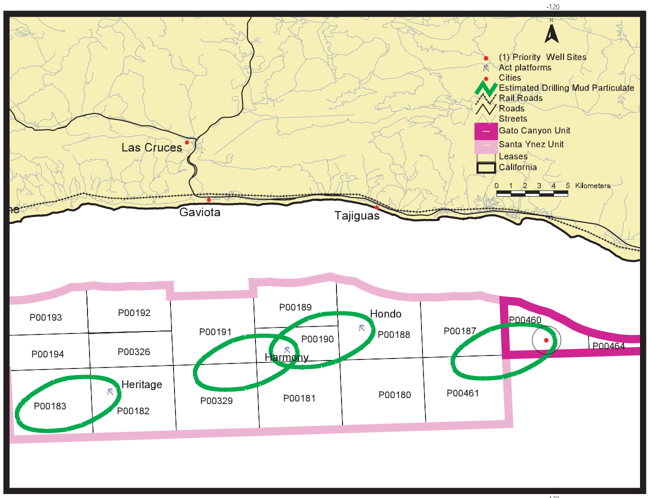

Figure 5.2.2.2-2. Estimated dispersion of drilling mud that remains in the water column for drilling at the Gato Canyon Unit site. The Santa Ynez Unit platforms are also shown. Ellipses are approximately 7 km long and 3 km wide.

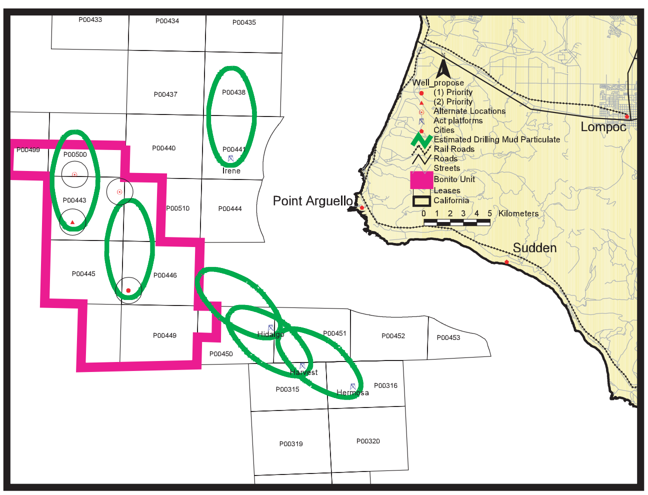

Figure 5.2.2.2-3. Estimated dispersion of drilling mud that remains in the water column for drilling at the Bonito Unit site. The Point Arguello Unit platforms are also shown. Ellipses are approximately 7 km long and 3 km wide.

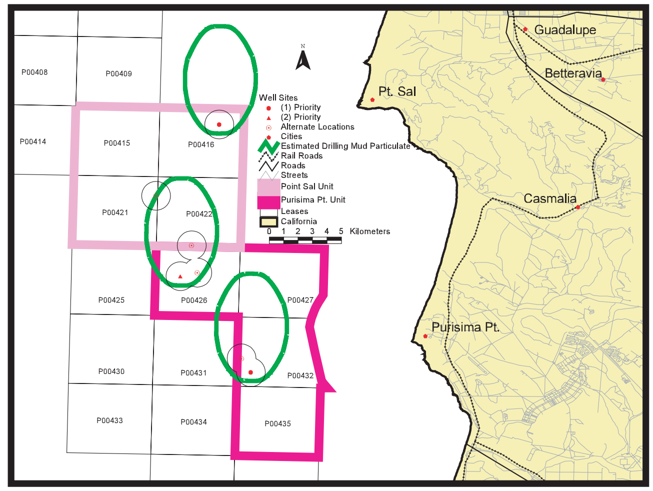

Figure 5.2.2.2-4. Estimated dispersion of drilling mud that remains in the water column for drilling at the Point Sal and Purisima Point Unit drilling sites. Ellipses are approximately 7 km long and 4 km wide.

5.2.3 IMPACTS ON ROCKY AND SANDY BEACH HABITAT

This section discussed impacts from the proposed project on biological resources found on rocky and sandy intertidal beaches.

5.2.3.1 IMPACTS OF THE PROPOSED PROJECT ON ROCKY AND SANDY BEACH HABITAT

Criteria used here and in Chapter 6 to assess impacts to these resources are:

HIGH

Impacts that result in a measurable decline in a population beyond that which can be explained by normal variability, result in a measurable change regionally in species composition, ecological function or community structure, or result in a measurable reduction in regionally important habitat are considered to be **high impacts**. These changes would be at a level, areal extent and duration that would be expected to place an individual species at risk, or alter the community structure or habitat on a regional scale for many years. Irreversible alteration of regionally important habitat or reduction of protected habitat would be considered high impacts.

MODERATE

Impacts that result in a measurable decline in species composition, species abundance, ecological function or community structure over several localized areas or result in alteration of locally important habitat are considered **moderate impacts**. These changes, while individually may persist for many years, are localized and cannot be detected on a population or regional level.

LOW

Impacts that result in a short-term change in species abundance or composition, a temporary loss in ecological function or community structure, a short-term disturbance or temporary loss of access to locally important habitat are considered to be **low impacts**.

In this document, high and moderate impacts are considered significant; low impacts are considered to be insignificant.

5.2.3.1.1 IMPACTS COMMON TO ALL UNITS

There are no identified impacts to rocky or sandy beaches from the Proposed Action.

5.2.3.2 CUMULATIVE IMPACT ANALYSIS FOR ROCKY AND SANDY BEACH HABITAT

5.2.3.2.1 CUMULATIVE IMPACTS (2002-2006)

The Cumulative Description Section describes the projects considered in the cumulative analysis for the proposed exploration activities. Possible sources of cumulative impacts in the project area include ongoing and proposed oil and gas activities in Federal and State waters, Alaskan and foreign import tankering, and military operations. Cumulative impacts to rocky and sandy beaches can also occur due to public use (collecting, fishing, and trampling), pollution events from surface runoff and sewage spills, and natural occurrences such as extreme storm events, increased ocean water temperature and spreading of disease.

Cumulative Impacts Without the Proposed Action (2002-2006): Since there are no impacts from the Proposed Action on rocky or sandy beach resources, no analysis of cumulative impacts is appropriate here. However, impacts to this resource could occur if development of the 36 undeveloped leases occurs. These impacts are discussed in Chapter 6.

5.2.4 IMPACTS ON SEAFLOOR RESOURCES

This section discusses impacts from the proposed projects on biological resources found on the ocean floor, exclusive of kelp beds.

5.2.4.1 IMPACTS OF THE PROPOSED ACTION ON SEAFLOOR RESOURCES

Criteria used to assess impacts to these resources here, and in chapter 6, are as follows:

HIGH

Impacts that result in a measurable decline in a population beyond that which can be explained by normal variability, result in a measurable change regionally in species composition, ecological function or community structure, or result in a measurable reduction in regionally important habitat are considered to be **high impacts**. These changes would be at a level, areal extent, and duration that it would be expected to place an individual species at risk, or alter the community structure or habitat on a regional scale for many years. Irreversible alteration of regionally important habitat or reduction of protected habitat would be considered high impacts.

MODERATE

Impacts that result in a measurable decline in species composition, species abundance, ecological function or community structure over several localized areas or result in alteration of locally important habitat are considered **moderate impacts**. These changes, while individually may persist for many years, are localized and cannot be detected on a population or regional level.

LOW

Impacts that result in a short-term change in species abundance or composition, a temporary loss in ecological function or community structure, a short-term disturbance or temporary loss of access to locally important habitat are considered to be **low impacts**.

In this document, high and moderate impacts are considered significant; low impacts are considered to be insignificant.

Impacts Common to All Units: Impacting agents from the proposed action, described below, would not affect resources in the shallow subtidal zones. Therefore, this discussion will only include discussion of impacts on offshore benthic resources. Impacting agents that could affect benthic resources include the drilling of holes into the substrate, placing the drill plate on the ocean floor, discharging drilling muds and cuttings, placing anchors, retrieving anchors, and removing the drill plate. Impacts from these activities include direct smothering, increased turbidity, physical disturbance, and elevated levels of metals on the ocean surface and in the water column.

Physical Disturbances. Physical disturbances associated with the projects include the placement and removal of the drill plate, the physical drilling of a hole in the substrate, and placement and removal of anchors and associated chains. Physical disturbances on soft bottom habitat are predicted to cause only temporary changes in species abundance or composition, insignificantly impacting soft bottom benthos. Soft-bottom infauna is expected to rapidly repopulate or recolonize, and changes are expected to be well within natural variability for the resource. In general, the constant sediment movement on soft bottom surfaces overwhelms the physical disturbances caused by these activities.

Physical disturbances on hard bottom substrate, however, can cause moderate impacts. If disturbances occur in relatively undisturbed or high relief hard bottom habitat, impacts could include changes in species composition and community structure by altering the natural composition of the substrate, i.e. breaking the larger rocks into smaller pieces which could be recolonized by different species. Anchors and their chains, if placed in high relief hard bottom habitat, can crush or smother long-lived animals over the localized area contacted. In 1995, a study was completed which conducted field investigations of OCS wells to document the extent of physical damage by anchoring operations and quantify the recovery time from these types of disturbances (MEC, 1995). After review of 60 wellsite locations near potential hard substrate, 9 were identified which appeared to disturb hard bottom communities. Investigation of these nine wellsites found disturbances at four wellsites. Conclusions from the study are as follows:

1) The primary impact is the physical alteration of the substrate size and the amount of exposed hard substrate. Hard bottom communities will not recover to pre-disturbed conditions where substrate has been altered, and instead a different type of hard substrate community will develop.

2) Depending on the size and frequency of the disturbance, hard bottom communities can recover. Deeper water communities are slower to recover than communities found in shallower water.

3) Recovery takes years to decades depending on the complexity of the community, high relief communities being the most complex.

4) Since exploratory anchoring activities are infrequent and impact less than 1% of hard bottom habitat within a given mooring system, this level of disturbance does not represent a threat to the maintenance of a diverse and abundant epifaunal community.

5) There was no evidence for the persistence of drilling muds or cuttings near wellsites investigated in the study.

6) Impacts are more pronounced in areas of high percentages of hard substrate because the anchors reduce the size of the rocks and alter the available habitat for high relief species.

7) Anchor impacts in areas of low percentage of hard substrate were actually found to increase the amount of hard substrate habitat by uncovering the veneer over the rocks and by piling the rock in higher berms.

Discharges — Soft Substrate Habitat. The contribution of muds and cuttings to the soft bottom benthic environment is not expected to significantly alter the natural habitat or cause population level changes in abundance or composition of species. Impact on this resource from drilling mud and cuttings discharges primarily due to localized smothering and alteration of sediment grain size over a localized area, a low impact.

Due to the cutting's larger grain size, the cuttings fall close around the wellsite. The muds, a very small grain size, tend to be carried in the water column and dispersed further from the wells, at distances up to 6 km (Battelle, 1991) (see the Water Quality Impact Section). Phase II of the California Monitoring Program (Battelle, 1991) monitored the drilling from Platforms Hidalgo, Hermosa and Harvest from 1986 to 1989, when a total of 39 wells were drilled. Phase III of CAMP (SAIC and MEC, 1995) continued to monitor potential effects on the benthic communities for an additional six years to look for sublethal effects. Extensive chemistry sampling, detailed soil analysis, and intensive biological monitoring enabled researchers to detect trace levels of metals and hydrocarbons and low levels of biological change. Conclusions from Phase II and III (Battelle, 1991; and SAIC and MEC, 1995) are as follows:

1) The concentrations of metals generally reflected average concentrations in crustal rocks and their origin is believed to be the deeper formations drilled by the wells.

2) The concentration of petroleum hydrocarbons in the surficial sediments and water column was occasionally elevated. Because the patterns did not match drilling activity levels or

location, the investigators concluded that these random increases were influenced by natural tar seeps, rather than drilling activities.

3) With the exception of barium, none of the metals was elevated in concentration in the sediments during the drilling period, and only barium and zinc were higher in the drilling muds than in surface sediments

4) Within one and a half years after cessation of drilling, barium levels reached background in the sediment traps, but were still slightly elevated in the surface sediments.

Any biological effects due to the drilling muds were related to physical effects of smothering, not chemical toxicities, and are limited to within one km of the discharge source (Battelle, 1991). Based on these findings above for drilling 39 wells over a concentrated area, impact to soft bottom habitat overall from drilling the 5 delineation wells is expected to be low. Low impacts could occur under the wellsites due to changes in sediment grain size and the resultant changes in species composition.

Discharges — Hard Substrate Habitat. Impacts from drilling mud discharges from five delineation wells are expected to be low. Impacts from drill cutting discharges from the five delineation wells range from low to moderate, depending on the location of the wellsites in relation to high relief habitat, and mitigation applied. Several of the potential wellsite locations are proposed near potential hard substrate habitat. If biological surveys of canyons and potential outcrop features identify important high relief habitat within 325m (1000 feet) of the wellsite, discharges of cuttings from drilling without mitigation may result in moderate impacts.

Potential effects of drilling muds and cuttings on hard substrate communities offshore California were discussed in "Review of Recovery and Recolonization of Hard Substrate Communities of the Outer Continental Shelf" (Lissner et al, 1987). The study was funded by MMS in response to questions asked by agencies, fishermen and scientists interested in these hard bottom biological communities. While much of this study addressed anchoring impacts, the study did discuss sedimentation impacts on hard substrate communities. Lissner et al. (1987) point out that the natural sediment movements overwhelm the sediment changes documented from drilling mud discharges. Natural movements of large quantities of bottom sediments periodically covering and uncovering broad low relief hard substrates have been documented off Florida and Oregon and are believed to be consistent with patterns observed offshore California. Strong bottom currents known to exist, and observations of sediment movement are consistent with this theory. Inputs from the projects drilling muds and cuttings are of shorter duration comparatively and much more localized in effect (Lissner et al., 1987; Neff, 1987).

Direct smothering and turbidity can adversely affect filter-feeding organisms such as the sponges, cup corals, and anemones found on naturally occurring hard bottom reefs. Because habitat supporting these animals occurs within the immediate vicinity of the Point Arguello platforms and pipelines, intensive monitoring was conducted during drilling activities at the three Point Arguello platforms from 1986 to 1995. Conclusions from Phase II and III that pertain to hard substrate habitats are as follows:

1) Four of 22 taxa displayed significant time/dose interactions representing possible negative responses to the drilling mud discharges in specific habitat. These taxa were sabellids in deep low-relief habitat, <u>Caryophyllia sp(p)</u> in deep low relief and deep high-relief habitat, galatheid crabs in deep low-relief habitat, and <u>Halocynthis</u> <u>hilgendorfi igborja</u> in deep low-relief habitat. Combined trends for the various taxa were not statistically significant.

2) It was concluded that any biological effects due to the drilling muds were related to physical effects of the increased particle loading, not chemical toxicities.

3) Adverse biological effects on the benthos from this study, as in other documented studies, were limited to within one km of the discharge source.

<u>Impacts Unique to Each Unit:</u> Impacts to hard substrate communities are dependent on the location of wellsites and anchors to hard bottom substrate.

Point Sal Unit. In the Operator's project description, Aera states that well locations have been chosen to be at least 325 m (1,000 feet) from mapped outcrops, anchor activities will follow a Project Anchoring Plan, and hard bottom substrate will be avoided.

The operator's preferred wellsite is OCS-P 0416 #3 (Figure 5.2.4-1). While the wellsite is located 92 m (300 feet) from a small identified hard bottom feature, the feature has little or no relief and it is not believed to contain hard bottom communities. The lack of exposed hard bottom was corroborated by the lack of rockfish fishing in the area of the feature (pers. comm., S.Timoschuk). Impacts from this wellsite would be low. Another possible wellsite location is along the southern border of OCS-P 0422 (Figure SF 1). This site is located sufficiently distant from identified outcrop that it is unlikely that anchors would reach potential habitat. The third location, P 0421 #1, is located 325 meters (1000 feet) from a potential exposed rocky outcrop mapped at the border between Lease OCS-P 0421 and P 0422. Longline rockfish fishermen identify this feature as a habitat for rockfish (pers. comm., S. Timoschuk), which provides further indication that this is exposed hard substrate habitat. As proposed, it is expected that physical disturbance from drilling cuttings should not adversely impact hard substrate communities, but drilling muds could cause increased turbidity and potentially affect the community. Currents in the area would tend to move mud toward the hard bottom feature. While the volume of mud released from drilling one well is low, it is estimated that impacts could range from low to moderate, based on the proximity of the wellsite to the feature and prevailing currents.

The proximity of the wellsite to this long feature makes anchoring without impacting the feature difficult. It would appear that anchors or their chains would unavoidably impact the feature at the current location. Impacts from more than one anchoring event across the hard bottom are considered a moderate impact, since without additional data, it is assumed that the feature contains high relief communities. The duration and severity of impact would depend on the number of anchors impacting the feature and the complexity of the biological community found on it.

The Biological Lease Stipulation has been invoked on P 0421 and P 0422, requiring the operator to either avoid impact to the identified rocky outcrop, or conduct a biological survey of the feature.

Purisima Point Unit Description. The above measures for the Point Sal Unit were also provided by Aera in the Project Description for Purisima Point. One isolated feature has been mapped in the center of lease on Lease OCS-P 0426 (Figure 5.2.4-1). While the size of the feature is small, shallow hazards data indicates sufficient relief to support hard substrate communities. Fishermen confirmation of this feature as good rockfish habitat (pers. comm., S. Timoschuk) lends further support that it contains exposed habitat. Both preferred proposed wellsite locations for this Unit are located within 1,000 meters of this feature. If biological surveys confirm the presence of hard substrate communities, both drilling muds and anchors could impact these communities from the drilling of either well. This would be considered a moderate impact. The duration and severity of impact would depend on the number of anchors impacting the feature and the complexity of the biological community found on it. The biological lease stipulation has been invoked on lease P 0426.

Bonito Unit Description. The primary area of interest in this unit is presence of deep canyons. One small and four large canyons traverse the Bonito Unit (Figure 5.2.4-2). Shallow hazards review confirms the presence of very steep slopes and potential outcrop areas in each canyon, particularly on the southern wall. In general, outcrop areas are more likely to be located along the steepest portions of the canyon wall, and along the crest of the canyon, though fishermen information indicate that exposed habitat is present on the sides and at the bottom of the canyon (pers. comm. S. Timoschuk). The priority wellsite, P 0446 #5, is sufficiently distant from canyon features that well drilling activities, with the possible exception of a long anchor, would not be expected to impact hard bottom resources. The remaining three proposed wellsite locations are located proximal to the same canyon and would likely to cause moderate impacts as presently proposed. These include OCS-P 0500 #2, located 1200 m (4,000 feet) from the edge of the canyon, OCS-P 0443 #3, located 365 m (1200 feet) from the southern wall of the canyon; and OCS-P 0443 #4, located approximately 457 m (1500 feet) from the southern wall of the canyon.

