regular basis, especially considering that they exhibit a strong avoidance reaction to sulfide (EPA 1976, 1986).

Oil Spills

Research shows that hydrocarbons and other constituents of petroleum spills can, in sufficient concentrations, cause adverse impacts to fish (NRC, 1985; GESAMP, 1993). The effects can range from mortality to sublethal effects that inhibit growth, longevity, and reproduction. Benthic macrofaunal communities can be heavily impacted, as well as intertidal communities that provide food and cover for fishes. Although fish can accumulate hydrocarbons from contaminated food, there is no evidence of food web magnification in fish. Fish have the capability to metabolize hydrocarbons and can excrete both metabolites and parent hydrocarbons from the gills and the liver. Nevertheless, oil effects in fish can occur in many ways: histological damage, physiological and metabolic perturbations, and altered reproductive potential (NRC, 1985). Many of these sublethal effects are symptomatic of stress and may be transient and only slightly debilitating. However, all repair or recovery requires energy, and this may ultimately lead to increased vulnerability to disease or to decreased growth and reproductive success.

The egg, early embryonic, and larval-to-juvenile stages of fish seem to be the most sensitive to oil. Damage may not be realized until the fish fails to hatch, dies upon hatching, or exhibits some abnormality as a larva, such as an inability to swim (Malins and Hodgins, 1981). There are several reasons for this vulnerability of early life stages. First, embryos and larvae lack the organs found in adults that can detoxify hydrocarbons. Second, most do not have sufficient mobility to avoid or escape spilled oil. Finally, the egg and larval stages of many species are concentrated at the surface of the water, where they are more likely to be exposed to the most toxic components of an oil slick.

Impacts of Past and Present OCS Activities

Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995, 1997; MMS, 1996). No impacts on threatened or endangered fish from past and present OCS-related oil and gas activities in the Pacific Region have been reported.

6.6.1 Tidewater Goby (Endangered)

Tidewater gobies, which are found in shallow coastal lagoons, stream mouths, and shallow areas of bays, would not be impacted by effluent discharges. Over the distance from Platform Irene to the shore, any pollutants discharged would be diluted to background levels.

There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms blocking the stream mouths from the ocean have been breached. Breaches usually occur during the winter and spring months, and tidewater gobies often move upstream out of the lagoons during this period. Although direct oil contact with gobies would be unlikely, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. When the gobies returned, short-term sublethal effects would also be expected, since gobies burrow into and feed in the sediment and rely on macrofaunal and intertidal communities for food and shelter from predators. The level of impacts, however, would be dependent on the volume of oil that reached their habitat and the amount of weathering and mixing the oil had undergone before reaching the habitat.

The most likely oil spill scenario for the Tranquillon Ridge development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl would occur during the life of the project (Section 5.3). Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. An oil spill of this size would weather, mix, and break up to the point where only limited tarring would be expected to coastal lagoons in the Point Arguello area. Such a level of spillage would be unlikely to have a detectable effect on tidewater gobies.

Most goby habitat during fall will be separated from the ocean by sand berms and thus would be protected to some degree. However, tides, heavy surf, or early seasonal rains could breach these barriers. Oil spill response teams would be expected to protect these habitats further with booms and enhancement of the natural berms. During winter months, after rains and storms have breached the natural sand barriers, protection of goby habitat that is within the contact zone of a spill would rely on the speed and effectiveness of the oil spill response team. A spill of about 200 bbl that hit the mainland coast in the Point Arguello area would in all likelihood contact and impact one or two tidewater goby habitats, possibly resulting in some mortality and likely short-term sub-lethal effects. This would depend on the amount spilled and the weathering of the oil.

Given the low probability that an oil spill of about 200 bbl would contact tidewater goby habitat in the coastal lagoons, that the oil spill prevention and response capabilities are in place, and the ability of tidewater gobies to re-colonize their habitat, expected impacts to tidewater gobies from the proposed Tranquillon Ridge project are low.

6.6.2 Steelhead Trout (Endangered)

Direct toxicity from effluent discharges associated with the Tranquillon Ridge development project is unlikely due to discharge requirements and rapid dilution of the discharges. Heavy metals and hydrocarbons are not expected to be accumulated by their prey to toxic levels due to cellular mechanisms for removal of these substances. Thus, no impacts on steelhead trout are expected from effluent discharges.

The critical habitat for steelhead includes all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Santa Maria Basin to Malibu Creek. In the Point Arguello area, this would include the Santa Ynez River, San Antonio Creek, the Santa Maria River, and perhaps Jalama and Cañada Honda Creeks. Only winter steelhead occur along the south-central coast. Winter steelhead enter their home streams from November to April to spawn. Juveniles usually migrate to sea in spring.

The most likely oil spill scenario for the Tranquillon Ridge development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl would occur during the life of the project (Section 5.3). Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. Based on OSRA model runs, the greatest threat is to steelhead populations north of Point Conception from November to April (winter and spring). If a spill from the Irene-to-shore pipeline were to occur during these months, the OSRA model runs (Section 5.3.1) predict up to a 15.3% probability of contact with the Point Arguello area within 3 days.

During winter months, after rains and storms have breached the natural sand barriers, protection of steelhead habitat that is within the contact zone of a spill would rely on the speed and effectiveness of the oil spill response team. A spill of about 200 bbl that hit the mainland coast in the Point Arguello area would in all likelihood contact and impact one or two steelhead critical habitats, possibly resulting in some mortality and likely short-term sub-lethal effects. In particular, spills from the pipeline between the shoreline and Lompoc Oil and Gas Plant (LOGP) could enter the Santa Ynez River, which is designated critical habitat for steelhead. Effects on steelhead would depend on the time of year and size of the spill, and the weathering of the oil.

Impacts would be greatest if the spill occurred during adult or juvenile migration to or from spawning and rearing areas upstream of the project. Although little mortality would be expected from a spill of 200 bbl, sublethal effects causing stress might lead to increased vulnerability to disease and perhaps reduced reproduction to impacted individuals. Migration could also be disrupted. Oil avoidance reactions are well documented in salmon. Adults and juveniles can detect sublethal levels of hydrocarbons (Rice, 1973; Weber et al., 1981) and have been observed actively avoiding contaminated areas (Patten and Patten, 1977; Weber et al., 1981). These effects are expected to be short-term due to the weathering and mixing that would occur to the oil before it reached the shore. The high-energy environment of the south-central California coast would further minimize the toxicity and persistence of the oil in the environment. Also, in the event of a spill, oil spill response teams would identify river and stream mouths at risk of oil contact and would immediately boom or build protective berms at the river and stream mouths, which could further disrupt migration. Cleanup efforts could also adversely affect steelhead present through direct mortality or stress from harassment or capture and relocation.

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

If a spill were to contact shore in the Point Arguello area during the steelhead trout migration, some mortality and short-term sublethal impacts to steelhead might occur. Oil spill response teams would be expected to boom the mouths of creeks and rivers or enhance the existing berms in the event of a spill, thus minimizing the chance of oil reaching critical habitat. Additionally, although the toxicity and persistence of the oil in the environment would be low due to the weathering and mixing of the oil at sea and the high-energy environment of the south-central coast, some mortality may occur.

In conclusion, oil spills associated with the Tranquillon Ridge development project would be expected to have minor impacts on steelhead trout if a spill were to contact critical habitat (such as the Santa Ynez River) during a period when steelhead are migrating. Due to the openness of the south-central coast and the high-energy environment of the area, a spill of about 200 bbl originating at Platform Irene or along the more offshore portions of the pipeline would likely break into smaller slicks, and some of the oil would disperse into the water column. Thus, concentrated oiling of steelhead habitat would not be expected. However, the Irene-to-shore pipeline comes ashore just north of the Santa Ynez River. Historically, this system supported the largest steelhead run in southern California, and it is currently designated critical habitat for this species. A spill originating near where the pipeline comes ashore would likely result in impacts to this steelhead utilizing the Santa Ynez River, including limited mortality. However, given the low probability of a spill from the Tranquillon Ridge field area contacting the mainland, and that the oil spill prevention and response plans are in place, adverse impacts to southern steelhead from the proposed project are not likely to affect the species at a population level.

6.7 TERRESTRIAL PLANTS

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on terrestrial plants. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on endangered plant species in the project area.

There are two threatened or endangered species of plants in the general area of concern for the Tranquillon Ridge field project: salt marsh bird's-beak and California sea-blite. Of the three potential impact sources identified for this project (Section 5.0), only an oil spill could adversely affect these species. Platform discharges and noise and disturbance are not expected to have an effect on these onshore species.

Plant mortality from oil spills can be caused by smothering and toxic reactions to hydrocarbon exposure, especially if oil reaches shore before much of the spill's lighter fractions have evaporated or dissolved. Generally, oiled marsh vegetation dies, but roots and rhizomes survive when oiling is not too severe (Burns and Teal, 1971). Research has shown that recovery to pre-oiling conditions usually occurs within a few growing seasons, depending on the magnitude of exposure (Holt et al., 1975; Lytle, 1975; Delaune, et al., 1979; Alexander and Webb, 1987).

Impacts of Past and Present OCS Activities
Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al., 1988; Bornholdt and Lear, 1995, 1997; MMS, 1996). No impacts on threatened or endangered plants from past and present OCS-related oil and gas activities in the Pacific Region have been reported.

6.7.1 Salt Marsh Bird's-Beak (Endangered)

The Salt marsh bird's-beak was first listed on September 28, 1978. Salt marsh bird's-beak is a diffusely branched annual herb in the figwort family (Scrophulariaceae). The plants are hemiparasitic, sometimes obtaining moisture and nutrients from the roots of their host plants, which are usually perennials. Salt marsh bird's-beak grows in the higher reaches of coastal salt marshes to intertidal and brackish areas influenced by freshwater input. The salt marsh bird's-beak is at risk from an oil spill, because this plant is limited to coastal salt marshes that could be contacted by oil. The cleanup process, if not conducted with respect to Federal and State regulations, could exacerbate the effects of an oil spill on this species and its habitat.

Historically, salt marsh bird's-beak was widespread in coastal salt marshes from Morro Bay in San Luis Obispo County to San Diego County and northern Baja California. Salt marsh bird's-beak is currently limited to a very few (<10) salt marshes along the coast of California and Baja California, Mexico, which makes this species more vulnerable to an oil spill. Within the general vicinity of the project area, these marshes include Ormond Beach and Mugu Lagoon in Ventura County, Carpinteria Salt Marsh in Santa Barbara County, and Morro Bay in San Luis Obispo County.

Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the

MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

If a spill of about 200 bbl were to occur, move north, and contact Morro Bay, impacts to salt marsh bird's-beak could occur. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the bay. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid (see Section 5.3.2). Also, Morro Bay is located more than 80 km (50 mi) north of the Tranquillon Ridge field, and responders would have ample time to deploy protective measures in this area. The very nature of the bay itself provides many opportunities for protecting the areas occupied by salt marsh bird's-beak.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the very low probability of contact with a single occupied marsh (Morro Bay, see Appendix B) located more than 80 km (50 mi) north of the Tranquillon Ridge field, and that the oil spill prevention and response capabilities are in place, no impacts to salt marsh bird's-beak are expected from the development of the Tranquillon Ridge field.

6.7.2 California Sea-Blite (Endangered)

California sea-blite is at risk from an oil spill, because, within the project area, this plant is presently limited to a single coastal salt marsh, Morro Bay, which could be contacted by oil. The cleanup process, if not conducted with respect to Federal and State regulations, could exacerbate the effects of an oil spill on this species and its habitat.

Since sea-blite is limited to a single marsh, this plant is highly vulnerable to an oil spill. Section 5.3 of this evaluation discusses oil spill risk associated with the proposed Tranquillon Ridge field development. Our oil spill risk calculations project a 58.9% chance of an oil spill between 50-999 bbl and a 17.7% chance of an oil spill of 1,000 bbl, or greater, over the lifetime of the project. Using data from the MMS U.S. Oil Spill Database for the Gulf of Mexico and Pacific Regions, the most likely spill volume from Tranquillon Ridge field development would be less than 200 bbl. Reviewing historic oil spill data specific to the Pacific Region's 23 offshore platforms supports a conclusion that there would be a low risk of a large oil spill from the Tranquillon Ridge field development. Since 1971, slightly more than 844 bbl of oil have been spilled during all oil and gas development and production activities on the Pacific coast; 99.5% of these spills were less than 1 bbl and none were greater than 200 bbl.

If a spill of about 200 bbl were to occur, move north, and contact Morro Bay, impacts to sea-blite could occur. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the bay. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid (see Section 5.3.2). Also, Morro Bay is more than 80 km (50 mi) north of the Tranquillon Ridge field, and responders would have ample time to deploy protective measures in this area. The very nature of the bay itself provides many opportunities for protecting the areas occupied by sea-blite.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the fact that only a very slight chance of contact with Morro Bay is estimated, and that the oil spill prevention and response capabilities are in place, no impacts to California sea-blite from the development of the Tranquillon Ridge field are expected.

7.0 CUMULATIVE EFFECTS

The three impacting sources identified for the proposed project are: noise and disturbance, effluent discharges, and oil spills. Of these three sources, only the increased risk of an oil spill associated with the proposed project would add to, or interact with, effects from related or unrelated actions or projects. The proposed project will fall within the approved level of activity scheduled to occur at Platform Irene, and will not add spatially to the impacts caused by effluent discharges, noise and disturbance sources that were scheduled to occur and are covered under permits at Platform Irene, it will extend the productive life of the Point Pedernales facilities for 10 years.

Table 7.1 Cumulative Offshore Energy Projects (Non-Federal)

#	Project, Applicant	Description	Status
1	Ellwood Full Field Development, Venoco, Inc.	Oil and Gas Development Project	Under Review
2	Ellwood Marine Terminal Lease Renewal, Venoco, Inc.	Oil Transportation	Under Review
3	Resumption of State Lease PRC-421, Venoco, Inc.	Oil and Gas Development Project	Under Review
4	Carpinteria Field Development, Carone	Oil and Gas Development Project	Under Review
5	Paredon Project, Venoco, Inc.	Oil and Gas Development Project	Under Review

Table 7.1 has identified five similar non-Federal projects that are reasonably likely to occur and will be considered in the cumulative effects analysis. These actions include activities that could produce effects in the project area during the expected life of the Tranquillon Ridge field development project (approximately 15 years). These projects include development of State leases from Platform Hogan, the development of the Paredon field, and three proposed options for modification and upgrades to Platform Holly and the associated onshore Ellwood facilities. These five proposed projects would slightly increase the risk of an oil spill occurring. All five proposed projects are expected to occur from existing facilities and within the levels of activity planned and analyzed for the facilities. Thus, none of the proposed projects would add to the impacts caused by effluent discharges, and noise and disturbance sources that were scheduled to occur are covered under permits at Platform Holly.

Ellwood Full Field Development, Venoco, Inc. Platform Holly is located in State waters approximately 4 km (2.4 mi) southwest of Coal Oil Point, in the Santa Barbara Channel. This project would extend the boundaries of State lease PRC 3242.1 eastward, while lease 3120.1 would be extended south to the state water's three-mile limit to facilitate oil and gas extraction from Platform Holly. The project would move gas processing offshore to platform Holly, remove the Ellwood Marine Terminal, and develop the South Ellwood field using extended-reach drilling technology from platform Holly. No new or modified subsea pipelines would be constructed. If approved, the project is anticipated to have a peak oil production rate of 12,600 bbl per day and a peak gas production rate of 20 MMscfd after five years (SBC, 2006). The project is currently undergoing an environmental review. If approved construction would be expected to begin in 2008 to 2009.

Up to 40 new wells would be drilled using an electric drill rig. Twenty of the wells would be drilled between 2008 and 2015, with approximately two mechanical replacement wells drilled per year thereafter. Platform Holly does not discharge effluents. All fluids and cuttings produced on the platform are re-injected down an existing offshore well or in an approved onshore disposal site. Additionally, Platform Holly is served by a crew boat that transports personnel and supplies from the Ellwood pier. The proposed project is not expected to alter the current boat traffic load to and from Platform Holly. Thus, no cumulative noise and disturbance effects to protected species are expected from this project.

Removal of the offshore components of the Ellwood Marine Terminal will involve a small number of vessels working along the shoreline. The removal process, including pipeline flushing and abandonment, and removal of the mooring equipment will last about 9 weeks. Venoco, Inc. will conduct surveys to verify the absence of sensitive marine habitats (hard bottom, eelgrass, kelp, surfgrass) in the offshore work area. Removal of the marine terminal loading line and moorings will be conducted in a manner that avoids potential impacts to these resources, if present.

Development of the South Ellwood field would cause a slight increase in spill risk. However, the removal of the Ellwood Marine Terminal would outweigh any spill risk due to the South Ellwood field development. Current marine terminal operations involve the transfer of up to 55,000 bbl of oil from onshore tanks via a subsea pipeline to a barge for shipment to refineries in the Los Angeles area. This process, which takes approximately 17 hrs, occurs every 5-12 days. The currently proposed Ellwood full field development project would eliminate the risk of an oil spill from the marine terminal.

Ellwood Marine Terminal Lease Renewal, Venoco, Inc. Venoco, Inc. is currently seeking approval from the California State Lands Commission for a new Sate Lease (PRC-3904.1) through February 28, 2013. This would allow Venoco, Inc. to continue operating the existing Ellwood Marine Terminal located offshore the City of Goleta and lands under the ownership of the University of California, Santa Barbara. The proposed project does not include the construction of any new facilities or the modifications to existing facilities; however, it does include the potential for increasing the crude oil throughput and transportation from current levels to permitted levels. A draft EIR has been issued for the project and the public review has been completed, the EIR is currently being finalized. This project has the potential to increase the likelihood of an oil spill along the South-Central California Coast along the barge routes to Los Angeles and San Francisco.

Resumption of State Lease PRC-421, Venoco, Inc. In May 2004, Venoco, Inc. proposed to bring two idle Coastal Zone oil production wells within State Lease PRC-421 back into production. The wells are located in the City of Goleta on two adjacent piers. Pier 421-1 supports an idled water and gas injection well, while Pier 421-2 supports an idled oil production well. Venoco, Inc., Inc. proposes to install new production equipment and reactivate the oil well on Pier 421-2, and reactivate the injection well on Pier 421-1 for disposal of wastewater and natural gas (SBC 2006). Based upon current projections, the estimated life of the proposed project would be twelve years of oil production; production would be expected to be no more than 700 bbl per day in the first year, tapering off to approximately 100 bbl per day by year twelve. The proposed project is currently under review, and would marginally increase the likelihood of an oil spill off the South-Central California Coast.

Carpinteria Field Development Project. This project includes directional drilling from Platform Hogan into existing State Leases PRC-4000, PRC-7911, and PRC-3133. The applicant has proposed to drill up to 25 wells. Estimated peak production from Platform Hogan would increase to approximately 6,000 bbl per day and 6 MMscfd of gas after the first six years of production, and then would decline. The project would be expected to have a 12 year economic life. The resulting oil and gas production will be sent to La Conchita Facility for processing via the existing pipelines. This project would result in increased spill risks near the platform. Oil and gas produced from this project would flow through submerged pipelines to the Carpinteria Processing Facility (CPF).

The project has undergone partial environmental analysis. The environmental analysis determined that the structural integrity of Platform Hogan needs to be verified to determine if the platform is capable to support a drilling rig needed to accomplish this project. Therefore, the project is on hold until such determination is completed. If the structural integrity is not adequate, some construction work may be required at Platform Hogan to reinforce the platform's structure. The timing of the project is currently unknown.

The Paredon Prospect Development, Venoco, Inc. This project aims to conduct extended reach drilling from an onshore operations site located at Venoco, Inc.'s existing CPF, located on the coast in the City of Carpinteria, in southern Santa Barbara County. The Proposed project would develop and produce oil and gas from hydrocarbon-bearing reservoirs (the Paredon Prospect) lying primarily offshore of the Carpinteria area in State Leases PRC 3150 and PRC 3133. The Paredon Prospect is estimated to contain recoverable reserves of approximately 23.5 million bbl of oil and 43 billion standard cubic feet of natural gas. Although all of the drilling and construction for this project would occur from the CPF, and land this project has a limited potential to spill oil to the marine environment in the event of a well blow out or frac-out, or in the event of a pipeline break.

Oil and Gas Development. There are a total of 79 OCS oil and gas leases (43 developed leases and 36 undeveloped leases) offshore of southern California. Offshore oil and gas reserves are produced via the 23 existing oil and gas platforms in Federal waters and 4 platforms in State waters offshore southern California. The cumulative effects of these structures and development activities on the OCS can be found in numerous reports, and environmental documents (MMS 1992, MMS 1995, MMS 1996). The proposed Tranquillon Ridge development project would add to the overall oil spill risk associated with ongoing OCS oil and gas activities in the Pacific Region (MMS, 1996). The proposed Platform Holly/Ellwood, and Paredon projects would add smaller increments to the overall oil spill risk offshore southern California based on their smaller recovery volumes.

Production from the 43 developed leases is expected to continue for the next five to 20 years. The MMS currently has no proposals for decommissioning offshore facilities. The future of the 36 undeveloped leases is in question as a result of litigation.

Other Activities. Offshore shipping traffic contributes to oil spill risk, both in terms of fuel spills and the potential loss of cargo from oil transport vessels. Ships and military sonar exercises introduce anthropogenic noise into the marine environment. The water quality in the southern California coastal zone is affected by many activities including, dredging and discharge of dredged material, aquaculture, wastewater discharge, hazardous waste spills, coastal development, and agricultural runoff. All of these activities are expected to continue into the future.

Summary of Effects. Despite the spatial proximity and temporal overlap of these activities, the incremental contribution of the proposed development of the Tranquillon Ridge field is not expected to add to the cumulative effect or affect protected species at a population level.