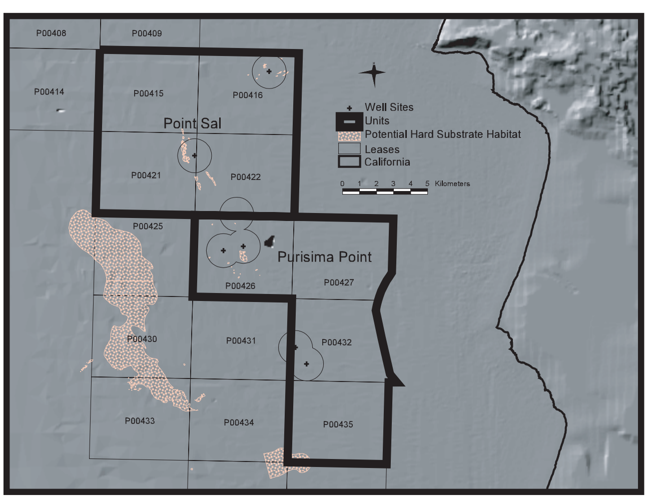

Figure 5.2.4-1. Identified hard bottom in the Point Sal and Purisima Point Units

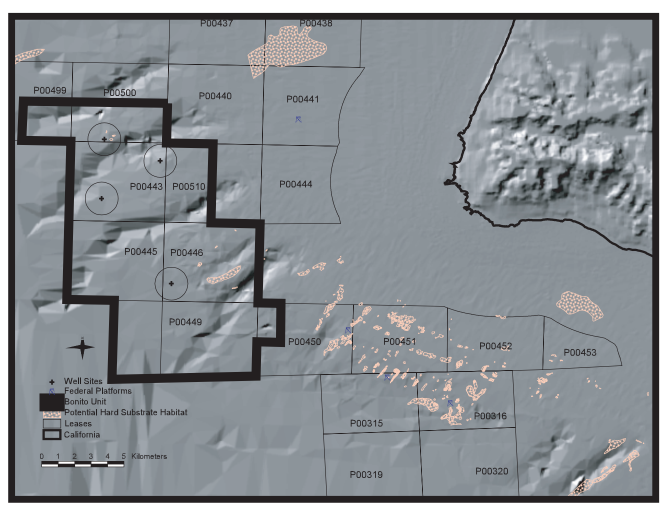

Figure 5.2.4-2. Identified canyons and hard bottom in the Bonito Unit.

Prevailing currents would tend to move muds and cuttings from the wellsites on P 0443 in a northwest direction toward the canyon. However, because the volume of muds released during the drilling of one well is small, impacts from mud discharges are expected to be low to moderate. Prevailing currents would tend to move the muds and cuttings from the wellsite on P 0500 into the canyon further to the north, rather than to the canyon located just south of the wellsite. The distance from P 0500 #2 to the northern canyon is further and impacts on hard bottom habitat from muds and cuttings discharges would, therefore, be expected to be low and less than that from the other two locations on P 0443. The biological stipulation has been invoked requiring avoidance or conduct of a biological survey. Extent of impact and duration of recovery from disturbance will depend on the complexity of the resources that have the potential to be impacted. In general, a well drilled at any location within anchor reach of a canyon would be expected to cause moderate impacts to resident benthic populations. The biological lease stipulation has been invoked on all leases in the Bonito Unit due to the presence of steep sloped canyons throughout the area.

Gato Canyon Unit. Samedan has restated that they are committed to the mitigation measures detailed in the original Exploration Plan for this lease and to the measures dictated by MMS in the original Letter of Approval. These measures include:

—Anchoring activities will be conducted in accordance with a project anchoring plan.

—Anchors will be placed and removed vertically to minimize impact on seabed organisms.

—Anchors and anchor chains will avoid hard bottom substrate to reduce potential to impact sensitive hard bottom habitat.

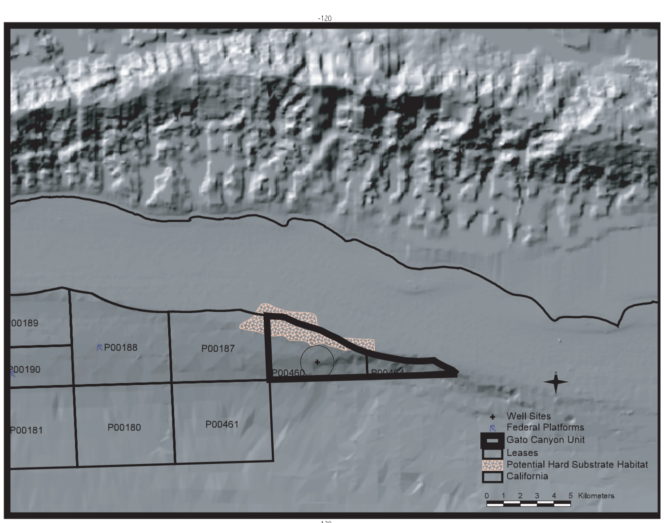

Figure 5.2.4-3. Identified hard bottom in the Gato Canyon Unit.

—Well location will avoid known outcrops by at least 1,000 meters.

Impacts from this project have been assessed assuming these measures are in place.

The wellsite OCS-P 0460 #3 is located approximately 6.5 km (4 miles) offshore El Capitan in 230 m (755 feet) of water, just shy of 1,000 m from the nearest potential hard bottom habitat (Figure 5.2.4-3). This wellsite has been set back to the west and south of their preferred location in order to respond to MMS concerns about anchoring into the potential hard substrate community located on the northern half of the lease. The current wellsite is located optimally to reduce anchor length while keeping the wellsite the maximum distance from identified hard substrate.

When drilling a previous well on P 0460, though the anchors to the north were specifically shortened to avoid hard bottom, piggybacking of one anchor was required to maintain stability. This resulted in an anchor extending into the potential hard bottom habitat. To anticipate and prevent this same situation from reoccurring, Samedan specifically moved the proposed wellsite to the west and south so that even piggybacked anchors would avoid the identified potential hard bottom habitat. Based on Samedan's proposed avoidance measures evident in the measures taken to locate the well, impacts to the resource from this delineation well as proposed are expected to be low. The biological stipulation has been invoked on this lease due to the presence of potential hard bottom communities on the lease.

5.2.4.1.1 SUMMARY AND CONCLUSION

Physical impacts to hard bottom seafloor resources, due to the potential to impact stable hard bottom communities with anchors and chains, are moderate for all projects except for the Gato Canyon Unit project, which is low. Impacts from all projects combined are also expected to be moderate. Both the drilling of individual wells with multiple anchoring events, and the drilling of several wells with multiple anchoring events near sensitive hard substrate habitat is likely to result in long-term impacts to plants and animals, and alter habitat in several localized areas, a moderate impact.

Due to the comparatively low volume of mud discharged during the drilling of delineation wells, the water depth of proposed wellsites, and proximity of wellsites to identified hard substrate, impacts on seafloor resources from drilling discharges are expected to be low to moderate. Wellsites located a distance of 1,000 m from identified hard bottom substrate would introduce low impacts to seafloor resources. Discharges from wellsites located within 1,000 m could produce moderate impacts to hard bottom habitat due to smothering, depending on the actual distance from the feature, predominate currents and quality of the habitat on the feature.

Overall impacts on seafloor resources from the proposed delineation wells combined are moderate, due to the potential to impact hard bottom communities.

5.2.4.1.2 MITIGATION MEASURES FOR IMPACTS FROM THE PROPOSED ACTION

The Biological Lease Stipulation, which has been specifically invoked on those leases where hard bottom habitat is believed to exist, provides the legal framework for mitigating impacts to sensitive biological resources. In the past where MMS has invoked the stipulation and carried out its provisions through avoidance and appropriate mitigation, the stipulation has been shown to be highly successful in reducing impacts to hard bottom communities (MEC, 1995). The primary mitigation for physical impacts from the delineation drilling is avoidance. Wellsites can be moved so that they do not come in contact with hard bottom habitat and avoid all potential impacts to this community from well placement. Anchors can also be positioned specifically to avoid impacting potential or identified hard substrate habitat with either the anchors or chains. Avoidance, monitoring, and other measures are identified to reduce impacts from drilling discharges.

Mitigation SF1—Move Wellsite off Features. To avoid physical disturbance from the hole and drill plate, move wellsite at least 92 m (300 feet) from identified hard bottom substrate. This placement is verified in the plan and as inspected in the field during placement by MMS inspectors. This mitigation is not needed at this time, as no proposed wellsites are currently located on a feature. This mitigation may be used in the future if wellsite relocations are needed for other environmental or technical reasons.

Mitigation SF2—Anchor Handling and Avoidance. Avoid impacts from anchors and chains. Require an anchoring plan that identifies specifically, based on the MODU, the proposed anchor locations by wellsite. This plan should clearly demonstrate avoidance to identified hard bottom habitat with a buffer dictated by the precision of the data. The plan should also detail anchor handling procedures with an anchor handling boat, use of a vertical retrieval system and a weather shut down plan to ensure anchors are not placed during inclement weather and do not drag on the seafloor at any time. Require operator to meet with MODU personnel to familiarize them with the plans. MMS would inspect the operations in the field to ensure the plan is followed and any variances in the field are approved prior to placement.

Mitigation SF3—Wellsite Relocation. To avoid potential smothering impacts from drill cuttings and muds on hard bottom habitat, move wellsite locations at least 1000 m (3280 feet) away from identified hard bottom habitat.

Mitigation SF 4—Wellsite Relocation and Monitoring. To avoid potential impacts from drill cuttings, move wellsites locations at least 300m (984 feet) from habitat. If within 1000 m (3280 feet) of the habitat, to avoid impacts from drill muds, establish an ongoing discharge monitoring program which permits discharge only when currents are moving away from the identified biological communities. Current meters need to be placed at the site so that current direction at the discharge point is known. Shunting of discharges away from identified communities may also be considered, in addition to monitoring at the surface, if the predominant current regime tends to move mud toward features. Mitigate on a case-by-case basis as needed to ensure that significant smothering impacts are not occurring on identified hard bottom habitat features.

Mitigation SF 5—Zero Discharge. To avoid potential impacts from drilling muds and cuttings on the identified habitat, require a zero discharge of muds and cuttings within 1,000 m (3280 feet). Discharges may either be placed downhole, shunted outside a 1,000 m (3280 feet) distance from the habitat, barged to shore (covered in Alternative 2), or a combination of these measures to accomplish the objective.

Site-Specific Mitigation. The following measures would be needed to reduce identified moderate impacts to low impacts for each wellsite, assuming biological surveys confirm the presence of hard bottom habitat.

Point Sal Unit. OCS-P 0421 #1: The wellsite will likely need to be moved so that anchoring on the feature is avoided (SF 3). It seems unlikely that the operator would be able to successfully mitigate anchor placement at its present location. If the anchoring issue is resolved and the well is left at its current location, the operator would need to actively monitor discharges and mitigate their project based on the monitoring program (SF 4), or not discharge (SF 5). To fully mitigate drilling mud discharges, the wellsite would need to be located 1,000 m from the feature (SF 3); or have a zero discharge (SF 5). If future well relocations to address safety or geologic concerns move the wellsite inside 300 m (984 feet), the operator would need to have a zero discharge (SF 5) to avoid moderate impacts from cuttings.

Plan revisions would need to be specifically reviewed for all wells in the plan, once the MODU is known, to ensure that anchors avoid placement on identified rocky features. Such review cannot be conducted at this time due to lack of site-specific rig information.

Purisima Point Unit. OCS-P 0426 #1, #2: The Anchor Handling and Avoidance Mitigation (SF 2) would be needed to reduce physical impacts to low. Either SF 3, SF 4, or SF 5 would be needed to ensure that smothering effects from drilling discharges were reduced to low for wellsite #2.

Bonito Unit. OCS-P 0500 #2: Mitigations SF 2 and SF 3 would need to be adopted to avoid impact to potential resources from wellsite P 0443 #3, and 4 and P 0500 #2. Mitigation SF 2 would need to be adopted to ensure that anchoring activities from P 0446 #5 avoided impacting potential resources in the canyon.

5.2.4.2 CUMULATIVE IMPACTS ANALYSIS FOR SEAFLOOR RESOURCES

5.2.4.2.1 CUMULATIVE IMPACTS (2002-2006)

The cumulative introduction section describes the projects considered in the cumulative analysis for the proposed delineation activities. Cumulative impacts to seafloor resources may occur from commercial fishing operations, fiber cable installation operations, ongoing and reasonably foreseeable oil and gas activities in Federal and State waters and non-anthropogenic and anthropogenic sources of sediment and contaminants.

Cumulative Impacts Without the Proposed Action (2002-2006): The projects discussed in this section include past, present, and foreseeable actions that may produce impacts during 2002-2006, the expected duration of the proposed delineation activities.

<u>Discharges.</u> A natural source of sedimentation is the turbidity current or flow. This sediment-laden, density-driven current "avalanches" along the seafloor bringing pulses of sediment from the continental shelf toward deep water (see Water Quality section "resuspension processes".) These flows are the most pronounced during onshore flooding years in which large amounts of sediment are discharged into the marine environment by rivers, creeks and storm drains. The largest volume of sediment recorded occurred in 1969 following extreme flooding events (Kolpack and Drake, 1985). In contrast, sediment input to the environment from drilling muds and cuttings is periodic, localized, and of substantially less volume overall. Natural sediment flows and resuspension processes overwhelm the turbidity plumes from past or ongoing oil and gas drilling activities in the Basin or Channel both in terms of volume of sediment and areal extent of affect (Drake, Kolpack, and Fischer, 1972)

Anthropogenic sources of pollution that may affect seafloor resources in the area of the proposed projects, especially biota closer to shore, include point source discharges (sewage outfalls), dredging activities, surface runoff, thermal discharges (nuclear generating stations) and the Guadalupe oil field "spill". Future projects in the area include dredging at Boathouse at the southern edge of Vandenburg Air Force. Hydrocarbons from seepage from onshore tanks in the Guadalupe oil field was detected offshore in the CAMP study (SAIC and MEC, 1995). The dredging activity would have localized turbidity impacts and is unlikely to overlap with resources affected by the proposed projects. Overall impacts from these anthropogenic sources of pollution are difficult to quantify, but they are expected to create increased turbidity, increased uptake of heavy metals, oils and potentially toxic substances by the biota. These impacts would be expected to be highest nearshore, near sources of pollution. These impacts range from low to moderate on the resource.

<u>Physical Disturbances.</u> Bottom Trawling Activities. The activity which has the highest potential to directly impact seafloor resources in proximity to the delineation wellsites during the period between 2002 and 2006 are the past, present and future bottom trawling commercial fishing activities. Bottom trawling for halibut and other groundfish occurs in the upper portion of the Santa Maria Basin along the eastern portions of Purisima Point and Point Sal Units, and rockfish trawling occurs in deeper waters in the Bonito Unit and in State waters near Point Conception (see Commercial Fishing section). Rockfish trawling also occurs near the State line and across the Gato Canyon Unit. Primary activity for trawling associated with groundfish fisheries such as halibut would be expected to occur to soft bottom habitat. However, rockfish trawling activities primarily affects hard bottom habitats. The use of roller gear off the Pacific coast, while reducing impacts from otter door troughs to the seafloor, has permitted fishing in formerly inaccessible rocky areas (NMFS, 1998).

Impacts from bottom trawling fishing activities in the Santa Maria Basin and Santa Barbara Channel range from low to high. In the soft bottom environment, troughs made by trawling gear create short-term depressions in sandy sediments, or may create troughs lasting months to years in clay or mud sediments. Biological effects on the soft bottom habitat, however, would be considered low from groundfish fishing due to the level of activity in the Santa Maria Basin/western Santa Barbara Channel, and the fact that the community would be expected to recolonize within a relatively short period of time. However, habitat alteration of higher relief rocky reefs could create moderate to high impacts depending on the amount and extent to which complex communities have and continue to be altered. Fishing gear impacts the biological seafloor resources by removing marine plants, corals and sessile organisms, upending rocks, leveling rock formations, re-suspending sediments (NMFS, 1998). These impacts irreversibly alter the marine habitat complexity. Since there is no restriction about the location that this fishing can occur, outside the fishermen's own concern for hanging up their equipment on the higher relief rocks, it is speculated that much of the hard bottom habitat in the area has been altered. In the absence of reliable field data, residual impacts are assumed to range from low to high, depending on the areal extent of impact and the overall impact on the population. NMFS views the impact to occur on a region wide basis, indicating a possible high impact. They conclude that:

"…there are few, if any, large virgin marine habitats off the Pacific Coast. Due to the high relief rocky nature of Pacific coast bottom habitat, however, there may be pockets of habitat that have undergone few alterations by trawl gear. High relief rock piles that are not accessible to trawl gear are usually accessible to commercial longline and recreational hook-and-line gear. Similarly, marine canyons that have not been trawled may be used by commercial longliners."

Existing Oil and Gas Activities. While there are several cumulative oil and gas projects that could occur during the time when delineation wells are being drilled, these activities do not overlap in space with the proposed projects. There is no ongoing oil and gas activity located close enough to the proposed wellsites to create impacts that overlap directly with the resources potentially impacted by the proposed projects.

Previous exploratory wells drilled in the 1980's on the same leases where delineation wells are proposed may have physically impacted seafloor resources. Residual impacts from these wells, however, would be low. If anchoring occurred in clay sediments, it is possible that some anchor scars still persist on these leases (Dunaway and Schroeder, 1989); however, impacts to the soft bottom resources would not have persisted since recolonization would have occurred a short time after the disturbance (camp). A total of ten wells have been drilled in the proposed units historically which could have impacted rocky habitat—six wells in the Bonito Unit, one well in Gato Canyon, two wells in the Point Sal Unit, and one well in the Purisima Point Unit. Anchoring impacts could have impacted rocky habitat; however, mitigation imposed on these wells to avoid anchoring on or near rocky features would have minimized these impacts (MEC, 1995). Overall impact to the resource from previous oil and gas exploration is low.

In a cumulative sense, soft and hard substrate habitat has also been physically impacted by previous oil and gas activities on other leased areas within Central and Southern California. Drilling of exploratory and development wells, placing platforms and constructing pipelines, discharging muds and cuttings are all activities which impacted seafloor resources (refer to section 4.6.2—Impacts from Previous Oil and Gas Activities). Indeed, it is in large part because of the potential cumulative impact on regionally important hard substrate resources that extensive mitigation has been required by MMS to protect even small areas of hard substrate habitat. However, it has been shown in detailed field studies of exploratory oil and gas drilling activities (MEC, 1995) and platform and pipeline construction activities (Dunaway and Schroeder, 1989; Hardin et al., 1993) that these mitigation measures have been effective in mitigating impacts to hard bottom habitat. Therefore, cumulative residual impacts to these habitats and resources from previous oil and gas activities are low.

Fiber Optic Cable Installations. In the past few years, a number of companies have applied for permits to install fiber optic cables for commercial communication purposes. The Global West Fiber Optic Cable which traverses the California coastline from Bodega Bay to Point Loma (San Diego) is proposed to be laid offshore just outside existing OCS leases in the Santa Maria Basin and south of the Santa Ynez Unit in the Santa Barbara Channel. It comes to port at Santa Barbara and Morro Bay. The cable is proposed to be buried in the area just south of Gato Canyon along the 220 fathom line (just outside the proposed anchor radius for P 0460 #3). It also goes through the Bonito Unit crossing four canyons. Global West is using a cable that conforms to the contours of the seafloor so that it can go into the canyons. They have made an effort to avoid laying cable over rocky habitat and in areas of existing oil and gas pipelines. The EIR projects that 70-km of cable (7% of the total mileage) will not be buried because it is laid in areas of hard bottom. Of that distance, 9 km of the cable that is laid on hard bottom occurs in the area from Estero Bay to Santa Barbara, with most of the hard bottom habitat identified near San Luis Obispo (Estero Bay). Short segments crossing the canyons in the Bonito Unit are identified as being laid over hard substrate (Global West, 1999). Impacts to benthic resources in general are low due to the small size of the fiber optic cable and the lack of anchoring or other physical disturbances required to lay the cable.

Incremental Impacts from the Proposed Action (2002-2006): Physical impacts to hard bottom seafloor resources are moderate for all wells except the Gato Canyon Unit, due to the potential to impact stable hard bottom communities with anchors and chains. Individual wells with multiple anchoring events, and drilling of several wells with multiple anchoring events near sensitive hard substrate habitat is likely to result in long-term impacts to plants and animals, and alter habitat in several localized areas, a moderate impact. If the only well approved was from Gato Canyon, impacts to the resources would be low.

If any of the other wellsites proposed in the other units that are located proximal to hard bottom substrate were approved, impacts could be moderate.

Due to the comparatively low volume of mud discharged during the drilling of delineation wells, the water depth of proposed wellsites, and proximity of wellsites to identified hard substrate, impacts on seafloor resources from drilling discharges are expected to be low to moderate. Wellsites located a distance of 1,000 m from identified hard bottom substrate would introduce low impacts to seafloor resources. Discharges from wellsites located within 1,000 m could produce moderate impacts to hard bottom habitat due to smothering, depending on the actual distance from the feature, predominate currents and quality of the habitat on the feature. Impacts on seafloor resources from the proposed delineation wells are moderate, due to the potential to impact hard bottom communities. Physical impacts to hard bottom seafloor resources are moderate for all wells except the Gato Canyon Unit, due to the potential to impact stable hard bottom communities with anchors and chains. Individual wells with multiple anchoring events, and drilling of several wells with multiple anchoring events near sensitive hard substrate habitat is likely to result in long-term impacts to plants and animals, and alter habitat in several localized areas, a moderate impact.

Individual Projects. If wells for Point Sal only, or Purisima Point only or Bonito Unit only is approved and the wellsite location chosen for the delineation well or wells in the unit is at a location which impacts hard bottom resources, incremental impacts of any one of these projects could be moderate. Contribution from any specific project, however, is small in scope when compared to the impact from bottom trawling activities.

If Gato Canyon only is approved, contribution from the delineation well to the overall cumulative impact is negligible, particularly when considering that the habitat being avoided by oil and gas activities is being regularly trawled by commercial fisherman.

All Projects combined. The drilling of five delineation wells as proposed from the identified possible locations would cause moderate impacts if the locations drilled border hard bottom inhabited with stable, diverse hard bottom communities and mitigation to avoid them is not adopted. The impact is moderate because the drilling activities have the potential to impact several hard substrate areas, and in the absence of field data confirming the presence of sensitive habitat, the assumption is that sensitive habitat could be adversely impacted. In particular, moderate impacts would result due to the irreversible alteration of locally significant habitat by anchors and anchor chains. If the identified mitigation is adopted to avoid impacting these areas or if the field surveys determine these sensitive communities are not present on the identified hard substrate features, moderate impacts would be reduced to low impacts for the projects.

Summary and Conclusion (2002-2006): Soft and hard bottom seafloor resources have and continue to be impacted physically by commercial fishing activities. Impacts to hard bottom resources are significant due to alteration of the habitat, and the effect reducing the complexity of the habitat has on the ecosystem. In particular, alteration of hard bottom habitat by rockfish bottom trawling activities is high. Past oil and gas activities in the area, while having the potential to impact hard bottom areas, have contributed little to the overall cumulative impact due to effective mitigation, demonstrated in field studies. Other activities such as fiber cable projects, while affecting resources adjacent to the proposed projects including some hard bottom resources, contribute little to the cumulative impacts due to the small area physically affected.

Natural sediment turbidity flows contribute large volumes of sediment on the ocean floor especially during large flooding years that overwhelm potential cumulative contributions by drilling muds in volume and areal extent. Drilling muds and cuttings, even from multiple development operations, have been found to not contribute large scale impacts on the seafloor biota (Hyland et al, 1990).

All of the proposed delineation projects contain wellsite locations which could impact hard bottom resources, and if left unmitigated, and these wellsites are chosen and sensitive hard bottom communities are found to inhabit nearby features, irreversible habitat alterations could occur from anchoring activities in multiple locations.

Overall impacts to the relatively rare high relief hard bottom habitat are high from several cumulative sources. Every effort should be made to continue to mitigate potential impacts to this resource. Overall impacts to soft bottom resources is low, largely due to the high variability of the resource and the biota's tolerance to change and ability to recolonize.

Potential Mitigation Measures for Cumulative Impacts: The primary mitigation for cumulative impacts is avoidance of hard bottom resources by all activities. Any measure (avoidance, different gear which does not rest on the bottom) which reduces the physical impact bottom trawling fishing has on the habitat and species found on the features, would measurably reduce impacts to this resource. All measures which reduce physical impacts from oil and gas activities, such as avoidance of features with cuttings and anchoring activities, also reduce overall cumulative impacts to the resource. Based on studies of anchoring during development activities, properly mitigated anchoring activity offshore during construction should not produce significant impacts on the offshore biota

(Hardin et al., 1993). These impacts can be reduced if platforms and pipelines avoid hard bottom and if anchoring activities during installation include vertical handling procedures, anchor handling boats, shut down plans during inclement weather, precautions against dragging individual anchors and post-installation monitoring.

5.2.5 IMPACTS ON KELP BEDS

This section discussed impacts from the proposed project on kelp bed habitat. For a discussion of visiting or habiting fish, see the Fish Resources Section.

5.2.5.1 IMPACT OF THE PROPOSED ACTION ON KELP BEDS

Criteria used to assess impacts to these resources here and in chapter 6 are:

HIGH

Impacts that result in a measurable decline in a population beyond that which can be explained by normal variability, result in a measurable change regionally in species composition, ecological function or community structure, or result in a measurable reduction in regionally important habitat are considered to be **high impacts**. These changes would be at a level, areal extent, and duration that it would be expected to place an individual species at risk, or alter the community structure or habitat on a regional scale for many years. Irreversible alteration of regionally important habitat or reduction of protected habitat would be considered high impacts.

MODERATE

Impacts that result in a measurable decline in species composition, species abundance, ecological function or community structure over several localized areas or result in alteration of locally important habitat are considered **moderate impacts**. These changes, while individually may persist for many years, are localized and cannot be detected on a population or regional level.

LOW

Impacts that result in a short-term change in species abundance or composition, a temporary loss in ecological function or community structure, a short-term disturbance or temporary loss of access to locally important habitat are considered to be **low impacts**.

Impacts identified as high or moderate impacts are considered to be significant. Impacts identified as low impacts are considered insignificant.

5.2.5.1.1 IMPACTS COMMON TO ALL UNITS

There are no identified impacts to kelp beds from the proposed delineation wells. Crew boats will adhere to approved vessel traffic corridors that purposely avoid transit through kelp beds.

5.2.5.2 CUMULATIVE IMPACT ANALYSIS FOR KELP BEDS

The cumulative impact analysis section considers cumulative impacts occurring between 2002-2006 which would occur with and without the proposed projects. Another analysis of cumulative impacts can be found in chapter 6.

5.2.5.2.1 CUMULATIVE IMPACTS (2002-2006)

Since there are no impacts from the Proposed Action on this resource, no analysis of cumulative impacts is appropriate here. However, impacts to this resource could occur if development of the 36 undeveloped leases occurs. These impacts are discussed later in the cumulative section for 2002-2030.

5.2.6 IMPACTS ON FISH RESOURCES

Impact Level Definitions. The impact level analysis for fish resources in this document adopts the following impact level criteria:

HIGH

- A measurable change beyond normal variability in species composition, ecological function, or community structure over several local areas or a large regional area for a period of 5 yrs or longer; or
- A measurable reduction in regionally important habitat for more than 5 yrs, or adverse modifications of 10 percent or more of the habitat used by a given population lasting longer than 5 yrs.

MODERATE

- A measurable change in species composition or abundance beyond that of normal variability within several localized areas for a period of 1 to 5 yrs;
- A measurable change in ecological function or community structure within several localized areas for less than 5 yrs; or
- A reduction in or disturbance to locally important habitat for more than 5 yrs.

LOW

- A short-term (less than 1 yr) change in species composition or abundance;
- A temporary loss in ecological function or community structure; or
- A short-term disturbance or loss of access to locally important habitat.

For the purposes of this document, high and moderate level impacts are significant, while low level impacts are considered insignificant.

5.2.6.1 IMPACTS OF THE PROPOSED ACTION ON FISH RESOURCES

IMPACTS COMMON TO ALL UNITS:

Under section 305 (b) (2) of the Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq*) as amended by the Sustainable Fisheries Act on October 11, 1996, Federal agencies are required to consult with the Secretary of Commerce on any actions that may adversely affect Essential Fish Habitat. The Department of Commerce published an interim final rule (50 CFR Part 600) in the Federal Register (December 19, 1997, Volume 62, Number 244) which detailed the procedures under which Federal agencies would fulfill their consultation requirements. As set forth in the regulations, EFH Assessments must include: 1) a description of the Proposed Action; 2) an analysis of the effects, including cumulative effects, of the action on EFH, the managed species, and associated species by life history stage; 3) the Federal agency=s views regarding the effects of the action on EFH; and 4) proposed mitigation if applicable. Section 600.920 (h) describes the abbreviated consultation process MMS would like to follow for the proposed project. The purpose of the abbreviated consultation process is to address specific Federal actions that may adversely affect EFH, but do not have the potential to cause substantial adverse impacts.

The primary impact-producing activities associated with the proposed project are delineation drilling operations and related activities, which will be common to all units. The impacting agents will include drilling discharges, anchoring of the MODU, and explosive abandonment of the exploratory wells, if this option is used. The following sections describe the sources and types of these potential impacts.

Drilling Discharges. The drilling muds and cuttings of OCS oil and gas facilities could potentially affect fish species through direct toxicity through exposure in the water or ingestion of prey that have bioaccumulated toxins from the discharges, or through damage to essential fish habitat. 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 (SAIC, 2000a, b). All such discharges are required to meet NPDES water quality criteria, which were established to protect biological resources outside the 100 m mixing zone. Significant impacts from OCS discharges generally have not been associated with fish. In fact, Love (1999) suggests that offshore platforms may provide nursery grounds for some species of rockfish. And a successful mariculture operation has been selling mussels collected from OCS platform legs to local restaurants for over a decade. The mussels have consistently passed all FDA criteria for marketing shellfish. Impacts from drilling mud discharges from five delineation wells are expected to be low.

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. Impacts from drilling cuttings discharges from the five exploration wells range from low to moderate, depending on the location of the wellsites in relation to high relief habitat, and mitigation applied. Several of the potential wellsite locations are proposed near potential hard substrate habitat. If biological surveys of canyons and potential outcrop features identify important high relief habitat within 1000 feet of the wellsite, discharges of cuttings from delineation wells may result in moderate impacts to hard substrate (section 5.6.3).

Direct smothering and turbidity can adversely affect filter-feeding organisms such as the sponges, cup corals, and anemones found on naturally-occurring hard bottom reefs. Because habitat supporting these animals occurs within the immediate vicinity of the Point Arguello platforms and pipelines, intensive monitoring was conducted during drilling activities at the three Point Arguello platforms from 1986 to 1995. Conclusions from Phase II and III that pertain to hard substrate habitats are as follows:

1) Four of 22 taxa displayed significant time/dose interactions representing possible negative responses to the drilling mud discharges in specific habitat. These taxa were: sabellids in deep low-relief habitat, <u>Caryophyllia sp(p)</u> in deep low relief and deep high-relief habitat, galatheid crabs in deep low-relief habitat, and <u>Halocynthis</u> <u>hilgendorfi igborja</u> in deep low-relief habitat. Combined trends for the various taxa were not statistically significant.

2) It was concluded that any biological effects due to the drilling muds were related to physical effects of the increased particle loading, not chemical toxicities.

3) Adverse biological effects on the benthos from this study, as in other documented studies, were limited to within 1 km of the discharge source.

Currently there are eight generic water-based muds which have been approved for use by EPA. Discharge of oil-based drilling fluids into marine waters is not authorized by EPA. 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.

"Produced water" is the water present in the source petroleum. No produced water is expected to be discharged from any of the proposed drilling/well testing activities.

Under section 402 of the Clean Water Act, the Environmental Protection Agency (EPA) is authorized to issue National Pollutant Discharge Elimination System (NPDES) permits to regulate the discharges of pollutants to waters of the U.S., the territorial sea, contiguous zone, and ocean. EPA prepared an EFH assessment for the reissuance of a General NPDES permit for offshore oil and gas facilities in southern California (SAIC, 2000c). The general conclusions of the EFH assessment were that the continued discharge from the 22 platforms offshore California will not adversely affect EFH outside the mixing zones described as a 100 m radius from the discharge point. Within the 100 m radius mixing zone, produced water discharges may have localized effects on water quality and resident marine organisms, including EFH and fish (SAIC, 2000c).

Given the short-term nature and limited scope of the proposed drilling and testing program, low impacts to marine fish resources and EFH are expected from drilling discharges.

<u>Anchoring activities</u>. A total of eight anchors will be set and raised for each well site. The anchors will impact the sea floor and raise clouds of sediment a few meters into the water column. The silty sediments will likely settle to background within 500 m , and will not rise vertically within the water column in such a fashion to affect background sediment levels (normally 1-5 mg/l) over a large area (SAIC, 1986; 1995).

Section 5.6.3, Sea Floor Resources, concludes that physical impacts to seafloor resources from anchoring operations are moderate, due to the potential to impact high relief hard bottom communities. The impacts would result in a long term impact in a locally important habitat or over a very localized area. High impacts are not expected even if hard bottom is contacted since the level of activity, five delineation wells with 40 anchoring events, is unlikely to cause sufficient disturbance to be felt at a population or regional level. If mitigations SF1 and SF2, identified in section 5.6.3, are adopted, the impacts to fish resources and EFH would be low, or insignificant.

Well Abandonment. Once the drilling and testing have been completed, each of the delineation wells will be permanently plugged and abandoned (section 5.0). Part of the removal process involves cutting the well casing string approximately 5m (15ft) below the sea floor. The well casing may be cut mechanically, or with explosives. In the latter case, shaped charges are lowered inside the casing and detonated. Commonly, such charges weigh in the range of 16-20 kg (35-45 lbs) (Howorth et al., 1996; Howorth 1997).

Based on a 10 percent kill probability and using a 56 lb charge, the following can be expected (Goertner 1981):

1) In water depths of 500 ft, 1-oz fish near the surface can be killed out to a horizontal range of about 700 ft. The only other fish which are vulnerable to injury are those near the bottom within a radius of 30-40 ft from the charge.

2) For severence explosions in water depth of 1000 ft, no significant kills of fish will occur.

If explosives are used in the well abandonment process, the charge (16-20 kg) would be detonated in the well casing 5 m below the seafloor. This positioning of the charge would dampen the explosion and restrict the shock and acoustic effects. Thus, the 10 percent kill zone described by Goertner would likely shrink.

The use of explosives for well abandonment on the Pacific OCS would require the implementation of a wildlife mitigation plan designed to minimize impacts to marine life (Howorth 1997). Typically, such a plan has included the use of shipboard observers who would be charged with collecting injured or dead fish after the detonation. The detonation could also be postponed if the diver setting the charge reports an appreciable number of fish over the wellhead.

The latest wellhead removal on the Pacific OCS using exposives, occurred in 1997 on Lease 0215, offshore Ventura. The diver placing the charge reported about 20 juvenile rockfish over the wellhead before detonation. After the detonation, 17 rockfish and 6 surfperch were collected by observers. In addition, 18 California barracuda were recovered (Howorth 1997). The barracuda, an epipelagic fish, probably happened to be swimming over the detonation site just as the charge went off. A similar incident involving barracuda occurred on one occasion during the 4H platform removal project (Howorth 1996).

A small number of fish would be expected to be lost after the explosive removal of a wellhead. However, given the short duration of the project, few fish would be expected to be attracted to the wellhead and a low mortality is expected. Overall, impacts from this source are expected to be low. Low effects to fish resources and EFH are expected.

5.2.6.1.1 SUMMARY AND CONCLUSION

Overall, activities associated with the proposed delineation activities are expected to cause low impacts to fish resources and EFH in the project area. No impacts are expected from accidents or upsets.

5.2.6.1.2 MITIGATION MEASURES FOR IMPACTS FROM THE PROPOSED ACTION

The primary mitigation requirements include avoidance of hard bottom substrate to the maximum extent feasible. Section 5.6.3 Sea Floor Resources describes several measures to avoid potential impacts to hard bottom substrate and related communities.

Mitigation FR1 (Explosive subsea removal). Avoiding impacts to marine fish resources from the use of explosives for well abandonment on the Pacific OCS would require implementation of a wildlife mitigation plan similar to those employed for platform removal in California State waters (Howorth, 1997) and in the MMS Gulf of Mexico OCS Region (NTL 99-G21). Typically, such a plan has included the use of shipboard observers or divers (possibly supplemented by aerial surveys), the establishment of a safety zone around the detonation site for marine mammals and birds, and monitoring of the zone to ensure that no large numbers of fish are present when the charge is detonated.

Implementation of this mitigation would make it unlikely that any large fish mortality would occur as a result of well abandonment operations associated with the proposed delineation activities. Impacts to marine fish resources would be low.

5.2.6.2 CUMULATIVE IMPACT ANALYSIS FOR FISH RESOURCES (2002-2006)

CUMULATIVE IMPACTS WITHOUT THE PROPOSED ACTION (2002-2006):

Section 5.0 describes the projects considered in the cumulative analysis for the proposed delineation activities. Possible sources of cumulative impacts in the project area include on-going and proposed oil and gas activities in Federal and State waters, Alaskan and foreign-import tankering, and military operations. Dredging and discharge of dredged material, aquaculture, coastal development, agriculture runoff, and commercial fishing are additional sources of potential cumulative impacts.