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Appendix A

Tranquillon Ridge Biological Evaluation :
List Of Federally Threatened And Endangered Species Evaluated

Federally Listed Species		
Species	**Status**	**Agency of Oversight**
Marine Mammals		
Blue Whale	Endangered	NMFS
Humpback Whale	Endangered	NMFS
Fin Whale	Endangered	NMFS
Sei Whale	Endangered	NMFS
Northern Right Whale	Endangered	NMFS
Sperm Whale	Endangered	NMFS
Steller Sea Lion	Threatened	NMFS
Guadalupe Fur Seal	Threatened	NMFS
Southern Sea Otter	Threatened	FWS
Birds	Endangered	FWS
California Brown Pelican	Endangered	FWS
California Least Tern	Endangered	FWS
Light-footed Clapper Rail	Threatened	FWS
Western Snowy Plover	Threatened	FWS
Bald Eagle	Threatened	FWS
Reptiles		
Leatherback Sea Turtle	Endangered	NMFS
Green Sea Turtle	Endangered	NMFS
Pacific Ridley Sea Turtle	Endangered	NMFS
Loggerhead Sea Turtle	Endangered	NMFS
Fish		
Tidewater Goby	Endangered	FWS
Steelhead Trout	Endangered	FWS
Plants		
Salt Marsh Bird's-Beak	Endangered	FWS
California Sea-blite	Endangered	FWS

APPENDIX B: Oil Spill Trajectory Modeling

Table of Contents

Appendix B Oil Spill Trajectory Modeling

B.1 Background

This appendix presents the results of pat drifter and trajectory studies and oil spill modeling conducted for Platform Irene and the Platform Irene to shore oil/emulsion pipeline. The modeling was conducted to determine the movement and fate of an oil spill occurring at either of these two locations. Two models were examined, the Minerals Management Service (MMS) Oil Spill Risk Analysis (OSRA) and the General National Oceanic and Atmospheric Administration Oil Modeling Environment (GNOME). Each are publicly available models.

B.2 Drifter Studies

The trajectories of drifters released near the project area generally reflect the surface flow patterns measured by long-term current-meter moorings (Crowe and Schwarzlose, 1972; Schwartzlose and Reid, 1972; Chelton, 1987; Winant et al., 1999). Namely, northwestward transport is observed throughout much of the year except during strong upwelling events that are most prevalent between April and June. Prevailing winds near Point Arguello are directed to the southeast except during brief, three-to-four-day periods when winter storms disrupt the normal pattern as they pass through the region. Surface currents near the project area are generally directed to the northwest, in opposition to, and uncoupled with the prevailing southeastward winds (Savoie et al., 1991; SAIC, 1995). During the spring and early summer, brief episodes of intensified southward-directed winds result in a reversal of surface currents. For periods of up to a week, near-surface flows turn toward the southeast in opposition to the northwestward current direction that is maintained throughout most of the water column.

The opposing directions of the wind and surface currents near Point Arguello are evident in drifter studies. California Cooperative Oceanic Fisheries Investigations (Cal COFI) drifter bottles released north of the Santa Barbara Channel in December 1969 migrated northward at speeds exceeding 15 cm/s. However at other times of the year, drift bottles released near Point Conception were recovered both to the north and to the south near San Diego. For release points near Point Arguello in 1984, many of the Central California Coastal Circulation Study (CCCCS) surface drifters traveled south in response to strong southward directed winds (Chelton, 1987). It was only during a brief period when southward winds weakened in July that the majority of drifters moved northward. However, the CCCCS drifter design is susceptible to a downwind motion of about 0.5% of the wind speed and thus may not accurately represent surface currents alone.

The drifters used in the Santa Barbara Channel to Santa Maria Basin (SMB) coastal circulation study were designed to minimize the influence of wind and wave drift in favor of tracking surface currents over a depth of about 1 m (Davis et al., 1982). As a result, flow statistics derived from the drifters compared well with that of the moored current meters (Dever et al., 1998). Discrepancies in mean flow direction have been ascribed to sampling bias (Dever, 2001b). Beginning in January 1995, many of these drifters were deployed within the Santa Maria Basin, including locations near the Tranquillon Ridge field. Few of the drifters released near the Point Arguello to Point Conception region beached before exiting the region (Dever et al., 2000; Winant et al., 1999). In a manner consistent with the long-term current meter data collected as part of the California Monitoring Program (CaMP), initial offshore movement was followed by northward movement into the SMB in fall and winter. Spring and summer deployments were more likely to show southward flow toward San Miguel Island. Few drifters moved eastward into the Santa Barbara Channel.

The complex interaction between winds and surface currents near Point Conception makes predictions of oil spill trajectories difficult. During much of the year, but especially in the fall and winter, the northwestward surface flow is in direct opposition to the prevailing winds. Certainly these surface currents, as determined by current meters and drifters, have a direct bearing on the fate and effects of potential oil spills resulting from the proposed project. However, winds also influence the spread and trajectory of oil slicks on the sea surface. Empirical data from the open ocean suggests that leading edge of an oil slick would drift at about 3% of the wind speed and oil-following drifters have been evaluated based on their ability to match this "3% rule" (Reed et al., 1988). However, there is no rigorously defensible theoretical basis or empirical data to support the application of this rule in coastal flow regimes.

Drifters deployed during the Santa Barbara Channel to Santa Maria Basin coastal circulation study tended to travel toward the south only about 31% of the time and only about 15% of these intersected the shoreline.

Drifters, with their measurable mass and finite vertical profile below the sea surface, cannot capture the behavior of an oil slick that is typically only a few millimeters thick (Reed et al., 1988). Furthermore, dispersion and weathering affect the spread of oil on the sea surface, and buoys cannot capture the changing slick dynamics across a wide range of winds, waves, and currents. Goodman et al. (1995) and Simecek-Beatty (1994) tested the oil-tracking ability of several drifter designs, including the Davis et al. (1982) design used in the Santa Barbara Channel-SMB coastal circulation study. They found that Davis-type drifters lagged behind simulated oil slicks presumably because they are optimized to track surface currents with minimal influence by winds and waves. In cases where winds opposed surface currents, the Davis-type drifters moved into the prevailing wind and in a direction opposite of the simulated oil slicks made from wood chips. This is similar to the case in the southern SMB where the northward-flowing Davidson current often opposes the prevailing southward-directed winds.

B.3 MMS OSRA Model

The oil-spill risk analyses described in this evaluation were performed using the MMS numerical Oil Spill Risk Analysis (OSRA) model for the Pacific Region. It calculates probabilities of shoreline impact, as well as ocean area impact, after applying a drift equivalent to 3.5% of the prevailing wind velocity in its trajectory computations. Because of the heavy influence of southward-directed winds near Point Conception, the model results indicate that the probability of shoreline impacts along the Channel Islands to the south is far higher than at sites along the central coast to the north. The influence of southward directed winds in the model effectively overcomes the northwestward surface currents observed over part of the year in the field programs. This contrasts with other drifter studies which tend to show travel toward the south only about 31% of the time and only about 15% of these intersect the shoreline (Browne, 2001). In Browne's analysis, northward transport has a slight edge with 32% of the trajectories traveling to the north and contacting the coast about 23% of the time.

The OSRA Model utilizes a seasonally averaged ocean currents for four seasons: winter, spring, summer and fall. The seasonally average current fields are provided by Scripps Institution of Oceanography and are based on several years of current meter and free-floating drifter data. Shoreline segments are divided into their respective quad areas and the probability of impact on each quad is calculated. Weathering factors are not addressed.

The use of the seasonal average ocean currents tends to smooth out the effect of the northward currents which may occur and thereby reduce the northward movement of the trajectories.

The complexity of opposing winds and currents near the project area makes the reconciliation between OSRA model results and drifter observations difficult. Because the applicability of the "3.5% wind rule" in complex coastal flow regimes has not been rigorously quantified, this environmental evaluation also addressed the GNOME model which indicates more northward impacts (see following section) due to its separation of flow regimes.

However, drifters, with their measurable mass and finite vertical profile below the sea surface, cannot capture the behavior of an oil slick that is typically only a few millimeters thick (Reed et al., 1988). Newer style drifters (called "oil following") have been deployed recently and may provide better data when available. Furthermore, dispersion and weathering affects the spread of oil on the sea surface, and buoys cannot capture the changing slick dynamics across a wide range of winds, waves, and currents.

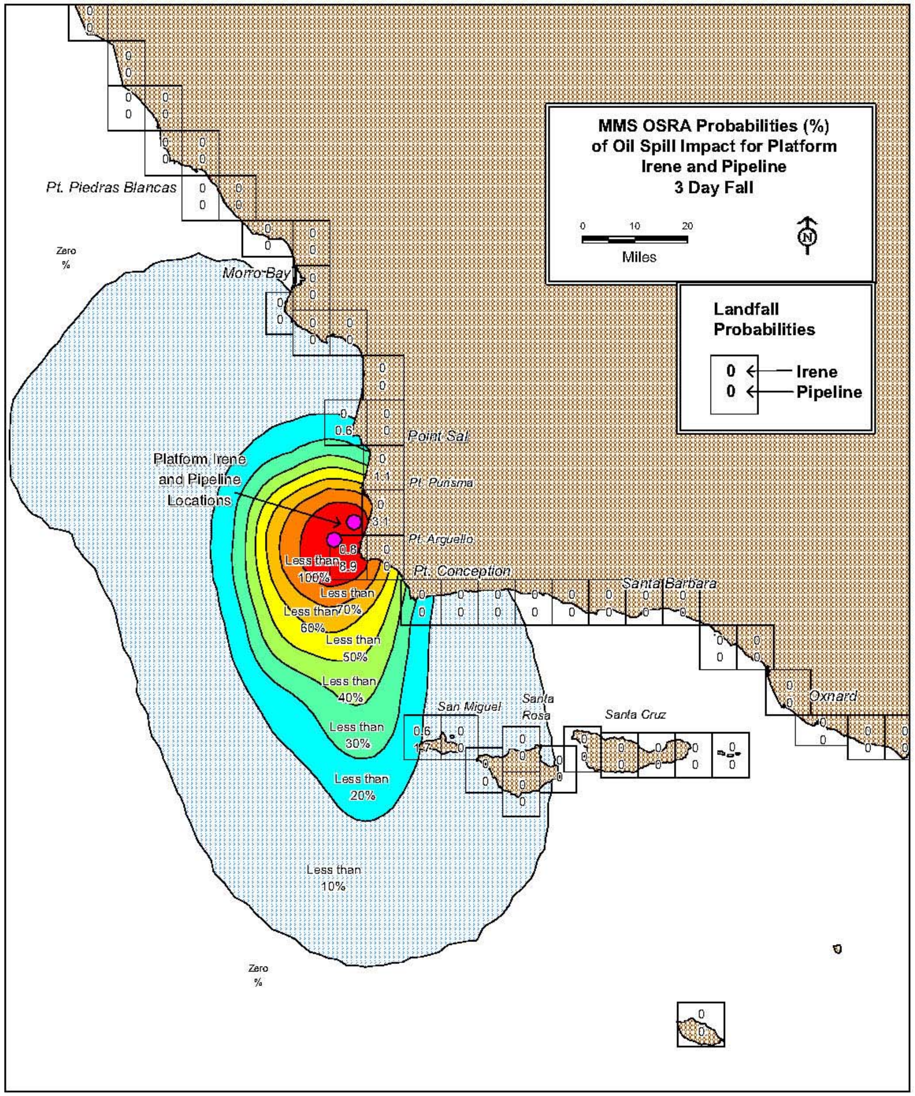
B.4 OSRA Results

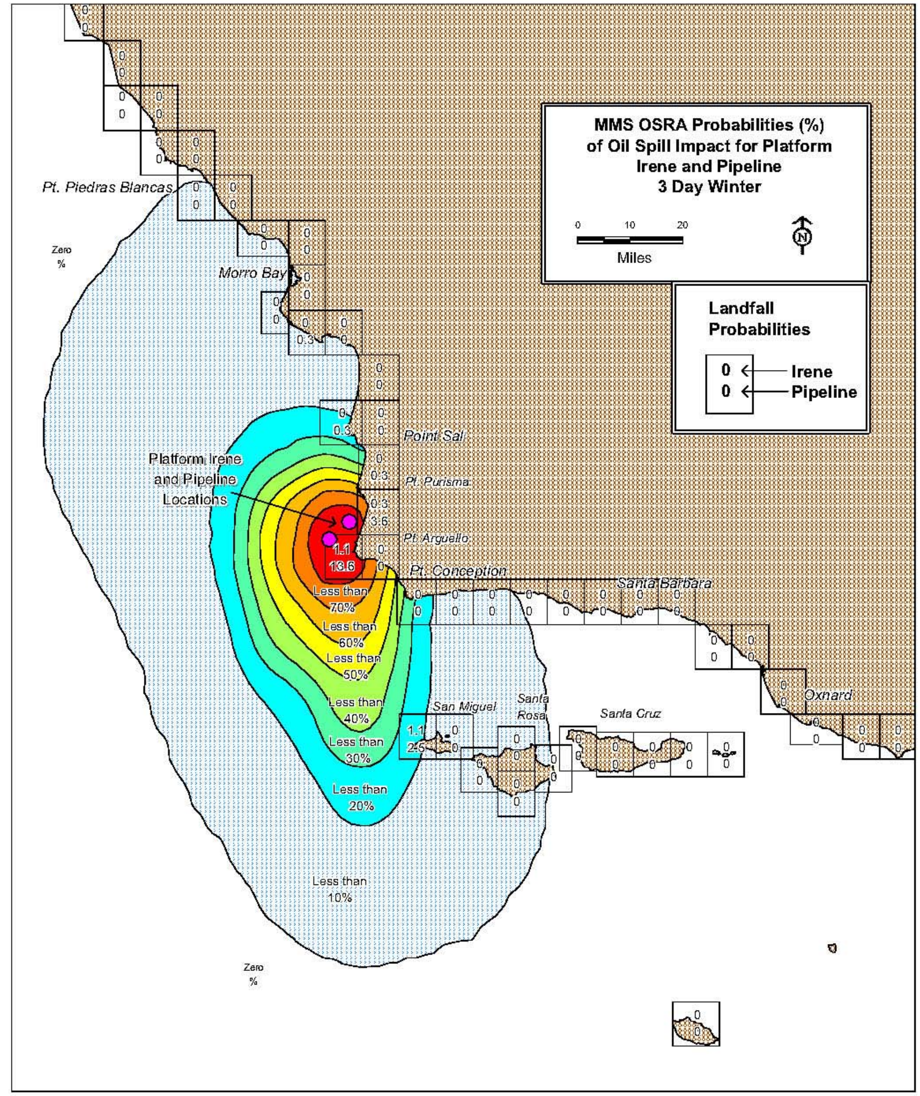
The MMS has developed OSRA reports for the Pacific Region OCS, amongst other regions. Because oil spills may occur from activities associated with offshore oil exploration, production, and transportation, the MMS conducts a formal risk assessment to evaluate the risk of oil spill contact from existing and proposed oil and gas operations. Contact is evaluated at each block in a grid encompassing the entire ocean region as well as grids located along the shoreline. Risks are examined for spills from 23 OCS platforms, 11 pipelines, 10 potentially developed units and the transportation routes. The analysis assumes that a spill has occurred and estimates the trajectories of the hypothetical oil spills from potential accident sites to land and ocean segment locations. It then provides conditional probabilities of oil impacting a given area.

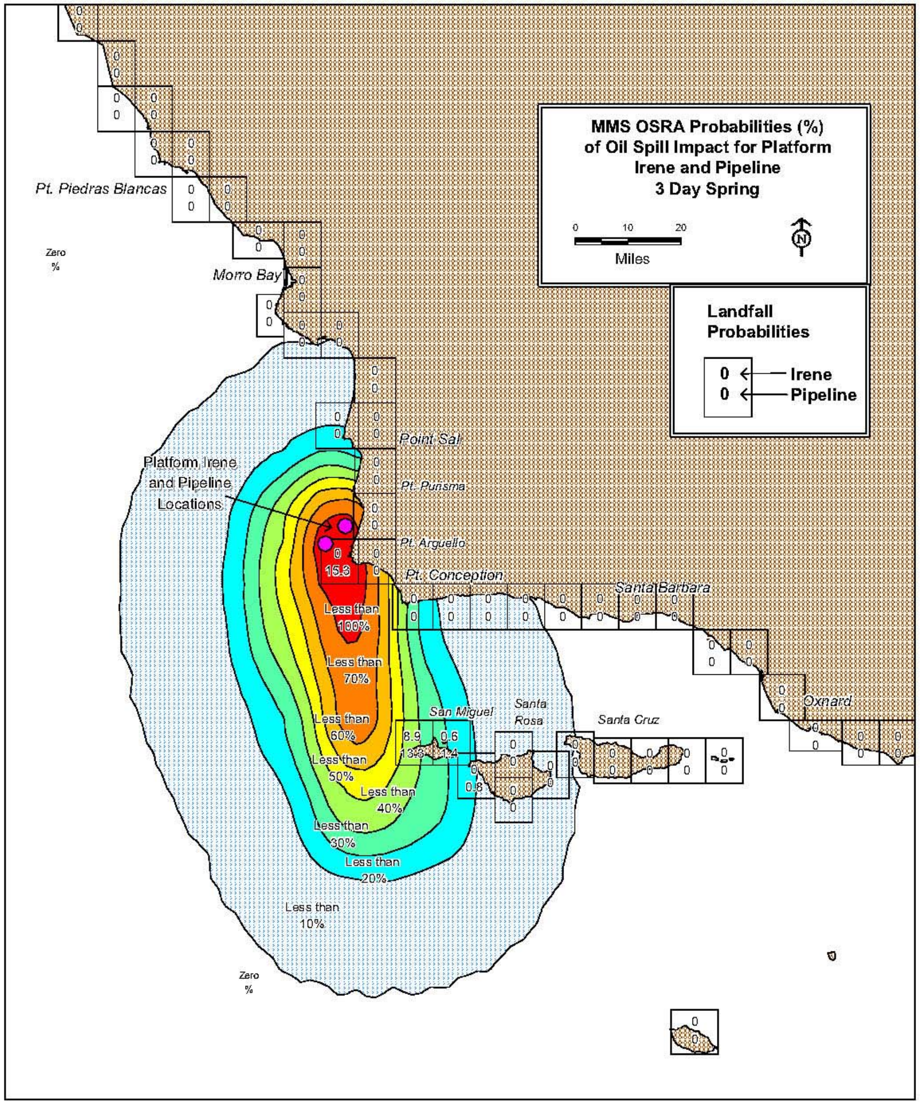
The trajectory simulation portion of the MMS OSRA model consists of many hypothetical oil-spill trajectories. The trajectories are the consequence of the integrated action of temporally and spatially varying wind and ocean current fields on the hypothetical oil spills. Collectively, they represent a statistical set of the winds and currents that will occur over the life of the production period. The analysis uses a combination of observed and theoretically computed ocean currents and winds. Most of the ocean currents used were generated by a numerical model. They were supplemented with many direct observations of the currents in the Santa Barbara Channel resulting from deployments of surface drifting buoys. The sea surface winds over the study area were derived from an atmospheric model and from measured winds at buoy, platform, island and land-based wind stations. The studies are conducted for four seasons (winter, spring, summer and fall) when currents and winds are different.

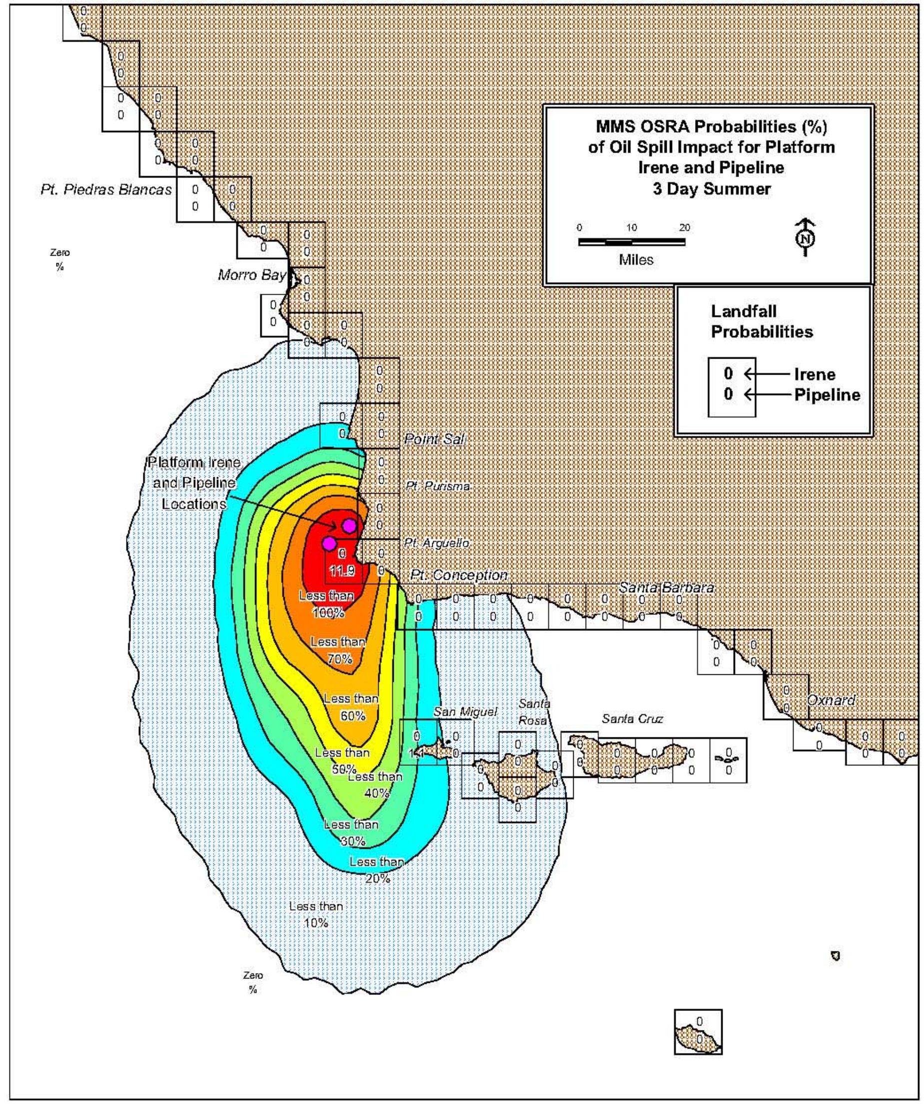
Results of the oil spill trajectory model are presented below for Platform Irene and the Irene oil/emulsion pipeline. These figures show both the conditional probabilities of oil impacting different locations on the ocean and the conditional probabilities of oil impacting the designated land segments. Conditional probabilities are shown within each land segment block for both Platform Irene and the oil/emulsion pipeline. Ocean impact areas are similar for Platform Irene and the pipeline. Information is presented for all 4 seasons (spring, summer, winter, fall) and for the periods of 3 and 10 days. The 30 day annual average is also shown.