The projects discussed in this section include past, present, and foreseeable actions that may produce impacts during 2002-2006, the expected duration of the proposed exploration activities. Potential cumulative impacts are discussed below.

Offshore Oil and Gas Activities. 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 the San Pedro Bay. Within the next 5 yrs, two new Federal projects are likely to occur from existing OCS facilities, and 1 new State project is likely to occur from existing OCS facilities. Section 5.0 describes the routine offshore oil and gas activities that may result in impacts to fish resources. These include geophysical surveys, construction, drilling and production activities with associated support activities, and the abandonment, or decommissioning, of wells and offshore facilities. As discussed in section 5.2.6.1, the major impact agents expected from these proposed activities are noise and disturbance, damage to hard-bottom habitat, and drilling discharges. The potential use of explosives in the abandonment of wells and offshore platforms also raises the possibility of lethal impacts to fish resources. Oil spills are the primary source of accidental impacts to fish resources from offshore oil and gas activities and tankering.

Geophysical surveys. Several studies have examined the effects of seismic energy on various life stages of fish (e.g., Dalen and Knutsen, 1986; Falk and Lawrence, 1973; Greene, 1985; Holliday, et al., 1987; Kostyuchenko, 1973; Pearson, et al., 1987; Turnpenny and Nedwell, 1994). The studies indicate that direct damage to adult fishes is mainly to the swimbladder and at fairly close ranges to the air gun. The lethal range for coregonid fishes does not extend beyond 19 ft (Falk and Lawrence, 1973). Damage to anchovies does not extend past 3 ft (Holliday et al., 1987). The risk of mortality to juvenile or adult fish would therefore be limited to the occasional fish that was close to the airgun array when shooting began; other fish would move beyond the potentially lethal range (Turnpenny and Nedwell, 1994).

Direct effects on fish eggs and larvae appear to be minimal. Holliday et al. (1987) reported that northern anchovy eggs and 15-22-day-old larvae were not significantly affected by sound pressures 3-4 times the level expected from a seismic airgun array passing directly over a specimen at 10 ft. However, 2-day-old and 4-day-old yolk-sac larvae suffered subtle, but statistically significant reductions in survival and growth rates when exposed to the same pressure levels. Since no physical damage was detected in the yolk-sac larvae, it was postulated that the observed survival and growth rate reductions were due to interference with the change in feeding behavior from yolk nutrition to active plankton-feeding. Pearson et al. (1988) exposed Dungeness crab zoeae to one discharge from a 7-airgun array and found no significant difference in survival or behavioral response compared to controls. In general, the acoustic pulse from airguns has relatively little effect on marine invertebrates, presumably due to their lack of a swim bladder.

Airgun energy appears to have behavioral effects on fish. Generally, pelagic schooling fishes seem to swim away and leave the area, while demersal fishes appear to respond by flattening to the bottom. Pearson et al. (1987) exposed several species of rockfish to acoustic energy in a controlled test. Three behavior patterns were noted: (1) the school dove to the bottom and remained motionless; (2) the school dove to midwater and swam rapidly in changing directions; and (3) the school broke into smaller schools and fled in different directions. These patterns were not always maintained throughout the exposure, indicating that fish may habituate to the sound. The fish returned to their pre-exposure behavioral patterns within minutes after the end of the sound presentations eliciting responses. Rockfish aggregations, as measured by fathometer, showed no significant areal difference between control and seismic sound emission trials, although a decrease in aggregation height was detected (Pearson et al., 1987). Perhaps more importantly, this study showed a decrease in CPUE (catch per unit effort) of 52.4 percent during airgun exposure. However, the study did not conclude how long this decrease in CPUE would be expected to last or over how great a distance this reduction might occur. Studies by Engas et al. (1993) and Lokkeborg and Soldal (1993) reported that cod and haddock show significant catch reductions over areas of several kilometers and periods of at least 5 days.

Any impacts to fish resources caused seismic surveys are expected to be negligible. Any direct mortality to adults, eggs, and larvae would only occur very close to the airgun arrays—within 5-20 ft of the source. Some short-term behavioral changes might occur, but would not cause a significant impact to the fish resources of the survey area. Pelagic fishes, such as anchovies, mackerel, sharks, and barracuda, would swim away from or would avoid the area during the survey. Demersal fishes, such as rockfishes, flatfishes, and ling cod would either flatten to the bottom or leave the area during the survey. These behavioral changes would be short-term and the fishes would return to the area once the survey was completed.

Since 1963, more than 400 geological and geophysical surveys, including both 2-D and 3-D seismic surveys, have been conducted in the Santa Barbara Channel and Santa Maria Basin (table 4.0.1-6), and many others have occurred in state waters. Most of these surveys occurred during the 1970's and 1980's; the most recent seismic survey offshore southern California was the Exxon 3-D seismic survey conducted in the western Santa Barbara Channel in 1995 (MMS, 1995). Additional 3-D seismic surveys may occur during the next few years. However, no Pacific OCS operators have approached MMS with proposals to conduct such surveys to date. Significant cumulative impacts to fish resources from high-energy seismic survey activities have not been documented; evidence to date indicates that cumulative impacts on the marine environment are insignificant.

Construction and Drilling Activities. As of April 2000, more than 1,200 wells had been drilled in the

Pacific OCS Region. This number includes 881 oil and gas development wells drilled from platforms and 326 exploratory wells drilled from a variety of rigs, including mobile offshore drilling units (MODU's), jack-ups, barges, and drill ships. Currently, based on data from 1996 through 1999, slightly less than 2 development wells per month are begun from Region platforms. No exploratory wells have been drilled in the Pacific Region since 1989.

Adjacent hard-bottom habitats can be severely impacted by construction activities including anchoring, placing platforms, and laying pipelines. The impacts can result in the crushing, and removal or burial of substrate used for feeding or shelter purposes by fish species. Disturbances to the associated epifaunal communities may also result.

The discharge of drilling muds and cuttings can result in varying degrees of change on the sea floor and affect the feeding, nursery and shelter habitat for various life stages of groundfish and shellfish species. Exploratory activities may also result in increased turbidity, which reduces sunlight available for photosynthesis in plankton and decreases primary productivity in the area.

Fish resources have likely experienced sublethal and lethal impacts from past and present OCS oil and gas construction and drilling activities. However, it is unlikely that these impacts have amounted to more than low impacts at a regional or even local (within 2 km of a construction or drilling activity) area. The stipulations and conditions placed on OCS oil and gas activities have helped to mitigate impacts to hard bottom areas and spawning or nursery habitats for fish resources.

Offshore Facility Decommissioning. Section 5.2.6.1 discusses the process of exploratory well abandonment and the associated potential impacts to marine fish resources. Section 5.0 describes the processes involved in decommissioning offshore facilities. For purposes of analysis, it is assumed that decommissioning would encompass the complete removal of a platform and associated pipelines, with none of the leg structure left in place to form an artificial reef. To date, only one OCS facility in the Pacific Region has been decommissioned—the Offshore Storage and Treatment (OS&T) vessel that formerly served the Santa Ynez Unit platforms in the Santa Barbara Channel. In addition, six offshore platforms in State waters in the Channel have been removed—two in 1988 and four in 1996 (table 4.0.1-6).

The Select Scientific Advisory Committee on Decommissioning explored possible marine ecological implications related to the decommissioning of California's 27 offshore oil and gas production platforms. Biotic surveys of California platforms indicate that many different species of fish and invertebrates can be found on the current platform structures. However, there is not any sound scientific evidence to support the idea that platforms enhance or reduce regional stocks of marine fish species. The primary reason for this conclusion is that the 27 platforms represent a tiny fraction of the available hard substrate in the SCB, suggesting that for the majority of species any regional impacts from decommissioning are likely to be small and possibly not even detectable empirically. However, because species differ greatly in life history, population dynamics, and geographic distribution, it is possible that platforms could have a more substantial effect on some key species. These species of special concern could include several rockfish species whose low abundance has triggered severe restrictions on harvest and stock rebuilding plans. Bocaccio, for example, is estimated to have declined to about 1 percent of virgin biomass. Love et al. (2000) reported that Platform Gail had a density of adult bocaccio an order of magnitude greater than the average density found on 61 natural reefs in appropriate depths.

In the short term there could be several local impacts of removing platforms from the ocean. For example, explosives could result in fish mortality on or near the platform. Organisms on adjacent or nearby natural hard substrate could be damaged by anchors, or anchor scars could alter substrate and impact its value as habitat for benthic species. When the platform is removed from the ocean all the sessile organisms on it will die, and the mobile species (fish and invertebrates) would survive only if they could successfully relocate to suitable habitat elsewhere. On a long-term local basis, anchor scars and damage to the bottom could persist, thus altering the habitat quality for species associated with hard bottom substrate. A set of species associated with soft bottom would likely develop in the area previously occupied by the platform.

Mussel mounds located beneath the platform would also be impacted. With no supply of shells, organic material, settled larvae and young stages arriving from the top layers of the water column, the biomass and species composition of the community associated with the mussel mounds would be impacted. If the mussel mounds are removed, further impacts could occur. If explosives are used, many organisms in the vicinity could die. Removal would also result in loss of the habitat. Sessile organisms would die and mobile ones would only survive if they could find suitable natural habitat nearby. To the degree that chemicals or other anthropogenic materials have become entrained in the mussel mound, these might be released during the process of removal and might potentially affect biota locally.

The current state of knowledge seems to indicate that complete removal of California platforms will have low regional effects on fish stocks. Pipelines will be abandoned in place, and are not expected to add to the cumulative effects on fish resources of the SCB.

No offshore decommissioning activities are expected to occur in either Federal or State waters during the 2002-2006 duration of the proposed delineation activities.

Oil Spills. No oil spills are expected to result from the proposed activities. As discussed in section 5.0, the cumulative oil spill risk for the project area results from several sources: ongoing and projected oil and gas production from existing OCS facilities in the Santa Barbara Channel and Santa Maria Basin, several proposed development projects on the Federal OCS, ongoing production from one facility in State waters in the Santa Barbara Channel, two reasonably foreseeable oil and gas projects in State waters, and the tankering of Alaskan and foreign-import oil through area waters. Table 5.1-1 presents the estimated mean number of spills of various sizes and the probability of their occurrence as a result of the described activities.

The most likely oil spill scenario for existing and proposed offshore oil and gas activities is that one or more oil spills in the 50-1,000-bbl range would occur over the period 2002-2006, and that such a spill would most likely be 200 bbl or less in volume. The probability that one or more spills of this size will occur this period is 73.9 percent (table 5.1-1). The maximum reasonably foreseeable oil spill volume from future offshore oil and gas activities is 2,000 bbl, assumed for purposes of analysis to be a pipeline spill. The probability of a spill of this size occurring during the period 2002-2006 is 22.3 percent (table 5.1-1). Based on data from tanker spills in U.S. waters, the mean size for a tanker spill is assumed to be 22,800 bbl (with a probability of occurrence of 38.8 percent for this period; (table 5.1-1). The rationale for these estimated spill sizes is presented in section 5.0. The potential impacts to marine fish resources in the project area from spills of each of these three sizes are discussed below.

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.

Fate and Effects. When an oil spill occurs, many factors determine whether that oil spill will cause heavy, long lasting biological damage; comparatively little damage or no damage; or some intermediate degree of damage. Among these factors are volume spilled, geographic location, oceanographic and meteorological conditions, season, oil type, and oil spill response and cleanup preparedness and method. Interpolating from the model of Ford (1985), a spill of 200 bbl could oil 1-19 km of coastline. The likely result would be patches of light to heavy tarring of the intertidal zone along this 19 km stretch resulting in localized changes to the community structure. The recovery time would depend on the environment. High energy rocky coast will be mostly self-cleaned within several months, while low energy lagoons and soft-sediment embayments can retain stranded oil residue for several years. The same impacts would be expected from a 2,000-bbl oil spill, and from a 23,000-bbl oil spill, but over a larger area. It is estimated that a 2,000-bbl oil spill contact 3-53 km of coastline and a 23,000-bbl oil spill could contact 9-161 km of coastline.

Oil in the marine environment 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.

The field observations of an oil spill's impacts on the marine environment are taken mostly from very large oil spills that have occurred throughout the world over the past three decades. The *Exxon Valdez* spilled about ~270,000 bbl of crude oil into Prince William Sound and the *Sea Empress* released ~540,000 bbl of crude oil off southwest Wales. The *American Trader* spilled about ~10,000 bbl of crude oil offshore Huntington Beach, California. Due to pending litigation, we are unable to provide a complete environmental impact analysis of the September 1997 Platform Irene oil pipeline spill of 163 bbl off the southcentral California coast.

Fishes. Fish can be affected directly by oil, either by ingestion of oil or oiled prey, through uptake of dissolved petroleum compounds through the gills and other body epithelia, through effects on fish eggs and larval survival, or through changes in the ecosystem that supports fish. Although fish can accumulate hydrocarbons from contaminated food, there is no evidence of food web magnification. Fish have the capability to metabolize hydrocarbons and can excrete both metabolites and parent hydrocarbons from the gills and the liver (NRC, 1985). 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.

The *Exxon Valdez* oil spill (~270,000 bbl) provides several examples of how oil affects fish. For the sensitive stages of fish (eggs, larvae, and juveniles) the spill could not have occurred at a worse time. Pacific herring spawned along the shores of Prince William sound within weeks of the *Exxon Valdez* oil spill in March 1989, resulting in increased egg mortality and larval deformities. Also, fry from pink salmon emerged from their gravel spawning redds and entered the nearshore marine environment during the spill. Site-specific occurrences of instantaneous mortality suggest that a significant reduction in herring larval production occurred because of the oil spill (Brown et al.,1996). Brown et al. (1996) estimated that over 40 percent of the 1989 year-class was affected by *Exxon Valdez* oil at toxic levels. The herring population in Prince William Sound also suffered heavy losses in 1993 due to disease. However, it is not known what role, if any, exposure to oil may have played in the disease outbreak; natural variability and density-dependent effects could not be ruled out as the cause of the small year-class and disease. Despite the reduction in larval production, reduced abundance in the 1989 year-class recruiting as 4-year old adults in 1993 could not be determined because natural processes affecting herring recruitment are poorly understood (Brown et al., 1996).

Pink salmon, Dolly Varden, sockeye salmon, and cutthroat trout exposed to oil from the *Exxon Valdez* spill all showed reduced growth rates the season following the oil spill. Pink salmon also showed increased egg mortality in oiled-versus-unoiled streams through the 1993 season (Rice et al., 1996). Geiger et al. (1996) estimated that 1.9 million adult pink salmon failed to return to Prince William Sound in 1990, primarily because of a lack of growth in the critical nearshore life stage when they entered seawater in spring 1989 during the height of the spill. By 1991, 60,000 wild adult pink salmon failed to return. In perspective, in the years preceding the oil spill, returns of wild pink salmon in Prince William Sound varied from a maximum of 23.5 million fish in 1984 to a minimum of 2.1 million in 1988. Since the spill, returns of wild pinks have varied from a high of about 12.7 million fish in 1990 to a low of about 1.9 million in 1992. The decade preceding the oil spill was a time of very high productivity for pink salmon in the sound, and, given the tremendous natural variation in adult returns, it was impossible to measure directly the extent to which wild salmon returns since 1989 were influenced by the oil spill. Based on intensive studies and mathematical models following the oil spill, researchers determined that wild adult pink salmon returns to the sound's Southwest District in 1991 and 1992 were most likely reduced by a total of 11 percent (EVOSTC, 1999).

After the *American Trader* spilled ~10,000 bbl of North Slope crude oil offshore Huntington Beach, California, oil stranded along 22 km of coastline (Gorbics et al., 2000). The natural resource trustees (representatives from USFWS, CDFG, and NOAA) determined that post larval juvenile white sea bass were adversely impacted by the oil. Specifically, 10-15mm juvenile fish were killed by oil when it mixed with drift algae found near the surf line. The drift algae found in this area are the normal habitat for juvenile white sea bass and other croakers during and after the time of the spill (Gorbics et al., 2000).

Despite the fact that laboratory experiments and field observations indicate that fish are susceptible to adverse effects from hydrocarbons, with the exception of the *Exxon Valdez* oil spill, no direct impacts on fishery stocks have been observed following catastrophic spills. This is due in part to the complexities involved with the natural process of recruitment, which produces tremendous natural variations in year-class abundance that bear little relation to the size of the parent stock. Thus, any impacts from catastrophic oiling on fish stocks are probably masked by the natural variations in abundance. Also, massive fish kills during oil spills have not occurred, or if they have it is only in the egg and larval stages found in the surface waters. Adult fish have the ability to move away from an impacted area. One of the worst spills in recent times, the tanker *Sea Empress*, released ~540,000 bbl of crude oil and ~4000 bbl of fuel oil into the sea off Milford Haven waterway in southwest Wales on February 15, 1996. Oil came ashore along 200 km of coastline, much of it in a National Park and an area of international scientific interest. The *Sea Empress* Environmental Evaluation Committee, an independent committee set up by the UK government, reported that "Although tissue concentrations of oil components increased temporarily in some fish species, most fish were only affected to a small degree, if at all, and very few died" (SEEEC 1998). The study found that about 40 percent of the oil evaporated soon after the spill and around 52 percent dispersed into the water where it was broken down by microorganisms. Surveys at sea showed that the oil was not deposited in sediments in significant quantities. Between 5 percent and 7 percent (~36,000 bbl) of the oil stranded on shore; however, one year after the spill less than 1 percent remained on the shore.

Although many factors contribute to the overall impacts realized from an at-sea oil spill, fish are generally not adversely impacted at the population level. Given the high energy and high productivity environment of the Point Arguello area, the common meteorological and oceanographic conditions, and the oil spill preparedness and response capabilities in place, direct measurable effects to any fish stock abundance from a 200 to 23,000 bbl oil spill off the coast of Point Arguello, California are unlikely.

Food Web and Habitat. Fish can also be affected indirectly by oil through changes in the ecosystem that supports fish. In simplistic terms, this ecosystem would include all prey species and habitats the fish use during all life stages.