The OSRA trajectory analysis indicates that, generally, an oil spill would travel to the south of the spill, impacting ocean areas beyond the Channel Islands during all seasons. The probability of a northward traveling spill is greater during the winter and fall months with spills potentially reaching as far north as Piedras Blancas. Conditional probabilities of contacting land range up to 15.3% during the springtime for Point Arguello due east of Platform Irene and the pipelines.


MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
3 Day Fall
Miles
Landfall
Probabilities
Irene
Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene and Pipeline Locations
Less than 100%
Less than 70%
Less than 60%
Less than 50%
Less than 40%
Less than 30%
Less than 20%
Less than 10%
Zero %


MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
3 Day Winter
Miles
Landfall
Probabilities
Irene
Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene and Pipeline Locations
Less than 70%
Less than 60%
Less than 50%
Less than 40%
Less than 30%
Less than 20%
Less than 10%
Zero %


MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
3 Day Spring
0 10 20
Miles
Landfall
Probabilities
0 ← Irene
0 ← Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene and Pipeline Locations
15.3
Less than 100%
Less than 70%
Less than 60%
Less than 50%
Less than 40%
Less than 30%
Less than 20%
Less than 10%
Zero %
8.9
0.6
13.8
1.4
0.8


MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
3 Day Summer
0 10 20
Miles
Landfall
Probabilities
0 ← Irene
0 ← Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene and Pipeline Locations
11.9
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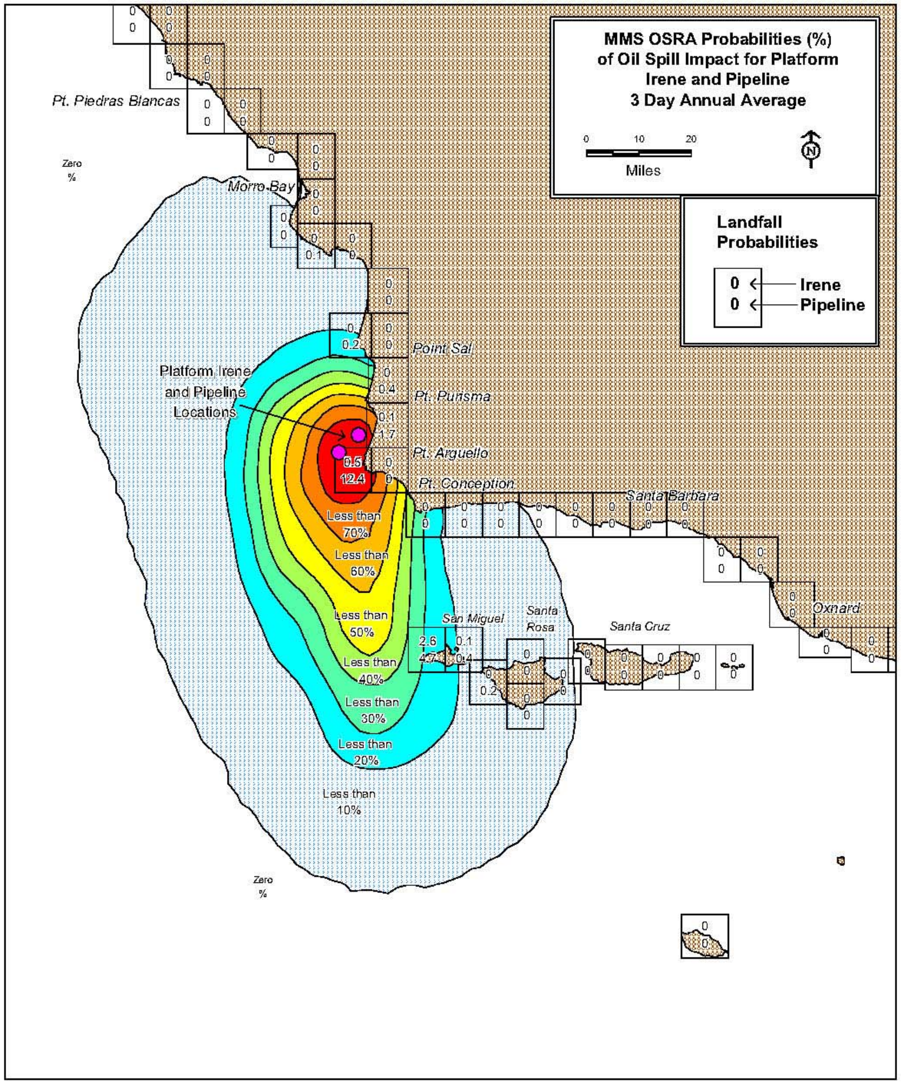
Less than 70%
Less than 60%
Less than 50%
Less than 40%
Less than 30%
Less than 20%
Less than 10%
Zero %



MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
3 Day Annual Average
0 10 20
Miles
Landfall
Probabilities
0 Irene
0 Pipeline
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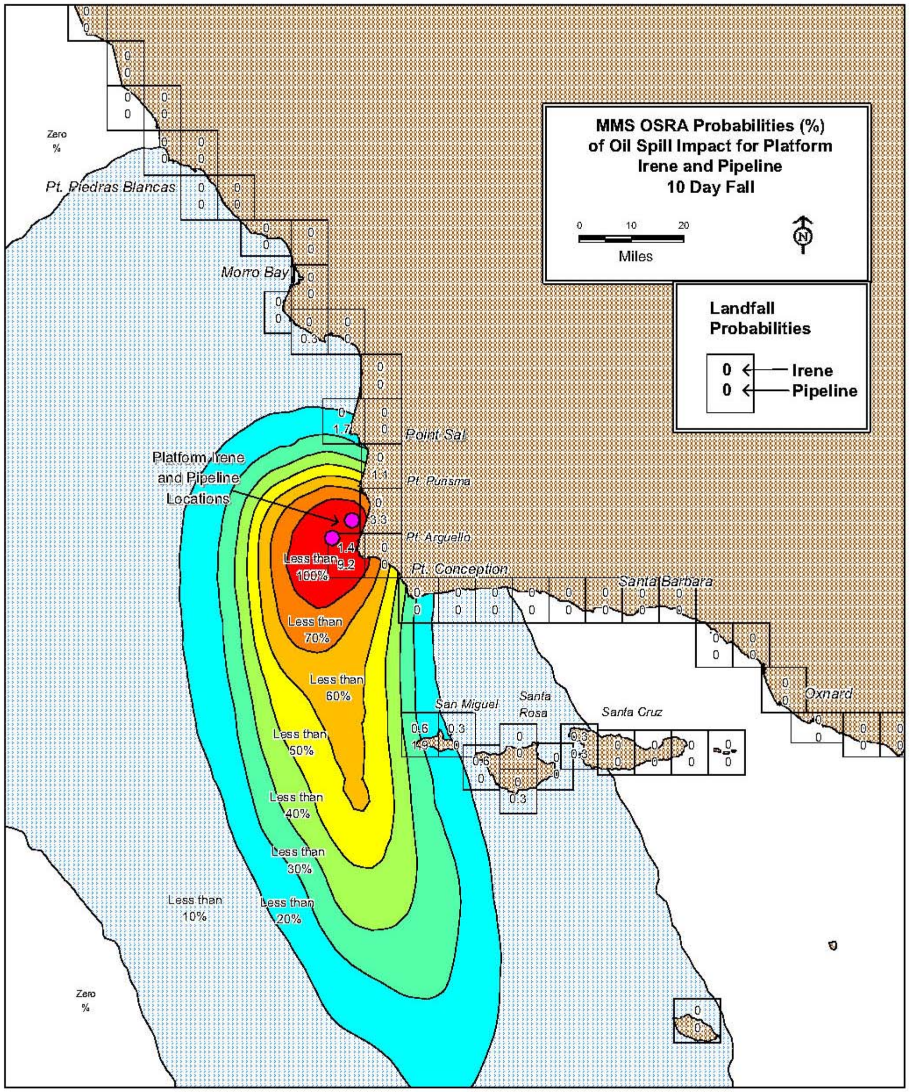
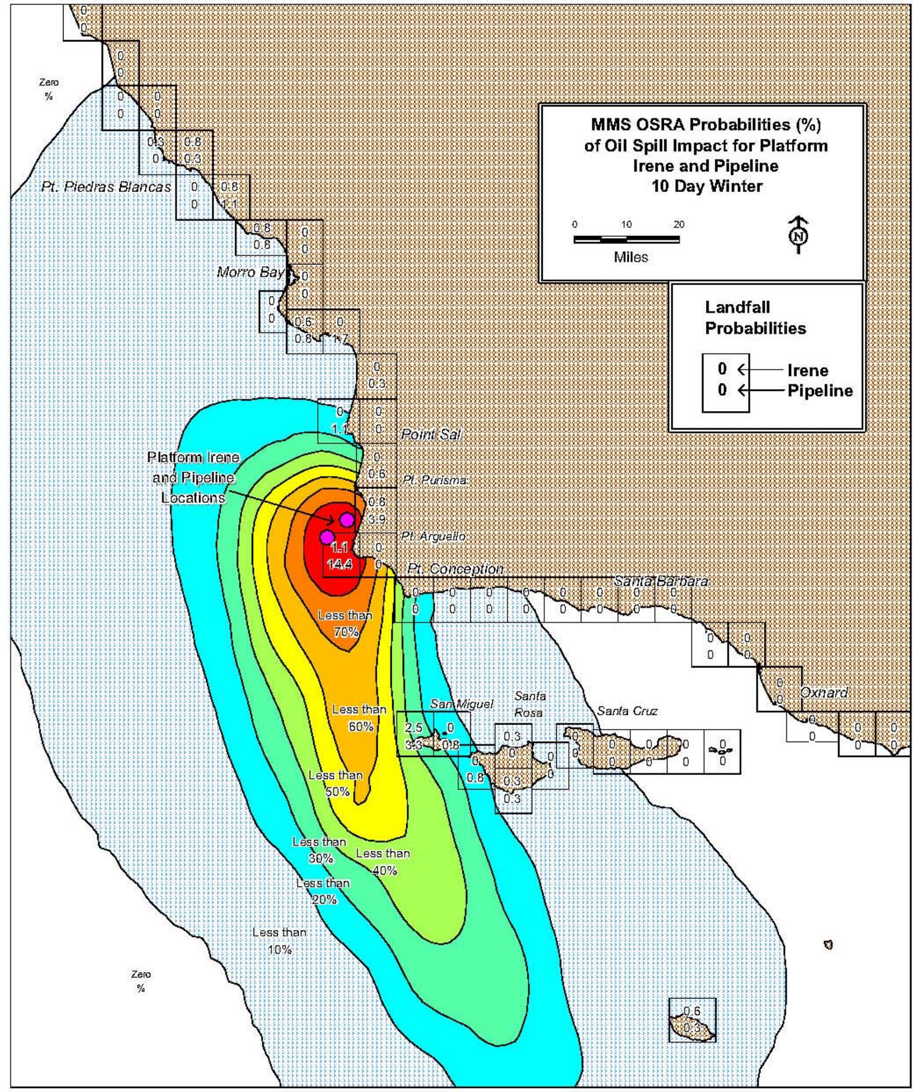
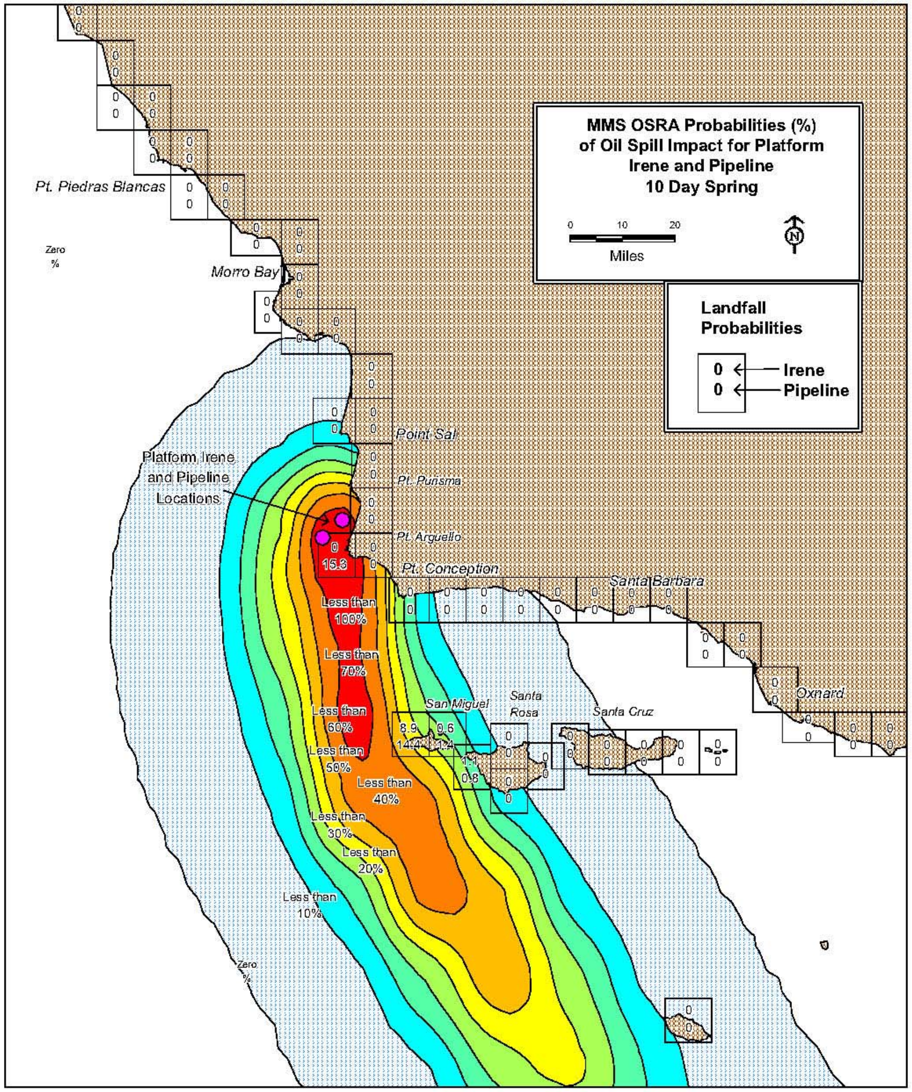
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene
and Pipeline
Locations
Less than 70%
Less than 60%
Less than 50%
Less than 40%
Less than 30%
Less than 20%
Less than 10%
Zero %



MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
10 Day Fall
Miles
Landfall
Probabilities
Irene
Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene
and Pipeline
Locations
Less than 100%
Less than 70%
Less than 60%
Less than 50%
Less than 40%
Less than 30%
Less than 20%
Less than 10%
Zero %



MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
10 Day Winter
Miles
Landfall
Probabilities
Irene
Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene
and Pipeline
Locations
Less than 70%
Less than 60%
Less than 50%
Less than 40%
Less than 30%
Less than 20%
Less than 10%
Zero %


MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
10 Day Spring
Miles
Landfall
Probabilities
Irene
Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene
and Pipeline
Locations
Less than
100%
Less than
70%
Less than
60%
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50%
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40%
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30%
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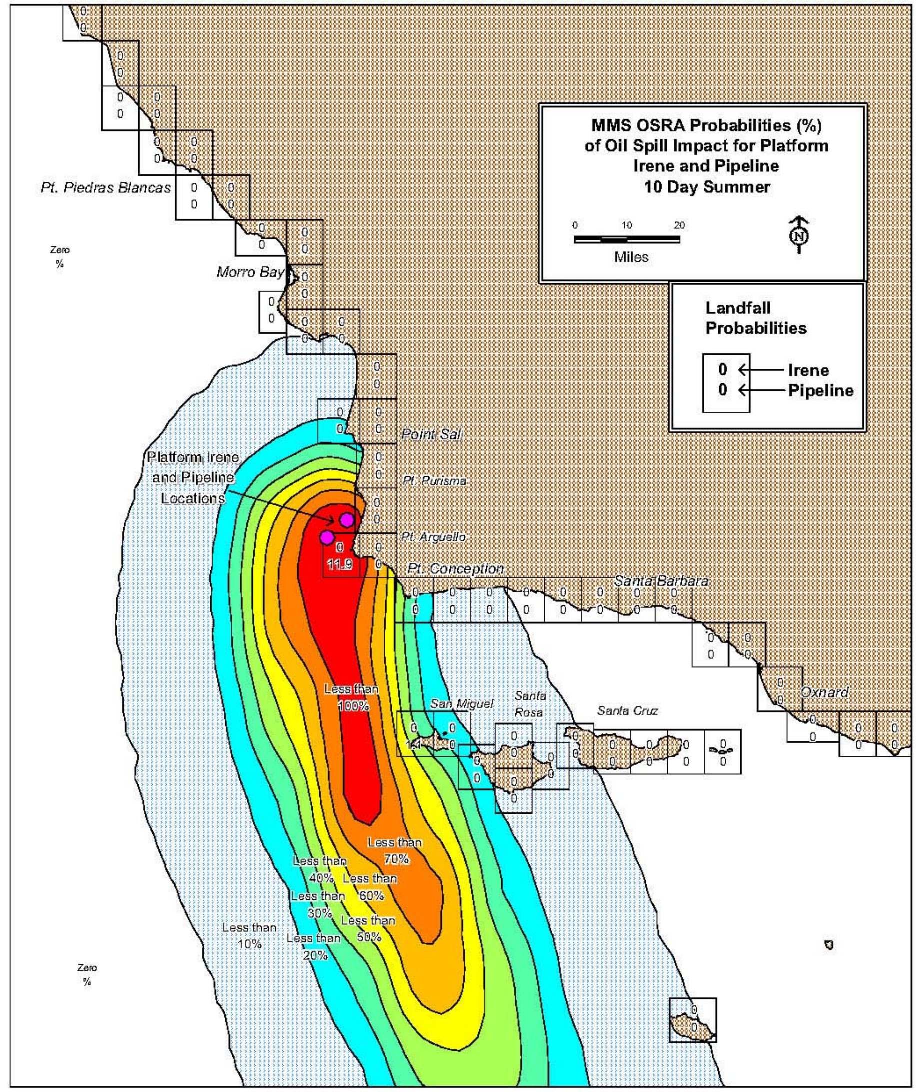
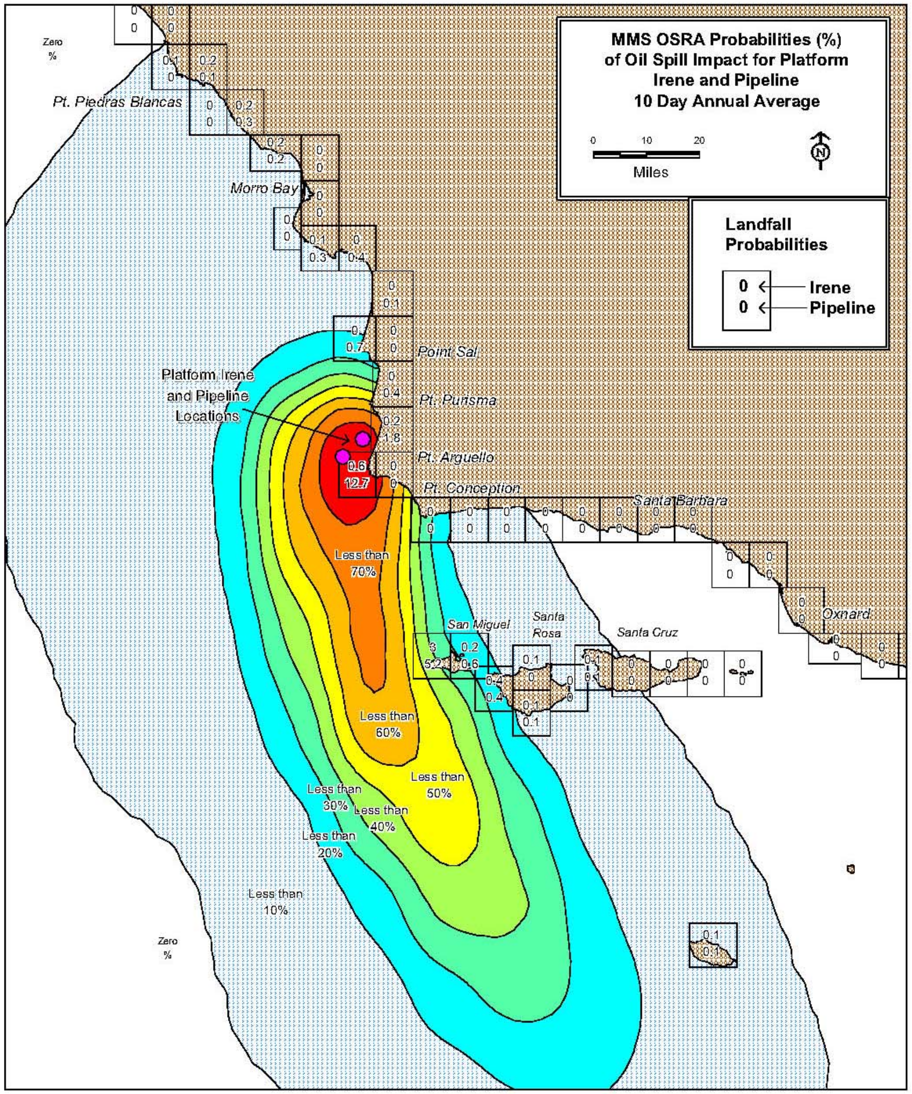
Less than
10%


MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
10 Day Summer
Miles
Landfall
Probabilities
Irene
Pipeline
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa Rosa
Santa Cruz
Platform Irene
and Pipeline
Locations
Less than
100%
Less than
70%
Less than
60%
Less than
50%
Less than
40%
Less than
30%
Less than
20%
Less than
10%

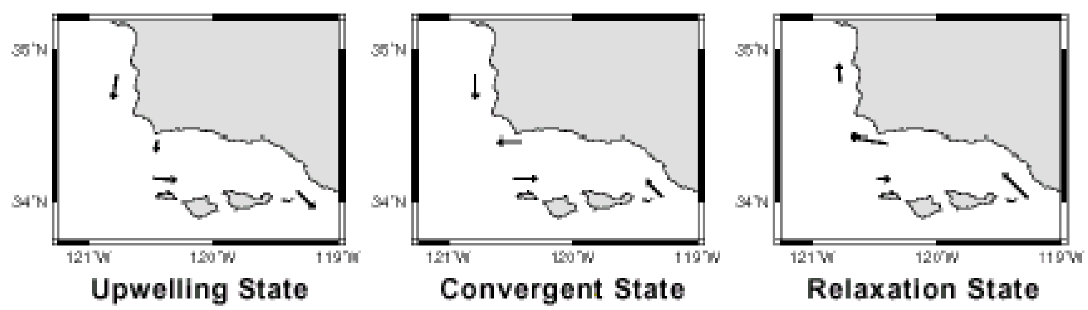

MMS OSRA Probabilities (%)
of Oil Spill Impact for Platform
Irene and Pipeline
10 Day Annual Average
Miles
Landfall
Probabilities
Irene
Pipeline
Platform Irene
and Pipeline
Locations
Pt. Piedras Blancas
Morro Bay
Point Sal
Pt. Purisma
Pt. Arguello
Pt. Conception
Santa Barbara
Oxnard
San Miguel
Santa
Rosa
Santa Cruz
Less than
70%
Less than
60%
Less than
50%
Less than
40%
Less than
30%
Less than
20%
Less than
10%
Zero
%

B.5 GNOME Model

GNOME is a publicly available oil spill trajectory model that simulates oil movement due to winds, currents, tides, and spreading. GNOME was developed by the Hazardous Materials Response Division (HAZMAT) of the NOAA Office of Response and Restoration (OR&R).