Perhaps the most important food on which all fish rely during their larval and juvenile stage is plankton. In general, the studies to date indicate that zooplankton are more susceptible to effects from oil spills than are phytoplankton. Even if a large number of algal cells were affected during a spill, regeneration time of the cells (9-12 hours), together with the rapid replacement by cells from adjacent waters, probably would obliterate any major impact on a pelagic phytoplankton community (NRC, 1985). After the *Tsesis* spill in the Baltic Sea, there was a decrease in zooplankton in the vicinity of the wreck. The quantity of phytoplankton increased briefly and it was concluded that the change was due to a decrease in the amount consumed by zooplankton. Similar results have been obtained in long-term oiling experiments. Individual organisms in oil spills have been affected in a number of ways: direct mortality (fish eggs, copepods, mixed plankton), external contamination by oil (chorion of fish eggs, cuticles and feeding appendages of crustacea), tissue contamination by aromatic constituents, abnormal development of fish embryos, and altered metabolic rates (Longwell, 1977; Samain et al., 1980). The effects appear to be short-lived and there are seldom prolonged changes in biomass or standing stocks of zooplankters in open water near spills, due largely to their wide distribution and rapid regeneration (Van Horn et al., 1988). During the *Exxon Valdez* spill, Celewycz and Wertheimer (1996) studied the impact of the spill on zooplankton and epibenthic crustaceans, potential prey species of pink salmon. They did not detect any reduction in abundance of either zooplankton or epibenthic crustaceans between oiled and non-oiled locations in either 1989 or 1990.

Intertidal and subtidal macrophytes provide shelter and food for fish and for fish prey species at various life stages along the northern Santa Barbara County coast. The habitats involved here include both high energy rocky shorelines, sand and cobble beaches, and the nearshore subtidal environment. Intertidally, the red alga *Endocladia muricata* and the brown alga *Pelvetia* spp. are species common to the area, as is surf grass (*Phyllospadix spp.).* Giant kelp, *Macrocystis pyrifera* is common to the nearshore subtidal area. Intertidal macrophytes seem to be more vulnerable to oiling than subtidal macrophytes. Losses of intertidal algal cover have been described after several spills. However, recovery appears to occur quite readily (Topinka and Tucker, 1981), though imbalances in the macrophyte community can persist for years. The proliferation of opportunistic intertidal algal species after a spill is invariably a direct result of the elimination, by the oil, of naturally occurring grazers—limpets and other intertidal herbivores (NRC, 1985). Little evidence exists that kelp is harmed by oil (MMS, 1992). An oil spill of 200 bbl would probably result in light to heavy tarring of the intertidal zone if oceanographic conditions carried the oil to shore. Impacts to intertidal macrophytes would be minimal and patchy over an estimated 10 km or less of shoreline. Raimondi (1998) reported that species abundance at two research sites within the exposure zone of the 163 bbl Irene pipeline spill showed no significant changes that could be attributed to the oil spill. Barnacle abundance at one site decreased in the Fall 1997 and Spring 1998 surveys, however no fresh tar or oil was observed at the site. In Spring 1998 surveys, the same site also showed decreases in mussels and surf grass cover, but these impacts were attributed to the effects of strong El Nino enhanced storms that ravaged the site in January and February of 1998. No measurable impacts would be expected to subtidal macrophytes from a 200 bbl oil spill.

Fluctuations of benthic and intertidal invertebrate populations may affect the fishes that normally feed on them. Considerable work has been done studying the effects of oil on macroinvertebrates. Most susceptible are those species inhabiting the intertidal zone, especially those found in lagoons, embayments, estuaries, marshes, and tidal flats. This risk derives from two factors: high oil concentrations and shallow depth of the water column. Aside from the physiologically toxic effect, intertidal organisms may be entrapped or suffocated by oil. In fact, a major impact of the *Sea Empress* spill was to the intertidal invertebrate community. Heavy limpet mortalities were recorded, and periwinkles and topshells died, though in lesser numbers. Amphipod mortalities were extensive, although substantial recolonization was evident at most sites one year later (SEEEC, 1998). Gorbics et al. (2000) reported that overall mortality of bean clams as a result of the *American Trader* spill (~10,000 bbl of crude oil) in February 1990 was estimated to be 24 percent. Sand crabs showed an increase in the body burden of aliphatic hydrocarbons until June 1990. It can be assumed that the oil from the *American Trader* that stranded along 22 km of coastline near Huntington Beach resulted in a significant increase in the mortality of intertidal invertebrates (Gorbics et al., 2000).

It can take several years for limpet and other mollusc populations to recover completely at heavily impacted sites. A 200- to 23,000-bbl oil spill in the western Santa Barbara Channel that contacted shore would likely result in mortality to various intertidal macroinvertebrates, including barnacles, limpets, mussels, starfish, anemones, and black abalone. Smothering would be the most common cause of mortality and would be limited to direct contact with weathered tar balls from the oil spill. After the 163 bbl Irene pipeline spill in September 1997, sand crabs within the spill zone showed significant hydrocarbon contamination (J. Dugan, UCSB, pers. com.). Sand crabs are an important component of the diet of several fishes. Though fish can metabolize hydrocarbons they accumulate, this process requires energy and may lead to an increased vulnerability to disease and decreased growth or reproductive success. Since sand crabs were contaminated after the oil spill, one can also assume that other invertebrates such as myssids, amphipods, and polychaetes were affected. In fact, one predatory polychaete has not repopulated some areas of the spill zone, though it can be found in areas outside the zone (J. Dugan, UCSB, pers.com.).

Coastal and offshore waters and benthic subtidal environments are important habitat for all fish species. The coastal and offshore waters are any areas seaward of the low tide level and include bays, open coastal waters, and the deep ocean. Oil spills in the open ocean do not appear to have as severe an effect on the biota as oil in coastal water or in the shore zone (NRC, 1985). This may be due to the fact that the shore zone and coastal waters are subject to serious effects from chronic pollution and an oil spill in this area is impacting a stressed environment. Benthic subtidal environments may be impacted when oil spilled onto the surface of the water column is transferred to bottom sediments through sorption on clay particles and subsequent sinking, sinking of dead organisms, uptake and packaging as fecal pellets by zooplankton, or direct mixing to the bottom in shallow water. This may impact fish both directly and indirectly. After the *Tsesis* oil spill, herring reproduction was significantly reduced in the spill area. Nellbring et al. (1980) reported that the reduced reproduction was due to a decrease in amphipod populations that graze on fungi growing on the fish eggs, leaving the eggs susceptible to fungal damage. Oiling of the sediments following the *Amoco Cadiz* spill had deleterious effects on plaice and sole, including reduced growth and increased incidence of fin and tail rot (Conan and Friha, 1981). In fact, flatfish may be particularly susceptible, since they spend a considerable amount of time lying on the bottom or even partially buried in the sediments.

An evaluation of the literature reveals that oil spills can cause mortality and sublethal effects on fish at all life stages, their prey, and their habitat. However, whether or not these impacts result in measurable adverse effects on EFH or fish resources is more difficult to determine. In 1985, a National Research Council committee found "no irrevocable damage to marine resources on a broad oceanic scale" as a result of oil pollution from either chronic, routine sources or from occasional major spills. At the same time, however, it cautioned that further research is needed before an unequivocal assessment of the environmental impact of oil pollution can be made, particularly as it applies to specific locations and conditions.

Given the national oil spill data collected from the Gulf of Mexico and Pacific Region OCS programs over the last 30 years, MMS expects that such a spill would probably be less than 200 bbl, and the maximum reasonably foreseeable is 2,100 bbl. Given the location, normal meteorological and oceanographic conditions, and oil spill response capabilities of the area, low adverse effects are expected to EFH or fish resources from an oil spill in this size range. Any direct mortalities to fish would probably occur only in the egg and larval stages found in the surface waters in the immediate vicinity of the spill. Depending on the oceanographic conditions at the time of the spill, some oiling of the intertidal zone along the south or central California coast or the northern Channel Islands is expected. Under normal conditions for the area, significant mixing and weathering of the oil would evaporate much of the toxic light-end hydrocarbons into the atmosphere, disperse the oil into the water column, and likely break the slick into smaller patches. The weathered tar balls would likely cause some mortality to intertidal macrophytes and invertebrates through smothering. Elevated hydrocarbon levels in nearshore invertebrates would be likely, leading to increased stress and potential decreases in growth and reproduction in fish feeding upon the invertebrates. These effects are expected to be short-term under normal conditions; however, oil may become sequestered in the sediments of low-energy embayments and persist for several years.

Accidental oil spills present an ongoing source of potential impacts to fish resources. The cumulative risk of oil spills arises from multiple sources, including offshore oil and gas activities in Federal and State waters and both Alaskan and foreign-import tankering. Tankering represents the greatest risk of an oil spill in the SCB. This risk is tempered by recently implemented or proposed mitigation (such as the rerouting of tankers farther offshore along the central California coast) and, as discussed in section 5.0, by modern oil spill response capabilities. The mean spill size derived from the U.S. Coast Guard database for accidents in U.S. waters is 22,000 bbl. A spill this size could contact up to 161 km of coastline. Fish resources and EFH would likely experience low impacts from a spill this size. The water quality from the

Point Conception area north and offshore the Channel Islands remains good. This area is very productive and is important habitat for many marine fish species. A large oil spill would impact the water quality of this habitat. Although only minimal adverse impacts to fish populations and their prey species would be likely from such an event, EFH in the Southern California Bight is stressed due to overfishing, and degraded water quality in estuaries south of Point Conception. Degradation of the water quality north of Point Conception due to an oil spill would cause further stress to EFH. The impacts to water quality from an open ocean spill would be short-term and not expected to last more than several days.

The potential for an oil spill occurring from continued oil and gas activities at the existing platforms on the Pacific OCS and State tidelands represents an insignificant incremental increase to the overall cumulative oil spill risk for fish resources.

Other Activities. NMFS (1998a,b) has identified several fishing and non-fishing activities that may cause adverse impacts to Federally-managed fish species and Essential Fish Habitat (EFH) along the Pacific Coast. These include dredging and discharge of dredged material, water intake structures, aquaculture, wastewater discharge, oil and hazardous waste spills, coastal development, agricultural runoff, commercial marine resource harvesting, and commercial fishing. Most of these activities occur throughout the California, Oregon, and Washington coastal habitat and all of these activities and impacting agents exist in the southern and central California coastal zone. As a result, marine water quality has been impacted by municipal, industrial, and agricultural waste discharges and runoff in much of the Southern California Bight (MMS, 1992).

An estimated 1.34 billion gallons of treated municipal sewage per day are discharged into the waters off southern California (SCCWRP, 1990). Despite current efforts to limit sewage discharge, pollution and its effects on fish of the SCB will remain at its present level over the next 25-40 years due to increasing coastal population.

Fishing pressure exerted by the combined efforts of commercial and marine recreational fishers is one of the most important man-induced stresses on some fish resources. Fishing pressures are expected to remain high in southern and central California as demand increases and fishing practices become more efficient. This will result in continuing short- and long-term declines in some fish stocks. Furthermore, NMFS (1998) stated that fishing gear impacts the biological seafloor resources by removing marine plants, corals and sessile organisms, upending rocks, leveling rock formations, and re-suspending sediments which irreversibly alters the marine habitat complexity. There are few, if any, large virgin marine habitats off the Pacific Coast. High relief rock piles that are not accessible to trawl gear are usually accessible to commercial longline and recreational hook-and line gear.

INCREMENTAL CUMULATIVE IMPACTS OF THE PROPOSED ACTION (2002-2006):

As discussed in section 5.2.6.1, routine activities associated with the proposed delineation activities are expected to result in low impacts to marine fish resources in the immediate area around the proposed well sites. No impacts are expected from accidents or upsets.

SUMMARY AND CONCLUSION (2002-2006):

Several fish stocks in the SCB are depressed. Unfortunately, it is difficult to apportion the reasons for a fishery's demise among overfishing, habitat degradation, pollution, and natural variability of the population. However, as fishery managers gather more detailed knowledge about fish life histories, including potential linkages between fish recruitment and long-term changes in ocean climate, they will be better able to prevent the overexploitation and resulting population crashes of one fish species after another. Many of these fish stocks have been monitored for less than the span of one of their generations. It may take decades of monitoring to fully ascertain the long-term feasibility of current fishery restrictions, proposed marine protected areas, and other fishery management options. The 1996 amendments to the Magnusen-Stevens Act addresses sustainable fisheries and sets guidelines for protecting marine fish resources and habitat from fishing related and non-fishing related activities.

The proposed delineation project will add incrementally to the overall impacts on fish resources in the Bight. The primary impacts would be to hardbottom habitat in the immediate vicinity of the well site and MODU anchoring system. No oil spills are expected to result from the proposed delineation activities. Due to the short duration of the proposed projects, the distances between the projects, and the mitigation measures placed on the projects, the environmental effects of the proposed project on the fish resources and EFH of the SCB are expected to add a negligible increment to the overall cumulative effects on fish resources in the SCB.

5.2.7 IMPACTS ON MARINE AND COASTAL BIRDS

This section analyzes the impacts of the proposed projects on marine and coastal birds. (Threatened and endangered species are analyzed in section 5.2.9.) The marine and coastal birds of the project area are described in section 4.6.5. Marine and coastal birds may be vulnerable to several potentially adverse impacts from operations associated with the proposed project. Operations assumed to occur as a result of the proposed projects include: towing and anchoring the MODU, support vessel traffic, helicopter flights, drilling, various discharges, barge transit and anchoring, and well abandonment. These operations are described in section 2. As stated in section 1.0, no oil spills are expected to occur from the proposed drilling activities that make up the proposed projects, and therefore, no impacts to marine and coastal birds from oil spills are expected.

In preparation for this analysis, the following impact level definitions were developed:

HIGH

Impacts are expected to include direct mortality, reduced survivorship, declines in reproductive success, shifts in distribution, and possibly, changes in species diversity. Mortality is expected to involve thousands of birds, with many more experiencing sublethal effects. This would be expected to result in measurable changes in distribution and abundance in the project area. Effects are expected to continue for more than 2 years.

MODERATE

Impacts are expected to include direct mortality, reduced survivorship, declines in reproductive success, and shifts in distribution. Mortality is expected to involve hundreds of birds from the project area, with many more experiencing sublethal effects. This would be expected to result in measurable changes in distribution and abundance in the project area. Effects are expected to continue for 1-2 years.

LOW

Impacts result in biologically important (e.g., a change in abundance, species diversity, reproductive success, growth rates, and/or survival) change(s) in a few local populations (e.g., a colony or beach), mainly due to high levels of disturbance. In this analysis, minor changes in behavior (e.g., a bird moving out of the path of an approaching boat) are not considered biologically important and are not indicative of an impact. Mortality, if any, would be limited to the loss of 10's of birds, with many more experiencing sublethal effects. Effects are expected to continue for no more than one year.

For the purposes of this document, high and moderate impacts are considered to be significant, while low impacts are insignificant.

5.2.7.1 IMPACTS OF THE PROPOSED ACTION ON MARINE AND COASTAL BIRDS

The following is a discussion of the impacts of operations to marine and coastal birds that are common to all units; no impacts to marine and coastal birds are unique to any one unit. Operations associated with the proposed projects described in section 2 that could have an effect on marine and coastal birds are: towing the MODU, support vessel traffic, helicopter flights, barging, and well abandonment. Other potential sources of disturbance, including the noise and activity associated with drilling operations, are not expected to have an effect. Platform discharges are not expected to have an effect due to the high degree of dilution that would occur and the fact that bioaccumulation of associated pollutants is not expected (SAIC, 2000).

The seabirds that are probably most sensitive to disturbance are those that are actively nesting. The activities associated with moving and positioning the MODU, support vessel traffic, and barging will be conducted either well away from any seabird colony or at ports (e.g., Port Hueneme) where there are no seabird colonies. These activities can also disturb birds at sea, but these effects would be limited to the immediate vicinity of the disturbance and would be very short in duration (e.g., a few minutes). Vessel traffic of various types is common throughout the project area, and seabirds have most likely become habituated to this activity. Seabirds are as likely to be attracted to these activities as dispersed by them. Shorebirds and marshbirds would not be affected by these activities because these birds are restricted to the shoreline.

Helicopter flights can have a negative impact on seabirds, although seabird reactions to helicopters and other aircraft are complex, depending on the species involved; colony size; previous exposure levels; and the location, altitude, and number of flights (Hunt, 1985). Seabirds may also habituate to air traffic over time (Hunt, 1985). Helicopter flights associated with the proposed projects will originate from either the Santa Maria or the Santa Barbara Airport (both of which are in Santa Barbara County), depending on the unit. The airports and the number of helicopter flights planned for each unit is shown in table 4.0.1-7. Low-flying aircraft, especially helicopters, can disturb nesting birds, causing them to leave their nests unattended. Although the adult(s) may be absent from the nest for only a short period of time, eggs and nestlings may be lost either due to exposure or predators, such as western gulls. Birds that nest on offshore rocks and cliffs are especially vulnerable because they may accidentally cause their eggs or young to fall from cliff ledges when they take flight due to a low-flying helicopter. Helicopters may also disturb roosting birds, such as cormorants, gulls, and pelicans. Helicopter flights may especially be a problem in undisturbed areas like the Pacific Northwest or Alaska. Studies in the Bering Sea have demonstrated that repeated aircraft flights near colonies may have been a factor contributing to fewer nesting attempts and reduced reproductive success of nesting seabirds (Biderman and Drury, 1978; Hunt et al., 1978). Due to the high background level of aircraft flight activity that occurs throughout much of the project area, however, birds may be habituated to this type of disturbance. Flights at low altitudes could still be a problem for nesting birds, however.

Within the project area, the vast majority of seabird colonies are located on the northern Channel Islands within the Channel Islands National Marine Sanctuary and Channel Islands National Park. Helicopter flights from the proposed projects are not expected to cross these areas. However, a small number of seabirds also nest along the mainland from Point Conception, north. The pigeon guillemot is the most abundant nesting seabird in this area (Carter et al., 1992). Other species, including pelagic cormorant, western gull, and rhinoceros auklet, occur in very small numbers. Most nests in this area are located at Point Sal and Point Arguello. Impacts to these species could occur if low altitude (less than 1,000 ft) flights over their colonies take place during the breeding season. Although pigeon guillemots may be the most abundant nesting seabird in this area, they may not be as sensitive to helicopter flights as other species because they nest in cracks and crevices and abandoned burrows. It should also be noted that only those helicopter flights in table 4.0.1-7 that originate from the Santa Maria Airport and service the Point Sal and Purisima Point Units could potentially cross these seabird nesting areas; based on the flight route for the Santa Barbara Airport (T. Marr, Petroleum Helicopters, Inc., pers. comm.), flights from that airport do not cross any seabird colonies. The flight path across the shoreline for helicopters from Santa Maria is well south of Point Sal and does not cross any seabird nesting areas (E. Rudolfs, Arctic Air, pers. comm.). Also, Vandenberg AFB, where most of the seabird colonies that might be exposed are located, has a 1,000 ft flight restriction over the major seabird colonies, which further protects most of the seabirds in this area (N. Read, VAFB, personal comm.). Based on the relatively small number of flights from the Santa Maria Airport, the fact that the normal flight path for helicopters does not cross any seabird colonies, and the flight restrictions on Vandenberg AFB, no impacts to marine and coastal birds from helicopters are expected.

Shorebirds and marshbirds could also be disturbed by low-flying helicopters, but the few species that nest in the project area occur in very low numbers and are unlikely to be affected.

Another activity associated with the proposed projects, well abandonment, could harm seabirds under certain circumstances. Each of the delineation wells in these projects will be permanently plugged and abandoned (section 2). As part of the abandonment process, the casings for these wells may be cut either mechanically or with explosives. Use of explosives raises the possibility of impacts to seabirds. Although no injuries to seabirds from well abandonment with explosives have been reported, brown pelicans, cormorants, gulls, and phalaropes have been killed or injured due to other sources of underwater explosions (Fitch and Young, 1948). To be killed or injured during well abandonment with explosives, a bird would have to be submerged at the exact moment of the explosion. Although safety information is not available for birds, research on fish (Gertner, 1981) and marine mammals (Young, 1991) indicates that, for the amount of explosives used in well abandonment, a safe distance for these animals ranges from about 1,000-2,000 ft, depending on the species (for details, see 5.4.4.1 for fish and 5.4.6.1 for marine mammals). Explosive charges will be set off 5 m (15 ft) below the sea floor, which would dampen the effect of the blast and reduce the area in which birds could be killed or injured; therefore, a bird would probably have to be submerged directly under the MODU to be affected by well abandonment. The seabirds that might be injured are those that forage underwater. These include grebes, loons, shearwaters, scoters, and alcids. Many of these species remain relatively close to shore and would not be affected. Gulls might be attracted to the area by the dead fish that result from underwater explosions, but gulls feed on the surface and would not be affected. Based on the damping effect of the explosions being below the sea floor and the very low probability that seabirds would be both submerged at the exact moment of an explosion and in close enough proximity to be killed or injured, no impacts to marine and coastal birds from well abandonment are expected.

5.2.7.1.1 SUMMARY AND CONCLUSION

No impacts to marine and coastal birds are expected as a result of operations associated with the proposed projects, including helicopter traffic and well abandonment, either for all units combined or any individual unit.

5.2.7.2 CUMULATIVE IMPACT ANALYSIS FOR MARINE AND COASTAL BIRDS (2002-2006)

Since there are no impacts from the Proposed Action on marine and coastal birds, no analysis of cumulative impacts is appropriate here. However, impacts to marine and coastal birds could occur if development of the 36 undeveloped leases occurs. These impacts are discussed in section 6.2.7.

5.2.8 IMPACTS ON MARINE MAMMALS

The impact analysis for marine mammals in this document adopts the following impact level criteria:

HIGH

Impacts result in the loss of hundreds of marine mammals from the project area due to direct mortality, reduced survivorship, declines in reproduction, and/or a shift in distribution. Effects are expected to continue for 5 or more years.

MODERATE

Impacts result in the loss of tens of marine mammals from the project area due to direct mortality, reduced survivorship, declines in reproduction, and/or a shift in distribution. Measurable, area-wide changes in abundance are not expected unless the impacts are confined to a limited area (e.g., San Miguel Island). Effects are expected to continue for 1 to 5 years.

LOW

Impacts result mainly in local changes in behavior (e.g., disruption of foraging) and/or displacement from rookery, haul-out, or foraging habitats due to disturbance. Mortality, if any, would be limited to the loss of a few individuals, although many more might suffer from sublethal effects. Impacts are expected to continue for no more than 1 year.

Impacts below these levels, involving no death or life-threatening injury of any marine mammal, no displacement from preferred habitat, and no more than minor disruption of behavioral patterns, are defined as negligible. For purposes of this document, high and moderate impacts are considered to be significant; low impacts are considered to be insignificant.

Marine Wildlife Contingency Plans. As part of the Project Descriptions submitted to MMS, marine wildlife contingency plans (MWCP's) have been prepared for each of the units where delineation activities are proposed (Aera, 2000a,b; Nuevo, 2000; Samedan, 2000). The MWCP's outline procedures intended to minimize potential impacts to marine mammals from the proposed delineation drilling operations, specifically those involving the use of marine vessels and helicopters.

For marine vessels, the guidelines specify that:

- Support vessels will make every effort to maintain a distance of 1,000 ft (300 m) from sighted whales.
- Support vessels will not cross directly in front of migrating whales.
- When paralleling whales, support vessels will not operate at a speed faster than the whales and will maintain a constant speed.
- Female whales will not be separated from their calves.
- Support vessels will not be used to herd or drive whales.
- If a whale engages in evasive or defensive action, support vessels will drop back until the animal calms or moves out of the area.

The MWCP's also provide guidelines for immediate operator notification of the NMFS Stranding Coordinator in Long Beach in the event of a support vessel collision with a marine mammal.

Support helicopters are advised to maintain at least a 1-mile (1.6-km) distance from observed wildlife concentrations and known wildlife concentrations, such as pinniped haul-out areas. The guidelines call for support helicopters to maintain a minimum overflight altitude of 1,500 ft (460 m) when unexpectedly encountering individuals or groups of whales at sea.

5.2.8.1 IMPACTS OF THE PROPOSED ACTION ON MARINE MAMMALS

The primary impact-producing activities associated with the Proposed Action include delineation drilling operations with associated support activities and are common to all the units. The major impact agents expected from these proposed activities are noise and disturbance and drilling discharges. The potential use of explosives in the abandonment of the delineation wells also raises the possibility of lethal impacts to marine mammals. The following sections describe the sources and types of these potential impacts.

<u>Noise and Disturbance</u>. The proposed activities associated with the delineation projects, including drilling and transportation, are among the most common sources of man-made, low frequency noise that could affect marine mammals. 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).

Offshore Drilling. As described in section 2.2, the semi-submersible drilling rig to be used for the proposed delineation activities will probably be a SEDCO 700-series rig, although the operators have not yet chosen a specific drilling vessel. It is estimated that noise from drilling activities will last less than 2 months at each well location (table 2.1.2-1). The sound levels produced by drilling from conventional, semi-submersible drilling rigs are relatively low (Gales, 1982; Richardson et al., 1995). Greene (1986) estimated source levels of about 154 dB re 1 mPa in the 10- to 500-Hz band for the SEDCO 708 in the Bering Sea. Gales (1982) measured levels of 125 dB re 1 mPa at frequencies of 29-70 Hz at distances of 13-15 m from two diesel-powered semisubmersibles, with somewhat lower infrasonic tones at 7-14 Hz. No source levels were estimated.

The reactions of pinnipeds (seals and sea lions) to offshore drilling noise have not been extensively studied (Richardson et al., 1995). Observations of ringed and bearded seals in Arctic waters indicate some tolerance of drilling noise. Seals were observed to approach and dive within 50 m of a sound projector broadcasting steady low-frequency (less than 350 Hz) drilling sound; received levels at this distance were about 130 dB re 1 mPa (Richardson et al., 1990a, 1991, 1995).

Most studies of the reactions of odontocetes (toothed whales) to offshore drilling noise have involved belugas (Richardson et al., 1995). In one study, belugas exposed to playback sounds from the SEDCO 708 semi-submersible rig reacted in one test at a distance of 300-500 m by increasing swimming rate and turning away from the projector. However, most of the belugas passed close to the projector (Stewart et al., 1983; Richardson et al., 1995). In general, odontocetes appear to be fairly tolerant of drill rig noise (Richardson et al., 1995).

For gray whales off the coast of central California, Malme et al. (1984) recorded a 50-percent response threshold to playbacks of semi-submersible drilling noise at a received level of 120 dB re 1 mPa. A similar playback study with humpback whales (Malme et al., 1985) demonstrated no clear avoidance responses at received levels up to 116 dB re 1 mPa. These levels would be reached well within 100 m of the drill rig in both nearshore and shelf-break waters; therefore, the predicted radius of response for grays, humpbacks, and probably other baleen whales as well, would also be less than 100 m. Richardson et al. (1995) also predicted similar radii of response for odontocetes and pinnipeds.

As discussed in section 4.6.6.1, migrating gray whales generally travel within 3 km (1.6 nm) of the shoreline over most of the route, unless crossing mouths of rivers and straits (Dohl et al., 1983; Braham, 1984a). South of Point Conception, the migration pathway widens; gray whales often cross the Santa Barbara Channel and travel through the Channel Islands (Jones and Swartz, 1987; Dohl et al., 1981, 1983; Bonnell and Daily, 1993). The potential drill sites for the units located north of Point Conception (Point Sal, Purisima, and Bonito) would likely be 8 km (4 nm) or more offshore, well beyond the main migration corridor. Migrating gray whales might be expected to pass relatively close to the drill site on the Gato Canyon Unit, which is located in the western Santa Barbara Channel 5 km (2.7 nm) or more from the mainland shore. However, the very small predicted radius of response for semi-submersible drilling noise makes it unlikely that any disruption of gray whale migration would occur.

Therefore, effects on marine mammals from drilling noise associated with the proposed delineation activities are expected to be restricted to minor, temporary (less than 1-hour) disturbances within approximately 100 m of the drilling rig. These impacts are considered to be negligible.

Vessel Traffic. 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.

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 (JOFLO). 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.

As described in section 2.4, support vessel traffic for the proposed delineation drilling operations will operate out of Port Hueneme, with some possible crew boat trips originating from the Carpinteria Pier. Crew boats will average 2-8 trips per month throughout the approximately 14-month period of delineation drilling activities for all four projects; a total of about 90 trips will occur. Supply boat trips will average 8-12 per month, for a total of approximately 148 trips over the 14 months. As the location of the delineation drilling activities shifts from units in the Santa Maria Basin eastward into the western Santa Barbara Channel (i.e., the activities on the Bonito and Gato Canyon Units), overall support vessel traffic will peak during the first 6 months at about 20 trips per month, then decrease to about 10 trips per month during the final 3 months of activity.

Additionally, fluid produced during the drill stem test of each delineation well will be barged to Long Beach (possibly Port Hueneme for the Bonito Unit) at the end of the testing period. Transportation of the barges will comply with established vessel traffic corridors. A total of 4-10 such trips is estimated to occur over the 14-month duration of the proposed delineation drilling activities.

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 machinery, 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.

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, 1984), 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).

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).

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 level of support vessel and barge traffic associated with the proposed delineation activities is expected to result in temporary (less than 1-hour), localized disturbances to some marine mammals, primarily baleen whales. Collisions between support vessels and marine mammals, while possible, are considered to be highly unlikely events. Impacts from these sources should be lessened by implementation of the marine mammal avoidance guidelines specified in the operators' MWCP's and described above and are expected to be negligible.

Aircraft. 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 OCS Region operates primarily out of Santa Maria, Lompoc, and Santa Barbara airports. Most of this traffic is to and from platforms in the western Santa Barbara Channel and Santa Maria Basin. In addition, several international and numerous smaller airports, along with several military airfields, exist along the southern California coast, and air traffic is a daily or even hourly occurrence in the region.

Beginning in the 1980's, 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."

Although the original ITL is no longer in force, tors in the southern Santa Maria Basin are complying with these restrictions (P. Schroeder, MMS, pers. comm.). Air traffic over the Channel Islands National Marine Sanctuary is restricted by Federal regulation to altitudes greater than 1,000 ft (15 CFR 922.71(a)(5)). Vandenberg AFB also has a 1,000-ft flight restriction over identified harbor seal haul-out areas (N. Read, Vandenberg AFB, pers. comm.). 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. These restrictions would be supplemented by the operators' MWCP guidelines (see above), which call for helicopters to maintain at least a 1-mile (1.6-km) distance from wildlife concentrations on shore and a minimum overflight altitude of 1,500 ft (460 m) at sea.

As described in section 2.4, helicopter trips in support of the proposed delineation activities are expected to average 20-30 per month. Helicopters will operate out of Santa Barbara Airport for activities in the Bonito and Gato Canyon Units and Santa Maria Airport for the Purisima and Point Sal Units. A total of 354 trips are projected for the duration of the projects.

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, and duration varies with depth. 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.

There have been few systematic studies on the reactions of pinnipeds to aircraft, including helicopters (Richardson et al., 1995). Most documented observations of the reactions of pinnipeds to aircraft noise have involved 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; M.O. Pierson, MMS, pers. obs.).

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 being 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.

The level of helicopter traffic associated with the proposed delineation activities is expected to result in temporary (less than 1-hour), localized disturbances to some marine mammals. These impacts should be lessened by implementation of the marine mammal avoidance guidelines specified in the operators' MWCP's and described above and are expected to be negligible.

Well Abandonment. Once the drilling and testing have been completed, each of the delineation wells will be permanently plugged and abandoned (section 2.3). Part of the removal process involves cutting the well casing string 5 m (15 ft) below the sea floor. Well casing may be cut mechanically or with explosives. In the latter case, shaped charges are lowered inside the casing and detonated. Commonly, such charges weigh in the range of 16-20 kg (35-45 lb) (Howorth et al., 1996; Howorth, 1997).

Underwater explosions are the strongest man-made point sources of sound in the sea (Richardson et al., 1995). The underwater pressure signature of a detonating explosion is composed of an initial shock wave, followed by a succession of oscillating bubble pulses (if the explosion is deep enough not to vent through the surface) (Urich, 1983; Richardson et al., 1995). Pulse rise time is very brief (within about a microsecond). The shock wave is a compression wave that expands radially out from the detonation point of an explosion. The wave is supersonic, but is quickly reduced to normal acoustic waves (Twachtman Snyder & Byrd, Inc., 2000). The broadband source level of a 20-kg charge is about 279 dB re 1 μPa, with dominant frequencies below 50 Hz (Richardson et al., 1995).

It has been shown that nearby underwater blasts can injure or kill marine mammals (Richardson et al., 1995). Although pinnipeds, odontocetes, and baleen whales are all known to have been killed by underwater explosives, threshold levels for injury or death are not well established (Fitch and Young, 1948; Ketten et al., 1993; Richardson et al., 1995). In general, damage tends to occur at boundaries between tissues of different densities, with gas-containing organs (such as lungs and intestines) and the auditory system being especially susceptible.

Young (1991) calculated safe distances for several marine animals from underwater explosions of various sizes. These calculations were for open-water blasts and did not account for the dampening effects that would occur if a charge were detonated 5 m below the sea floor. For an approximately 23-kg (50-lb) charge, the estimated safety distances were 530 m (1,750 ft) for odontocetes and 300 m (1,000 ft) for baleen whales.

Richardson et al. (1995) summarize available information on the reported behavioral reactions of marine mammals to underwater explosions. Experience with the use of seal bombs as scare charges indicates that pinnipeds rapidly habituate to and, in general, appear quite tolerant of noise pulses from explosives. Whether hearing damage or other injuries have occurred during these situations is unknown. Likewise, little success has been demonstrated in the use of scare charges to repel odontocetes. An example is the attempted use of seal bombs to move bottlenose dolphins away from platform abandonment areas where larger demolition blasts are about to occur (Klima et al, 1988).

There are few data on the reactions of baleen whales to underwater explosions. Gray whales were apparently unaffected by 9- to 36-kg charges used for seismic exploration (Fitch and Young, 1948). However, Gilmore (1978) felt that similar underwater blasts within a few kilometers of the gray whale migration corridor did "sometimes" interrupt migration. In Newfoundland, humpbacks displayed no overt reactions within about 2 kilometers of 200- to 2,000-kg explosions. Whether habituation and/or hearing damage occurred was unknown, but at least two whales were injured (and probably killed) (Ketten et al., 1993).

As previously stated, the use of explosives for delineation well abandonment would involve the detonation of a relatively small, 16- to 20-kg charge in the well casing 5 m below the sea floor. This positioning of the charge would dampen the explosion and restrict shock and acoustic effects primarily to the area of water immediately above the well head. However, a marine mammal close to the detonation site potentially could be injured or killed, or suffer permanent or temporary hearing damage. Some disturbance of marine mammals present in the vicinity of the detonation area could also occur, but these would be expected to be minor and temporary (less than 1 hour in duration). Overall, impacts from this source are expected to be low. These impacts could be further reduced through the implementation of a wildlife mitigation plan designed to minimize impacts on marine mammals and other marine animals (see Mitigation MM1, below).

Effluent Discharges. The potential effects of OCS 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), the U.S. Environmental Protection Agency (1985), and Neff (1987) do not address the potential effects of OCS discharges on these groups of animals (MMS, 1996). Significant impacts from OCS discharges have not been associated with marine mammals, because they are highly mobile and capable of avoiding such discharge, and their ranges far exceed the extent of the discharge plume.

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. No effects to marine mammals in the project area from effluent discharges associated with the proposed delineation wells are expected.

5.2.8.1.1 SUMMARY AND CONCLUSIONS

In summary, effects to marine mammals from noise and disturbance resulting from most activities associated with the Proposed Action, including drilling, support vessel and barge traffic, helicopter traffic, and delineation well abandonment, are expected to be restricted to temporary (less than 1-hour), localized disturbances. These impacts are considered to be negligible. The use of explosives for delineation well abandonment also raises the possibility that a marine mammal could be killed, injured, or suffer hearing damage. Overall, impacts from this source are expected to be low and could be further reduced through mitigation (see Mitigation MM1, below).

Overall, activities associated with the proposed delineation activities are expected to cause negligible to low impacts to marine mammals in the project area. These impacts would be common to all units and would remain the same for all units combined.

5.2.8.1.2 MITIGATION MEASURES FOR IMPACTS FROM THE PROPOSED ACTION

Mitigation MM1 (Explosive Subsea Removal): Avoiding impacts to marine mammals and sea turtles from the use of explosives for well and platform abandonment on the Pacific OCS would require implementation of a wildlife mitigation plan similar to those employed for platform removal in California State waters (Howorth, 1997) and in the MMS Gulf of Mexico OCS Region (NTL 99-G21). Typically, such a plan has included the use of shipboard observers or divers (possibly supplemented by aerial surveys), the establishment of a safety zone around the detonation site, and monitoring of the zone to ensure that no animals are present when the charge is detonated.

Implementation of this mitigation would make it unlikely that any marine mammal injury or mortality would occur as a result of well abandonment operations associated with the proposed delineation activities. Since 1986, during explosive removals of offshore platforms in the Gulf of Mexico (where a 915-m safety zone is employed), no confirmed marine mammal blast injuries or mortality have been reported. Impacts to marine mammals would be negligible.

5.2.8.2 CUMULATIVE IMPACT ANALYSIS FOR MARINE MAMMALS (2002-2006)

Cumulative Impacts without the Proposed Action: Section 5.1.2 describes the projects considered in the cumulative analysis for the proposed delineation activities. Possible sources of cumulative impacts in the project area include on-going and proposed oil and gas activities in Federal and State waters, Alaskan and foreign-import tankering, and military operations. Cumulative impacts to marine mammals may also occur from commercial fishing operations, shipping activities, and other anthropogenic and non-anthropogenic sources.

The projects discussed in this section include past, present, and foreseeable actions that may produce impacts during 2002-2006, the expected duration of the proposed delineation activities. Potential cumulative impacts are discussed below.