The GNOME Model includes variables that account for weatherization of the released materials as well as a separate set of ocean current regimes for the Santa Barbara Channel and SMB. Wind speed and direction as well as variability can be input to the model. This enables the analysis of specific spill situations with given meteorological conditions. However, in order to assess the probabilities of a specific modeled end result, wind distributions and ocean current time dependant distributions would need to be obtained and many modeling runs conducted for the area.

The GNOME model operates by generating “splots” associated with each spill scenario. The fate of the splots is either to remain on the water, to be beached, to be weathered and disappear or to travel out of the modeling space. The movement of the splots is defined by the ocean current “regime” and the wind influences. Ocean currents in GNOME are essentially divided into three regimes for the Santa Barbara Channel and the Santa Maria Basin: upwelling, convergent and relaxation. Each of these is shown figuratively below.



Upwelling

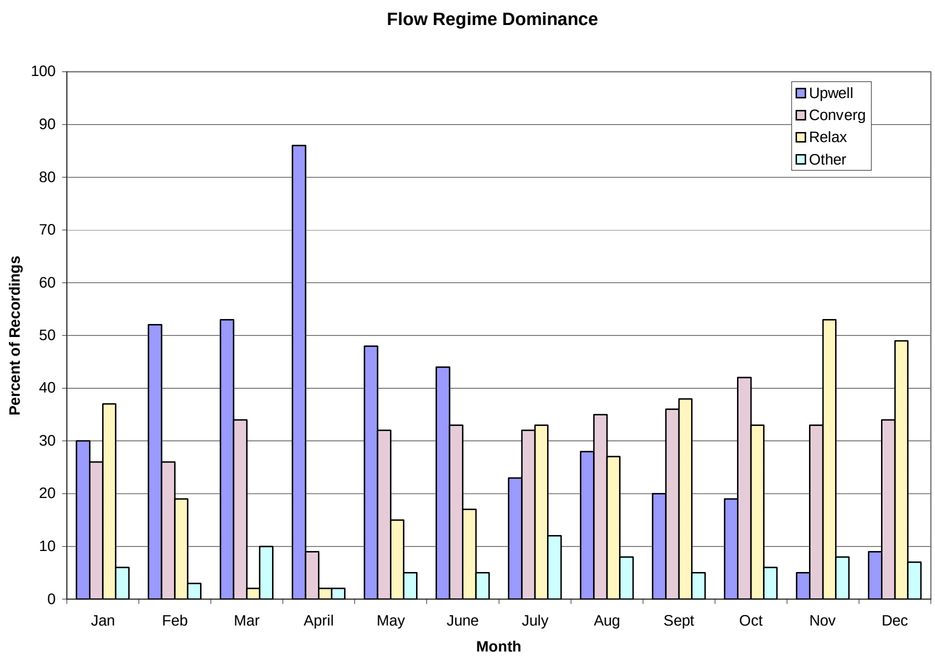
The upwelling state is named for the upwelling of cold (approximately 11°C) subsurface waters near Point Conception that often accompanies this state. The upwelling state occurs primarily in spring, although it has also been observed in other seasons. In terms of the conceptual models of the momentum balance, the upwelling state occurs when strong (>10 m/s), persistent (several days or more), upwelling favorable (equatorward) winds overwhelm any poleward, along-shelf pressure gradient.

Convergent

The convergent state is named for the convergence of southward flow west of Point Arguello with westward flow south of Point Conception. The convergent state occurs primarily in summer, although it has also been observed in other seasons. In terms of the conceptual models of the momentum balance, the convergent state tends to occur when upwelling favorable winds and a strong poleward, along-shelf pressure gradient exist. The most characteristic feature of the resulting flow field is a strong cyclonic recirculation in the western Santa Barbara Channel with about equal strength in the northern and southern limbs of the recirculation.

Relaxation

The relaxation state is named for the time periods when winds off Point Conception "relax" from their usual equatorward direction. The relaxation state occurs primarily in fall and early winter. In terms of the conceptual models of the momentum balance, the relaxation state occurs when poleward, along-shelf pressure gradients overwhelm upwelling favorable or weak winds. The most characteristic feature of the resulting flow field is a strong westward flow (>50 cm/s) through the Santa Barbara Channel and to the SMB. Flow in the SMB is strongest along the mainland coast Each of the three ocean current states includes a counter-clockwise circulation pattern in the Santa Barbara Channel. The frequency of occurrence of each flow regime is shown below.



B.6 GNOME Model Results

The GNOME model was run for the same oceanographic and meteorological conditions as were modeled in the MMS Report, Delineation Drilling Activities in Federal Waters Offshore Santa Barbara, California: Draft Environmental Impact Statement, 2001 (MMS 2001). These conditions are summarized below:

Current Regime	**Meteorological Conditions**	**Timeframe**
Upwelling	8 m/s NW	3 days 10 days
Convergent	7 m/s NW	3 days 10 days
Relaxation	4 m/s NW 4 m/s SW 0 m/s	3 days 10 days

These meteorological conditions are not intended to be all encompassing of the meteorological conditions that could be present during a spill scenario. Although the GNOME model takes ocean currents into account to a large degree, wind effects still have a large influence. Generally, winds originating from the east do not produce beach impacts and were therefore not included. The model was run for releases at three locations: Platform Irene, the pipeline midpoint, and the pipeline shoreline located about 0.25 miles offshore. The results of the modeling runs are shown in the following table and the following three figures. All splots for all the modeling runs are shown on each figure.

Flow Regimes
This figure shows the strong influence of the flow regime on the fate of the oil spilled. For the convergent and upwelling scenarios, occurring most frequently during the spring and summer, these two regimes produce oil spills that move in the southern direction impacting Point Arguello, Jalama Beach, Point Conception and San Miguel, Santa Rosa, and the Santa Cruz Islands. The counter-clockwise currents in the Santa Barbara Channel prevent oil from impacting the Coastline south of Point Conception.

Time Period
Two timeframes were examined in the modeling: 3 days and 10 days. The model indicated that after 3 days, impacts would range as far south as Point Conception and almost to the Channel Islands. Northward movement after 3 days during relaxation regimes would move as far north as Guadalupe. After 10 days, impacts would reach at least the Channel Islands to the South and Pismo and Avila Beach and Piedras Blancas to the north. These impacts shown are only for a limited set of meteorological conditions.

Release Point
Releases were modeled for three locations: Platform Irene, the midpoint of the pipeline, and the pipeline shoreline location about 0.25 miles from the shoreline. Impacts from spills at Platform Irene were the most far reaching due to their location farther from shore. However, all three release points could impact the Channel Islands.

Wind Direction
Releases were modeled for three wind directions correlated with the ocean current flow regimes. Winds from the south-west were modeled along with the relaxation regimes, winds from the northwest were modeled along with the upwelling and convergent regimes, and neutral winds were modeled with the relaxation regime. The wind direction figure shows the importance of wind direction as south-west winds drove the spilled oil into the coastline between Surf and Pismo Beach. Winds from the north-west moved the oil towards the south impacting Point Arguello, Jalama, Point Conception, and the Channel Islands.

GNOME Modeling Results

					Current Operations					Proposed Operations					
Release Point	Flow Regime	Wind Speed, m/s	Wind Direction	Release Duration, Days	Amount Released, Barre	Amount in Water, barrels	Amount on Beach, barrel	Amount Weathered	Amount off Map	Amount Released, Barre	Amount in Water, barrels	Amount on Beach, barrel	Amount Weathered	Amount off Map	Beach Impacted Areas
Irene	Upwell	8	NW	3	425	261	1	163	0	5020	3087	10	1923	0	PA, PC, J
Irene	Upwell	8	NW	10	425	8	168	195	54	5020	94	1984	2303	638	PA, PC, J, North Side of SM, SR, SC
Irene	Conv.	7	NW	3	425	261	1	163	0	5020	3087	10	1925	0	PA, PC, J
Irene	Conv.	7	NW	10	425	9	103	191	122	5020	106	1217	2256	1441	PA, PC, J, North Side of SM, SR
Irene	Relax.	4	NW	3	425	214	48	163	0	5020	2528	567	1925	0	S, PA
Irene	Relax.	4	NW	10	425	203	25	197	0	5020	2398	295	2327	0	S, PA, J
Irene	Relax.	0	-	3	425	262	1	163	0	5020	3095	5	1925	0	S
Irene	Relax.	0	-	10	425	224	3.4	197	0	5020	2646	40	2327	0	S, PP, PS, G
Irene	Relax.	4	SW	3	425	92	170	163	0	5020	1087	2008	1925	0	S, PP, PS
Irene	Relax.	4	SW	10	425	47	181	197	0	5020	555	2138	2327	0	PP, PS, G, P
PL Mid	Upwell	8	NW	3	1749	82	996	671	0	3671	173	2090	1408	0	S, PA, PC
PL Mid	Upwell	8	NW	10	1749	103	815	802	29	3671	216	1710	1684	60	PA, J, PC, SR, SC
PL Mid	Conv.	7	NW	3	1749	399	679	671	0	3671	838	1425	1408	0	S, PA, J, PC
PL Mid	Conv.	7	NW	10	1749	337	543	815	49	3671	708	1140	1710	104	S, PA, J, PC, SM, SR
PL Mid	Relax.	4	NW	3	1749	428	654	671	0	3671	898	1373	1408	0	S, PA
PL Mid	Relax.	4	NW	10	1749	761	177	811	0	3671	1598	371	1702	0	S, PA, J
PL Mid	Relax.	0	-	3	1749	1066	12	671	0	3671	2237	26	1408	0	S, PP
PL Mid	Relax.	0	-	10	1749	909	25	811	0	3671	1909	52	1702	0	S, PP, PS, G, P
PL Mid	Relax.	4	SW	3	1749	272	807	671	0	3671	570	1693	1408	0	S, PP, PS
PL Mid	Relax.	4	SW	10	1749	267	671	811	0	3671	561	1408	1702	0	S, PP, PS
PL. Shore	Upwell	8	NW	3	2868	69	1701	1098	0	6718	162	3984	2572	0	S
PL. Shore	Upwell	8	NW	10	2868	66	1471	1331	0	6718	155	3446	3118	0	S
PL. Shore	Conv.	7	NW	3	2868	92	1678	1098	0	6718	216	3931	2572	0	S
PL. Shore	Conv.	7	NW	10	2868	258	1279	1331	0	6718	604	2996	3118	0	S, PA, J, PC
PL. Shore	Relax.	4	NW	3	2868	410	1359	1098	0	6718	960	3183	2572	0	S, PA
PL. Shore	Relax.	4	NW	10	2868	619	918	1331	0	6718	1450	2150	3118	0	S, PA
PL. Shore	Relax.	0	-	3	2868	1560	209	1098	0	6718	3654	490	2572	0	S, PA, PP
PL. Shore	Relax.	0	-	10	2868	1494	43	1331	0	6718	3500	101	3118	0	S, PA, PP, PS
PL. Shore	Relax.	4	SW	3	2868	419	1351	1098	0	6718	981	3165	2572	0	S, PP
PL. Shore	Relax.	4	SW	10	2868	399	1139	1331	0	6718	935	2668	3118	0	S, PP, PS