Offshore Oil and Gas Activities. Section 4.0 describes the offshore oil and gas activities that may result in impacts to marine mammals. These include geophysical surveys, construction, drilling and production activities with associated support activities, and the abandonment, or decommissioning, of wells and offshore facilities. As discussed in section 5.2.1, the major impact agents expected from these proposed activities are noise and disturbance. The potential use of explosives in the abandonment of wells and offshore platforms also raises the possibility of lethal impacts to marine mammals.

Section 5.2.8.1 discusses the potential impacts to marine mammals from offshore oil and gas activities including well drilling, support vessel and helicopter traffic, and well abandonment. The potential impacts from geophysical surveys, construction, and platform-based development and production operations are discussed below.

Geophysical Surveys. Section 4.0 describes past geological and geophysical survey activities in the Pacific OCS Region. Since 1963, more than 400 geological and geophysical surveys, including both 2-D and 3-D seismic surveys, have been conducted in the Santa Barbara Channel and Santa Maria Basin (tables 4.0.1-2 and 4.0.1-3), and many others have occurred in State waters. Most of these surveys occurred during the 1970's and 1980's; the most recent seismic survey offshore southern California was an Exxon 3-D seismic survey conducted in the western Santa Barbara Channel in 1995 (MMS, 1995). No Pacific OCS operators have approached MMS with proposals to conduct such surveys to date, although additional 2-D or 3-D seismic surveys may occur during the next few years.

The potential impacts to marine mammals from the intense, low-frequency sounds produced by the airguns used to conduct offshore seismic surveys have become the focus of increasing concern in recent years (Malme et al., 1983, 1984; Turnpenny and Nedwell, 1994; Richardson et al., 1995; HESS, 1999; McCaughley et al., 2000; Pierson et al., 2001). Richardson et al. (1995) provide a detailed review of the available information. In summary, based on available information (Richardson et al., 1995; McCaughley et al., 2000), marine mammals would have to be very close to an operating airgun array, probably within 100 m, to be at risk of temporary or permanent hearing damage. The most likely effect of seismic surveys on marine mammals is short-term avoidance behavior. Data on the reactions of pinnipeds and odontocetes to seismic noise are relatively limited and inconclusive; however, some brief and localized avoidance responses from these small marine mammals could occur. Baleen whales are known to react to seismic survey noise and would be expected to display the most overt behavioral reactions, including active avoidance and changes in respiration and diving patterns. Based on information from field studies, the baleen whales in the vicinity of a seismic survey area would be likely to react at distances of 5-8 km (2.5-4 nm) or more from an airgun array.

Construction. As described in section 4.0, construction activities include the installation of platform jackets and topsides, the laying of pipelines, platform hook-up and commissioning, and the initiation of drilling. From 1967 to 1992, 19 OCS platforms and associated pipelines were installed in the Santa Barbara Channel and Santa Maria Basin (table 4.0.1-6). All of these platforms are still in place. Seven offshore platforms were installed in State waters in this area between 1958 and 1966, but only one, Platform Holly near Goleta, remains. No new offshore construction is expected to occur during the 2002-2006 duration of the proposed delineation activities.

Very little information exists on the noise produced by offshore construction activities. Most of the studies of marine construction noise have dealt with the construction of offshore oil industry facilities in shallow arctic waters and have focused on marine dredging (Richardson et al., 1995). These operations can be strong sources of continuous noise in nearshore waters. Broadband source levels of 172-185 dB re 1 :Pa-m have been recorded for dredging activities (Richardson et al., 1995). Although some higher frequency tones are produced, most of the energy is low frequency, below about 1,000 Hz, and dredge noise is usually undetectable in shallow water at ranges beyond 20-25 km.

The effects of dredging and other construction activities on marine mammals have received little study (Richardson et al., 1995). Pile-driving activities at a platform construction site in the Santa Barbara Channel had no apparent effect on the behavior of dolphins passing at an average distance of 3.5-4.3 km (1.9-2.3 nm) (Dames and Moore, 1990). In two instances, migrating gray whales that were passing 5-8 km (3-4 nm) from the same platform construction site in the Santa Barbara Channel were not observed to react to pile-driving activities (Dames and Moore, 1990). There are observations from studies in the Arctic indicating that belugas and bowhead whales may tolerate considerable dredge noise, but are more sensitive to moving tug-dredge combinations than to stationary dredges (Malme et al., 1989). In one experimental study of bowhead whales (Richardson et al., 1990b), whales exposed to recorded dredge noise at received levels of 122-131 dB re 1 Pa (21-30 dB above ambient) exhibited avoidance by stopping feeding and moving away from within 0.8 km (0.4 nm) of the sound projector to locations more than 2 km (1 nm) away. However, there is some evidence of habituation by bowhead whales to actual dredging activity (Richardson et al., 1995).

Migrating gray whales were monitored during an offshore pipeline construction project in the Santa Barbara Channel in 1991-1992 (Woodhouse and Howorth, 1992). The lack of baseline data made it impossible to determine whether gray whale migration pathways were altered. However, hundreds of whales did move through the project area on both the southbound and northbound legs of their migration, and although some animals appeared to make local course changes around construction activities, the authors found no evidence that gray whales were deterred in their migration activity by the construction. In general, marine mammal reactions to construction activities would likely involve temporary avoidance behavior at distances of 2 km (1 nm) or less from the operations.

Development and Production. Section 4.0 describes offshore development and production activities in the Pacific OCS Region. There currently are 23 offshore platforms in the Pacific OCS Region (table 4.0.1-5). Of these, 4 are in the Santa Maria Basin, 15 are in the Santa Barbara Channel, and 4 are in San Pedro Bay. As of February 2001, more than 1,200 wells had been drilled in the Pacific OCS Region. This number includes 890 oil and gas development wells drilled from platforms and 326 exploratory wells drilled from a variety of rigs, including mobile offshore drilling units (MODU's), jack-ups, barges, and drill ships. Currently, based on data from 1996 through 1999, slightly less than 2 development wells per month are begun from Region platforms. No exploratory wells have been drilled in the Pacific OCS Region since 1989.

Section 5.2.8.1 discusses the sound levels produced by semi-submersible drilling rigs and the potential impacts to marine mammals. 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). 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 mPa. The highest frequencies recorded were at about 1.2 kHz. Richardson et al. (1995) predict that the radii of audibility for baleen whales for production platform noise would be about 2.5 km (1.3 nm) in nearshore waters and 2 km (1 nm) near the shelf break.

For gray whales off the coast of central California, Malme et al. (1984) recorded a 50-percent response threshold to playbacks of drilling noise at 123 dB re 1 mPa (and about 117 dB re 1 mPa in the 1/3-octave band). This is well within 100 m (330 ft) 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.

Vessel Traffic. Section 4.0 discusses crew and supply boat operations in the Pacific OCS Region. Current levels of support vessel traffic for offshore platforms in both Federal and State waters are presented in table 4.0.1-6. Support of development and production activities in the eastern and central Santa Barbara Channel primarily involves crew and supply boats. Crew changes for platforms in the Santa Maria Basin are conducted by helicopter (see discussion in next section), resulting in lower levels of support boat traffic. In the Channel and Basin, approximately 90-140 crew boat and 10-12 supply boat trips are made each week. An additional 25 crew boat trips are made each week to State Platform Holly. Support vessels operate out of Port Hueneme, Ventura Harbor, Carpinteria Pier, or Ellwood Pier. It should be noted that many of these trips, particularly to the platforms off Carpinteria, are relatively short and that many trips may service more than one platform.

Section 5.2.8.1 discusses the sound levels produced by support vessels and the potential impacts to marine mammals. As discussed in section 5.0, the highest levels of support vessel traffic to a platform may be expected during the construction phase. During this phase, crew boat trips may occur as often as three times per day and supply boat trips twice per day for brief periods (table 4.0.1-7).

As discussed in section 5.2.8.1, the continued levels of support vessel traffic associated with offshore oil and gas activities in the project area are expected to result in temporary (less than 1-hour), localized disturbances to some marine mammals, primarily baleen whales. Collisions between support vessels and marine mammals, while possible, are considered to be highly unlikely events.

Aircraft. Section 4.0 discusses support helicopter operations in the Pacific OCS Region. Current levels of support helicopter traffic for offshore platforms in both Federal and State waters are presented in table 4.0.1-6. As discussed in section 4.0, the highest levels of support helicopter traffic to a platform may be expected during the construction phase. During this phase, helicopter trips to a single platform may occur as often as 7 times per day for brief periods (table 4.0.1-7). Support helicopter traffic is confined to platforms in the western Santa Barbara Channel and Santa Maria Basin, where 6-8 helicopter trips occur per day. These flights originate from the Santa Barbara and Santa Maria airports.

Section 5.2.8.1 discusses the sound levels produced by helicopters and the potential impacts to marine mammals. The levels of helicopter traffic associated with offshore oil and gas activities in the project area are expected to result in temporary (less than 1-hour), localized disturbances to some marine mammals.

Offshore Facility Decommissioning. Section 5.2.8.1 discusses the process of exploratory well abandonment and the associated potential impacts to marine mammals. Section 4.0 describes the processes involved in decommissioning offshore facilities. For purposes of analysis, it is assumed that decommissioning would encompass the complete removal of a platform and associated pipelines, with none of the leg structure left in place to form an artificial reef. To date, only one facility in the Pacific OCS Region has been decommissioned—the Offshore Storage and Treatment (OS&T) vessel that formerly served the Santa Ynez Unit platforms in the Santa Barbara Channel. In addition, six offshore platforms in State waters in the Channel have been removed—two in 1988 and four in 1996 (table 4.0.1-6). No offshore decommissioning activities are expected to occur in either Federal or State waters during the 2002-2006 duration of the proposed delineation activities.

Oil Spills. No oil spills are expected to result from the Proposed Action. As discussed in section 5.1.3, the cumulative oil spill risk for the project area results from several sources: ongoing and projected oil and gas production from existing OCS facilities in the Santa Barbara Channel and Santa Maria Basin, several proposed development projects on the Federal OCS, ongoing production from one facility in State waters in the Santa Barbara Channel, two reasonably foreseeable oil and gas projects in State waters, and the tankering of Alaskan and foreign-import oil through area waters. Tables 5.1.3.1-2 and 5.1.3.1-3 present the estimated mean number of spills of various sizes and the probability of their occurrence as a result of the described activities.

The most likely oil spill scenario for existing and proposed offshore oil and gas activities is that one or more oil spills in the 50-1,000-bbl range would occur over the period 2002-2006, and that such a spill would most likely be 200 bbl or less in volume. The probability that one or more spills of this size will occur this period is 75.9 percent (table 5.1.3.1-2). The maximum reasonably foreseeable oil spill volume from future offshore oil and gas activities is 2,000 bbl, assumed for purposes of analysis to be a pipeline spill. The probability of a spill of this size occurring during the period 2002-2006 is 23.3 percent (table 5.1.3.1-3). Based on data from tanker spills in U.S. waters, the mean size for a tanker spill is assumed to be 22,800 bbl (with a probability of occurrence of 99 percent for this period; table 5.1.3.1-3). The rationale for these estimated spill sizes is presented in section 5.1.3. The potential impacts to marine mammals in the project area from spills of each of these three sizes are discussed below.

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.

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 (Harvey and Dahlheim, 1994; 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). Most vulnerable to the direct effects of oiling among the pinnipeds are fur seals and newborn pups, which lack a thick insulating layer of fat (see section 5.2.9.2 for a discussion of oil spill impacts on sea otters). Frost et al. (1994) 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. Indeed, the majority of the dead harbor seals recovered were pups (Spraker et al., 1994). It should also be noted, however, that this mortality estimate has been questioned (Hoover-Miller et al., 2001). 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).

As stated above, it is assumed that the most likely size for a spill occurring from offshore oil and gas activities in the Pacific OCS Region is 200 bbl or less. If a spill of this size were to occur in the Santa Barbara Channel or Santa Maria Basin, it could contact the mainland shoreline or one of the northern Channel Islands. The largest aggregations of marine mammals in this area are found on San Miguel Island, which is at the western end of the chain and is part of the Channel Islands National Marine Sanctuary and National Park (section 4.6.9). However, San Miguel is approximately 40 km (20 nm) from Platform Heritage, the nearest offshore facility. A 200-bbl spill would be unlikely to reach the island and would not be considered a threat to marine mammals on San Miguel.

Data from moored current meters and surface-drifter trajectory observations (section 5.1.3) indicate that north of Point Conception a spill could move northward along the mainland coast, typically during relaxation current events when the wind is low. Individual drifters made landfall along the coast as far north as Point Lobos within 10 days. However, when averaged over all flow regimes, the most likely northern limit of shoreline spill contact is Ragged Point, near the southern end of the Big Sur coast and within the Monterey Bay National Marine Sanctuary (section 4.6.9).

Thus, it is possible that a 200-bbl spill would contact the shoreline in this area, although probably well south of Ragged Point. Predicting the length of coastline affected by an oil spill that comes ashore is extremely difficult due to the complexity of the transport process, which depends on factors such as nearshore wind patterns and currents, coastal bathymetry, tidal movements, and turbulent flow processes. Using historical data on marine spills, Ford (Ford, 1985; Ford and Bonnell, 1987) devised a model to simulate the length of coastline that could be contaminated. A recent assessment of the potential impact of oil spills on California sea otters by Brody et al. (1996) provides support for the general validity of the Ford model.

Based on the multiple regression equations developed by Ford, a 200-bbl spill would be expected to oil a mean stretch of 4-5 km (2-3 nm) of shoreline (Ford, 1985). The model further predicts a 95-percent probability that a 200-bbl spill reaching shore would contact a length of coastline greater than 1 km (0.5 nm) and a 5-percent probability that it would contact a length of shoreline greater than about 19 km (10 nm). Based on experience with past spills, continuous contact along such a length of shoreline would be unlikely. Rapid spill response (see section 5.1.3) would further limit shoreline contact.

Seasonally, the most vulnerable marine mammal resources along the coast between Point Conception and Ragged Point would be harbor seal hauling areas and pupping beaches during early spring. Harbor seal pups are very precocial and may enter the water soon after birth (Hoover, 1988; Riedman, 1990). In addition, harbor seal females may return to the water several times per day between nursing bouts, increasing opportunities for repeated contact with oil (McLaren, 1990). Northern elephant seals, which breed and pup on a rookery near Point Piedras Blancas during the winter, are considered less susceptible to the effects of oiling, given their larger size and the fact that females and pups remain ashore throughout the lactation period (Le Boeuf, 1971; McLaren, 1990; St. Aubin, 1990).

If a 200-bbl spill were to contact a harbor seal haul-out in this area, a few animals could be oiled. The *Exxon Valdez* oil spill demonstrated that harbor seals are susceptible to the effects of oiling (Frost et al., 1994; Lowry et al., 1994; Hoover-Miller et al., 2001). However, based on experience with past spills of this size in this general area (e.g., the 1997 Torch pipeline spill), it is doubtful that a spill of this size would result in mortality.

It is also unlikely that a 200-bbl spill would have more than a negligible impact on pinniped or cetacean populations at sea in the project area. As discussed in the 1984 EIR/EIS for development of the Point Arguello Unit (ADL, 1984), likely impacts could involve the oiling of a few individuals and/or temporary displacement from small areas of the western Santa Barbara Channel or southern Santa Maria Basin.

As stated above, the most likely maximum size of a major oil spill from future oil and gas development—the maximum reasonably foreseeable oil spill volume—is 2,000 bbl. A 2,000-bbl oil spill in this area could have more serious impacts on marine mammals, including longer-term displacement and some mortality. Based on the Ford model, a 2,000-bbl spill would be expected to oil a mean stretch of about 12 km (6 nm) of shoreline (Ford, 1985). The model further predicts a 95-percent probability that a 2,000-bbl spill reaching shore would contact a length of coastline greater than 3 km (1.5 nm) and a 5-percent probability that it would contact a length of shoreline greater than about 52 km (28 nm).

Again, the species most likely to be affected would be harbor seals. A 2,000-bbl spill could cause some pup mortality if it oiled harbor seal pupping beaches during the early spring. Elephant seals might also suffer some pup mortality if their rookery were contacted. Overall, impacts to marine mammals from a spill of this volume would be expected to be low.

Marine Tankers. As discussed in section 5.1.3, none of the oil produced on the Pacific OCS is transported by tanker. However, the tankering of foreign and Alaskan oil along the U.S. west coast does present an oil spill risk. The effects of a 22,800-bbl tanker spill on marine mammals in the project area potentially could be much more serious. Based on the Ford model, a 22,800-bbl spill would be expected to oil a mean stretch of about 39 km (21 nm) of shoreline (Ford, 1985). The model further predicts a 95-percent probability that a 22,800-bbl spill reaching shore would contact a length of coastline greater than 9 km (5 nm) and a 5-percent probability that it would contact a length of shoreline greater than about 161 km (87 nm). This may be somewhat of an overestimate, since U.S.-flagged oil tankers are now voluntarily transiting the coast north of Point Conception at distances of 90 km (50 nm) or more offshore, and a tanker spill in this area would likely occur relatively far from shore.

The effects of a tanker spill of this size on marine mammals would be most serious if the spill were to contact sensitive shoreline areas. As discussed above, northern fur seals depend on their dense underfur for insulation and thus are very vulnerable to the thermal effects of oiling. If a spill of this volume were to contact the fur seal rookery on Castle Rock off San Miguel Island during the summer breeding season, considerable adult and pup mortality could ensue. California sea lions, which breed nearby at Point Bennett on San Miguel, might also suffer some pup mortality. Local impacts to pinniped populations could range from moderate to high.

Although, as discussed above, cetaceans are considered to be less vulnerable to the effects of oiling than pinnipeds (Geraci, 1990; Würsig, 1990), a 22,800-bbl tanker spill would probably have some effect on cetaceans in the project area. Gray whales do relatively little feeding along the migration route (Oliver et al., 1983; Nerini, 1984); based on experience with the 1969 Santa Barbara spill (Battelle Memorial Institute, 1969; Geraci, 1990), a spill of this size would not be likely to disrupt the gray whale migration through the project area. (Potential impacts on endangered baleen whales are discussed in section 5.2.9.2.)

Although Würsig (1990) believes that odontocetes in general are too mobile and wide-ranging to be much threatened by oil, he does think that harbor porpoises may be at greater risk from oil spills than other odontocetes due to their restricted nearshore habitat. The same may be true of the nearshore California population of bottlenose dolphins. Densities of these two species are low in project area waters (Bonnell and Dailey, 1993; Forney et al., 2000), and it is considered unlikely that mortality would occur. However, it is unclear whether either of these species would avoid oiled areas (see Smultea and Würsig, 1995), and a substantial portion of their nearshore foraging habitat could be affected by a spill of this size. This could increase the potential for indirect effects, such as through the consumption of oiled prey. Impacts on nearshore odontocetes would be expected to be low.