Beach Impacted Areas defined as:

PA - Point Arguello, PC - Point Conception, PP - Point Purisima , PS - Point Sal, S - Surf,

P - Pismo Beach, SM - San Miguel Island, SR - Santa Rosa Island, SC - Santa Cruz Island

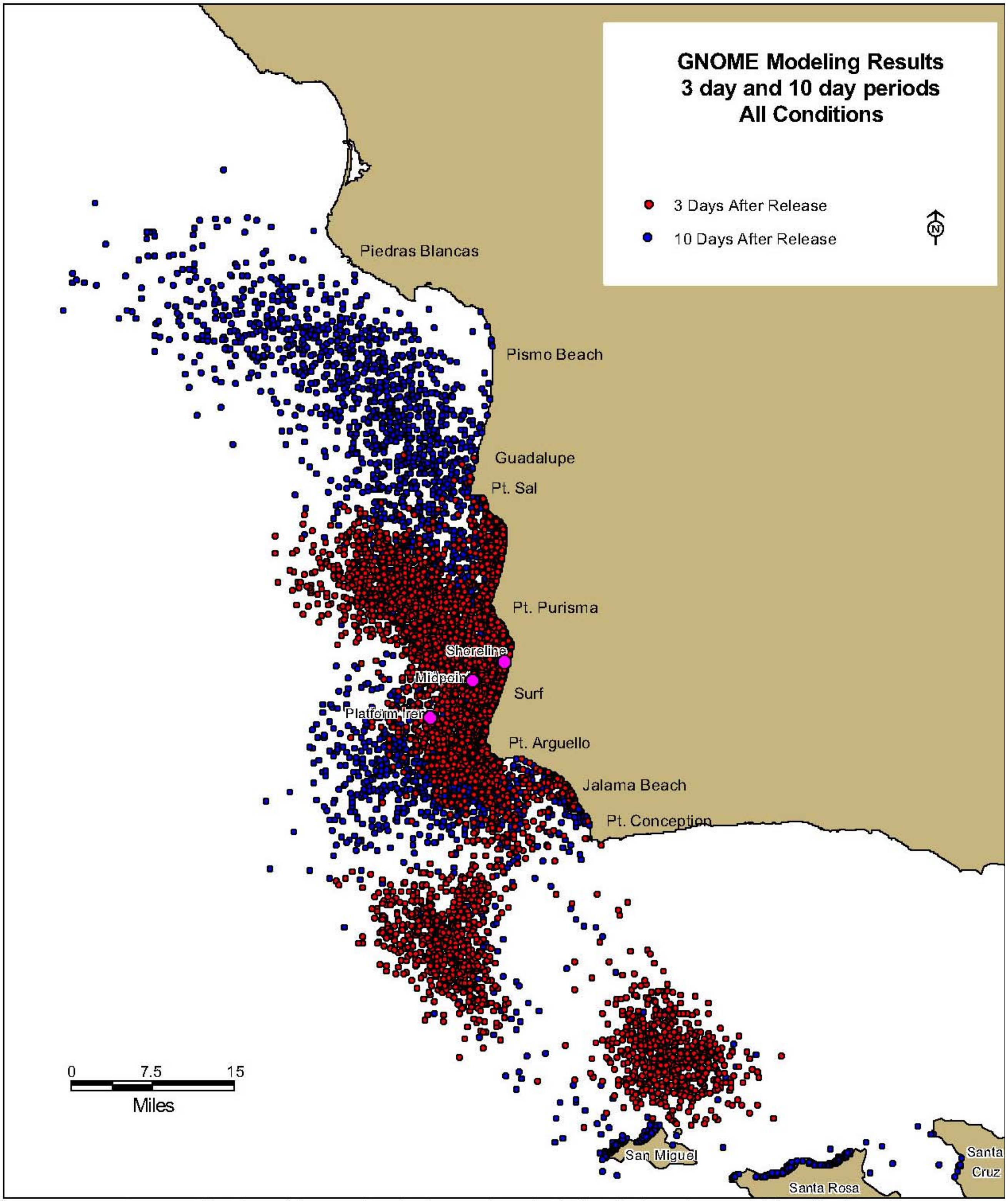
J - Jalama, G - Guadalupe

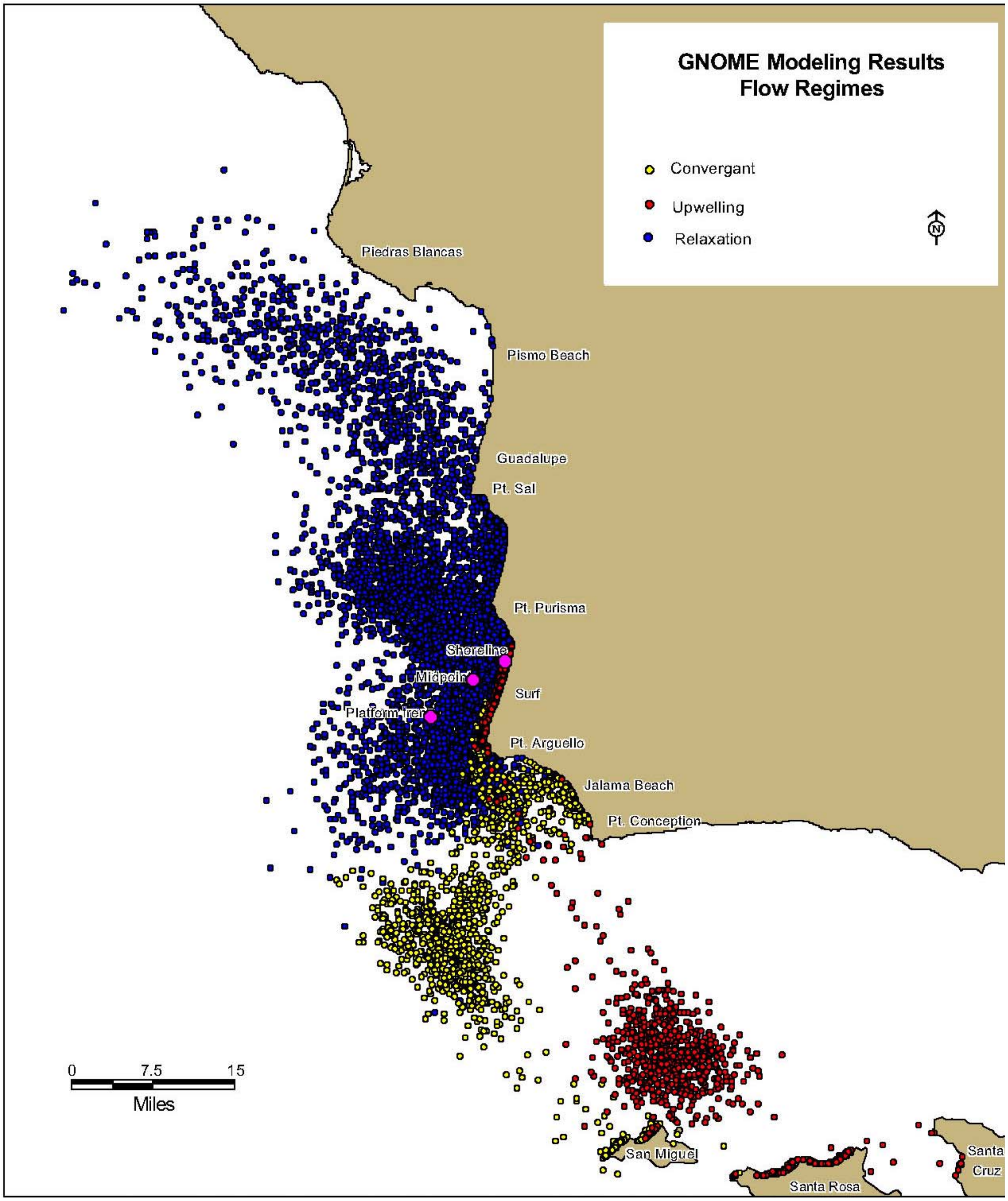
Neutral winds followed the flow regime, in this case relaxation, a moved primarily towards the north impacting the coastline from Point Arguello to north of Piedras Blancas. Wind directions between any of those modeled (such as SSW) would impact areas between those indicated above.

Operating Scenarios and Impact Levels

The GNOME model produces output which allows for quantifying the amount of oil that is either beached, left on the water, weathered or that is outside the scope of the model area. Current operating scenarios have the potential to beach a maximum of about 1701 barrels of oil from current pipeline operations. The proposed project would increase this beached amount to about 3,984 barrels. This maximum amount would be associated with the pipeline shoreline release during the upwelling regime and would occur primarily at the Surf location. Worst case impacts associated with a pipeline midpoint release would occur during an upwelling regime also and would total about 996 barrels and 2090 barrels for current and proposed operations respectively. This amount would impact Surf, Point Arguello and Point Conception. Worst case impacts associated with a release at Platform Irene would occur during a relaxation regime and would total about 181 barrels and 2138 barrels for current and proposed operations respectfully. This amount would impact Point Purisima , Point Sal, Guadalupe and Pismo Beach.

The following figures represent a combination of the results of releases from both Platform Irene and the Pipeline and a range of meteorological and regime conditions using the GNOME model.


GNOME Modeling Results
3 day and 10 day periods
All Conditions
3 Days After Release
10 Days After Release
N
Piedras Blancas
Pismo Beach
Guadalupe
Pt. Sal
Pt. Purisma
Shoreline
Midpoint
Surf
Platform Iren
Pt. Arguello
Jalama Beach
Pt. Conception
0
7.5
15
Miles
San Miguel
Santa Rosa
Santa
Cruz


GNOME Modeling Results
Flow Regimes
Convergant
Upwelling
Relaxation
N
Piedras Blancas
Pismo Beach
Guadalupe
Pt. Sal
Pt. Purisma
Shoreline
Midpoint
Surf
Platform Irene
Pt. Arguello
Jalama Beach
Pt. Conception
0
7.5
15
Miles
San Miguel
Santa Rosa
Santa
Cruz

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