<u>Military Activities</u>. Military operations that may have offshore impacts in the project area include those conducted from NAS Point Mugu and Vandenberg AFB (section 4.14). A recent draft EIS (U.S. Navy, 2000) analyzes the potential impacts of ongoing and proposed military activities in the U.S. Navy's Point Mugu Sea Range, which occupies a broad expanse of offshore waters in the Southern California Bight and Santa Maria Basin (figure 4.14-1). Navy activities in the Sea Range include vessel, aircraft, and missile operations. The EIS concludes that impacts to marine mammals would be less than significant and limited to short-term hearing effects for small numbers of marine mammals and some disturbance to pinnipeds hauled-out on San Nicolas Island.

Vandenberg AFB is located on the central coast between Point Arguello and Point Sal. The Air Force's primary missions at Vandenberg are launching and tracking satellites in space and testing and evaluating missile systems (U.S. Navy, 2000). These operations periodically result in temporary disturbance to marine mammals, particularly harbor seals, along the nearby shoreline (Thorson et al., 1998). Although the effect of launch noise on pinniped hearing is unknown, limited experimental evidence suggests that pinnipeds exposed to sonic booms produced by missiles in flight may be at risk of temporary hearing threshold shifts (Stewart et al., 1996; Thorson et al., 1998).

In addition, the U.S. Navy is developing a new sonar system to improve its antisubmarine warfare (ASW) capabilities. The Navy proposes to deploy up to four Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar systems worldwide for use in training, testing, and military operations. The high source levels and low frequencies (100-500 Hz) employed in this system have raised concerns over potential noise-related impacts to marine mammals. In response, the Navy has prepared an EIS (U.S. Navy, 2001) to analyze the potential impacts of the Proposed Action and has developed several mitigation and monitoring measures. These include limiting operations in coastal waters to prevent sound pressure levels of 180 dB greater from occurring within 22 km (12 nm) of land. Monitoring during LFA sonar operations would involve visual monitoring for marine mammals and sea turtles during daylight hours by trained personnel, plus both passive and active acoustic monitoring.

Given these measures and the small number of systems to be deployed worldwide, the Navy has concluded that the potential impacts on any stock of marine mammals from injury would be negligible and effects from significant change in a biologically significant behavior would be minimal. However, since the potential for incidental take of marine mammals does exist, the Navy is requesting a Letter of Authorization from NMFS.

<u>Commercial Fisheries</u>. Marine mammals are taken incidentally in a number of commercial fisheries along the U.S. west coast. Off California, greatest mortality in recent years has been recorded in the nearshore set gillnet and offshore drift gillnet fisheries (Barlow et al., 1998; Ferraro et al., 2000; Forney et al., 2000). However, marine mammal entanglement rates in the drift gillnet fishery have dropped substantially since a Take Reduction Plan involving the use of pingers was implemented in 1997 (Barlow and Cameron, 1999; Forney et al., 2000). The set gillnet fishery also has undergone changes and redistribu-

tion of effort since 1994 (Forney et al., 2000). Other fisheries in which marine mammal mortality has been documented include the offshore groundfish trawl fisheries, purse seine fisheries for squid and other species, troll fisheries for salmon and other species, the salmon net pen fishery, and the commercial passenger fishing vessel industry (Forney et al., 2000).

The minimum total fisheries-related take of California or west coast marine mammals currently appears to be more than 1,500 animals per year (Barlow et al., 1998; Ferraro et al., 2000; Forney et al., 2000). More than 1,000 of these are taken in the California angel shark/halibut set gillnet fishery. Most of the remainder are taken in the California-Oregon thresher shark/swordfish drift gillnet fisheries.

Most of this mortality involves pinnipeds and small cetaceans. More than 72 percent (>1,200) of the marine mammals taken are California sea lions; other pinniped species, including harbor seals, northern elephant seals, and a few Steller sea lions, account for about 14 percent (>250). Small cetaceans represent nearly 10 percent of the average annual take. The species most frequently involved include short-beaked common dolphin, harbor porpoise, northern right whale dolphin, Dall's porpoise, Pacific white-sided dolphin, and Risso's dolphin, but almost all cetacean species that occur in this area have experienced fishery-related mortality.

Of these, only the incidental take of harbor porpoises is of concern at the stock level. Harbor porpoise mortality is largely limited to the halibut set gillnet fishery in central California, where fishing effort has approximately doubled since 1995 (with the majority of recent effort in southern Monterey Bay) (Forney et al, 2000). Entanglement rates apparently have increased substantially since the early 1990's, and the estimated mean annual take for recent years (63) is above the calculated Potential Biological Removal (PBR) for the central California stock (42 per year) (Forney et al., 2000).

Although some mortality of large whales may occur (Heyning and Lewis, 1990; Mazzuca et al., 1998), large rorquals (such as blue and fin whales) are reported to be capable of swimming through nets without entangling (Forney et al., 2000). Because of their nearshore migration route, gray whales may be somewhat more susceptible to fisheries-related mortality than other large whales. In the 1990's, three gray whale mortalities were reported from the California-Oregon thresher shark/swordfish drift gillnet fishery and Makah Tribal set gillnet fishery in Washington State (Ferraro et al., 2000). Using these and other data, Ferraro et al. (2000) estimated a minimum annual fisheries mortality rate of 6.0 for the gray whale. They concluded that these mortalities are likely below 10 percent of the PBR and therefore can be considered insignificant.

<u>Other Anthropogenic Sources of Impacts</u>. Ship strikes are a recognized source of whale mortality. Eleven species are known to have been hit, including fin (the most frequently recorded), right, humpback, sperm, gray and minke whales (Laist et al., 2001). Most lethal or severe injuries to whales appear to be caused by ships measuring 80 m (260 ft) or more in length and travelling at speeds of 26 kph (14 kts) or greater (Laist et al., 2001).

As is the case with fisheries-related mortality (see above), the gray whale's nearshore migration may increase the potential for collision with ships (Rugh et al., 1999); five gray whale mortalities from ship strikes were recorded off California from 1993 to 1995 (Ferraro et al., 2000). Ferraro et al. (2000) consider this annual mortality rate of one to two gray whales per year to be a minimum estimate.

Although vessel strikes of the smaller toothed whales are rarely observed, one killer whale ship-strike mortality was recorded in the Bering Sea ground fish trawl fishery in 1998 (Forney et al., 2000).

Pinnipeds, including California sea lions, harbor seals, and northern elephant seals, are occasionally killed in collisions with boats. As discussed in section 5.2.8.1, the single reported collision between an oil industry support vessel and a marine mammal off southern California involved an elephant seal. Other sources of human-related pinniped mortality in California include shooting, entrainment in power plants, and entanglement in marine debris.

For cetaceans, especially baleen whales such as the gray whale, an additional source of potential impact is the whale-watching industry. Whale-watching boats attempt to approach whales as closely as possible, creating a potential for disturbance and displacement from essential habitat. In California, this is a major, seasonal industry—in the 1996-1997 season, more than 40,000 people took part on six Los Angeles-based boats alone (Rugh et al., 1999). Although whale-watching guidelines specify a minimum approach of 100 yards (or 100 m) and recommend that boats approach whales from the rear and avoid separating cow-calf pairs, there is little enforcement. Private boats, including jetskis, are a serious problem; at times, 8-12 boats may be following a single whale (Rugh et al., 1999).

The eastern North Pacific gray whale population is the only marine mammal stock occurring in the project area that is subject to subsistence hunting. The current (1998-2002) International Whaling Commission (IWC) quota allows for a harvest of 140 gray whales per year for local consumption (NMFS, 2001). In Russia between 1990-1998, aboriginal hunters averaged 139 whales per year along the Chukhotka Peninsula; the Russian Federation has agreed to take no more than 135 per year during 1998-2002 (NMFS, 2001).

No take has been allowed in Alaska by the IWC since 1991. However, there were 2 incidental takes by an Alaskan Native in 1995 (Quan, 1999). The Makah tribe of Washington received a 5-year quota to harvest 20 gray whales for ceremonial and subsistence purposes, with an allowed take of up to 5 per year during 1998-2002. One whale was struck and killed in May 1999 (NMFS, 2001).

Marine pollutants present a potential health hazard for marine mammals (O'Shea, 1999). Marine mammals include high-order marine predators that may be affected by the bioaccumulation of contaminants (Reijnders, 1986). Most marine mammal species have large stores of fat, acting both as insulation and as an energy reserve. Lipophilic contaminants can accumulate in this tissue and may be released at high concentrations when the energy reserves are mobilized (UNEP, 1991). No marine mammal deaths in the wild have conclusively been shown to result directly from exposure to organochlorines or toxic elements (O'Shea, 1999). In a few highly polluted areas, reproductive impairment and gross lesions in association with organochlorine contamination have been demonstrated, although there have been few cause-and-effect studies; the evidence for linkages with increased susceptibility to disease is mixed (O'Shea, 1999; O'Shea et al., 1999). Although the detrimental impacts of organochlorine contaminants on marine mammal populations have not been demonstrated with scientific certainty, there is a growing body of circumstantial evidence that such effects are occurring (O'Shea, 1999).

Few west-coast cetacean species have been tested for the presence of contaminants. However, pollutant levels, especially DDT residue levels, measured in California coastal bottlenose dolphins were found to be among the highest of any cetacean examined (O'Shea et al., 1980; Schafer et al., 1984; Forney et al., 2000). Results from the analysis of samples taken from killer whales in British Columbia coastal waters suggest that killer whales in the northeastern Pacific Ocean are highly contaminated with polychlorinated biphenyls (PCBs) and that the marine mammal-eating transient whales may be at particular risk for adverse effects (Ross et al., 2000).

A gray whale contaminant study has been conducted by Tilbury et al. (1999). The authors theorized that gray whale fasting during migration could alter the disposition of toxic chemicals within the whale's bodies. Thus, the whales may retain contaminants such as PCBs during fasting. Elevated levels of certain trace elements (e.g., cadmium) and aluminum in the tissues of stranded and harvested gray whales, compared with other marine mammals, were felt to be consistent with the ingestion of sediment during feeding.

A recent assessment of organochlorine levels in eastern North Pacific gray whales indicates that reproductive females may transfer contaminants to their calves, although the effects of observed contaminant levels on fetal development and calf health have not been determined (Krahn et al., 2000; NMFS, 2001). Tissue samples from two gray whales in Washington State revealed organochlorine (PCB and DDT) concentrations below U.S. Food and Drug Administration regulatory tolerance limits for human consumption based on fish and shell fish guidelines (Ylitalo et al., 1999; NMFS, 2001).

Pinnipeds such as California sea lions and harbor seals are primarily coastal animals and are probably susceptible to the effects of coastal pollution. Organic pollutants are known to cause reproductive failure in harbor seals (Reijnders, 1986). In the early 1970's, DeLong et al. (1973) suggested a possible cause-effect relationship between high levels of organic pollutants and premature births in California sea lions, but this apparently involved only a small percentage of annual pup production. Total DDT residues in California sea lions from southern and central California were high in the early 1970's (average levels up to 911 ppm wet weight) (Le Boeuf and Bonnell, 1971; DeLong et al., 1973); by the early 1990's, sampled levels were substantially lower (average levels of 5-24 ppm wet weight) (Lieberg-Clark et al., 1995). This trend, plus the cessation of DDT production, suggests that organochlorine contaminant levels will continue to drop (B.J. Le Boeuf, UC Santa Cruz, pers. comm.).

<u>Non-anthropogenic Sources of Impacts</u>. A number of diseases are known to occur in wild marine mammal populations (Geraci and Lounsbury, 1993). Except for leptospirosis in California sea lions (Gilmartin et al., 1976; Dierauf et al., 1985) and northern fur seals (York, 1987), bacteria do not appear to be significant agents of disease in marine mammals (Geraci and Lounsbury, 1993). However, viruses have emerged as serious pathogens in several species of cetaceans and pinnipeds (Geraci and Lounsbury, 1993). Morbillivirus was implicated in the 1987-1988 mass mortality of bottlenose dolphins on the U.S. Atlantic coast (Lipscomb et al., 1994) and apparently killed hundreds of striped dolphins (*Stenella coeruleoalba*) in the Mediterranean in the early 1990's (Duignan et al., 1992). The California coastal population of bottlenose dolphins may be vulnerable to the effects of similar morbillivirus outbreaks (Forney et al., 2000).

One type of morbillivirus, phocine distemper virus, was first described in the late 1980's, and outbreaks in western Europe were associated with the death of thousands of harbor seals (Ham-Lammé et al., 1999). Recent data on west-coast harbor seals reveal that morbillivirus is not endemic in the population, indicating that this population may be extremely susceptible to an epizootic of the disease (Ham-Lammé et al., 1999). A calcivirus, identified as the San Miguel sea lion virus, is known to infect at least 11 species of marine mammals, including sea lions, fur seals, elephant seals, gray and sperm whales, and bottlenose dolphins (Smith et al., 1998).

A number of naturally occurring marine toxins are known to have killed marine mammals (Geraci and Lounsbury, 1993). Saxitoxin produced by the dinoflagellate *Gonyaulax tamarensis* (responsible for paralytic shellfish poisoning in humans) killed at least 14 humpback whales off New England in the late 1980's (Geraci et al., 1989). During the same period, a brevetoxin produced by the dinoflagellate *Gymnodinium breve* was implicated in mass bottlenose dolphin mortality along the U.S. Atlantic coast (Geraci, 1989). In 1998, an outbreak of domoic acid toxicity resulting from a bloom of the diatom *Pseudonitzchia australis* affected tens of California sea lions along the California coast (Gulland, 2000).

For reasons that are not yet understood, gray whales have been stranding with increasing frequency during the last two or three years. Norman et al. (2000) reported that 273 gray whales stranded in 1999 along the west coast of North America from Alaska to Mexico, a number that is 5-13 times higher than annual stranding counts from 1995 to 1998 (IWC, 2000; NMFS, 2001). An additional 291 gray whale strandings were recorded in the U.S. and Mexico during the first five months of 2000 (NMFS, 2001). Although the IWC Scientific Committee concluded that the increase in per capita mortality rate indicated by these strandings, plus observed decreases in calf production in 1999 and 2000, could have caused an overall decrease in the abundance of the eastern North Pacific gray whale population, the current status of the stock cannot be assessed without new survey data (NMFS, 2001).

Four strong El Niño events in the past 30 years have adversely affected the annual production, pup mortality, and pup growth of California pinniped populations, particularly on the Channel Islands (DeLong and Melin, 2000). The species affected include the California sea lion, northern fur seal, and, to a lesser extent, northern elephant seal. Such strong El Niño events can reduce population levels for several years.

Incremental Impacts Associated of the Proposed Action (2002-2006): As discussed in section 5.2.8.1, activities associated with the proposed delineation activities are expected to result in temporary (less than 1-hour), localized disturbances to some marine mammals in the project area. These impacts are considered to be negligible to low. No impacts are expected from effluent discharges.

SUMMARY AND CONCLUSIONS (2002-2006):

Currently, the primary source of human-related impacts to marine mammals in the project area is incidental take in commercial fishing operations. However, these impacts are likely to decrease as additional restrictions and mitigation measures are imposed on coastal fisheries. For non-threatened and endangered species, the incidental take of harbor porpoises is of greatest concern at present.

Gray whales are also subject to a subsistence harvest in the Russian Arctic, although this source of mortality is not believed to have a significant effect on the population. However, the recent increase in gray whale strandings has raised concerns that an overall population decline may be occurring.

Although the effects of noise and disturbance generated by the Proposed Action are not expected to be significant in themselves, they will add to the cumulative noise and disturbance levels that marine mammals are subject to in the Santa Barbara Channel and Santa Maria Basin. In general, the presence of multiple sources of noise and disturbance, such as stationary OCS activities (construction, drilling, and production), ship and boat noise, aircraft, and seismic exploration noise, should result in more frequent masking of communications, behavioral disruption, and short-term displacement. In other areas, there is also some evidence for long-term displacement of marine mammals due to disturbance, particularly in relatively confined bodies of water (summarized in Richardson et al., 1995). Although some OCS activities off southern California, such as construction and seismic surveys, have declined over the past decade, overall vessel traffic, including commercial, military, and private vessels, is increasing.

These effects may be somewhat mitigated by habituation. Indeed, marine mammal populations in California waters have generally been growing in recent decades (Bonnell and Dailey, 1993; Barlow et al., 1997; Forney et al., 2000), despite a gradual increase in a wide variety of human activities in the area. There is no evidence that the noise and disturbance created by offshore oil and gas activities in both Federal and State waters and by increasing vessel traffic (of which oil and gas support vessels are a small part) have resulted in adverse impacts on marine mammal populations. By the impact level criteria adopted for this document (section 5.2), these impacts are considered to be low. The very minor effects in space and time projected to occur as a result of the proposed delineation activities are not expected to add measurably to cumulative impacts to marine mammals in the area.

No oil spills are expected to result from the Proposed Action. However, accidental oil spills do present an ongoing source of potential impacts to marine mammals. The cumulative risk of oil spills arises from multiple sources, including offshore oil and gas activities in Federal and State waters and both Alaskan and foreign-import tankering. The greatest oil spill risk to marine mammals in the project area results from tankering operations. This risk is tempered by recently implemented or proposed mitigation (such as the rerouting of tankers farther offshore along the central California coast) and, as discussed in section 5.1.3, by modern oil spill response capabilities.

If an oil spill were to occur in the project area during the period 2002-2006, impacts to marine mammals could range from negligible to high, depending on spill size, location, season, and a number of other factors. Most at risk are pinniped pups. Seasonally, the most sensitive areas are rookeries on the northern Channel Islands (particularly San Miguel Island) and along the mainland coast north of Point Conception.

The probabilities that one or more oil spills will occur during the period 2002-2006 from existing and proposed offshore oil and gas activities are 94.9 percent for a spill of 200 bbl or less and 41.2 percent for a spill of 2,000 bbl. The probability of a 22,800-bbl tanker spill occurring during this period is 38.8 percent.

5.2.9 IMPACTS OF THE PROPOSED ACTION AND CUMULATIVE IMPACT ANALYSIS FOR THREATENED AND ENDANGERED SPECIES

This section analyzes the impacts of the Proposed Action on threatened and endangered species in the project area. Threatened and endangered species may be vulnerable to several potentially adverse impacts from operations associated with the Proposed Action. Operations assumed to occur as a result of this project include towing and anchoring the MODU, support vessel traffic, helicopter flights, drilling, various discharges, barge transit and anchoring, and well abandonment. These operations are described in section 2. As discussed in section 5.1.1, no oil spills are expected to occur from the proposed drilling activities associated with this project; therefore, no impacts to threatened and endangered species from oil spills are expected.

Impact level definitions used in this analysis are as follows:

HIGH

Impacts result in a population decline in the project area due to direct mortality, reduced survivorship, declines in reproduction, and/or a shift in distribution. The decline, which could involve more than 5 percent of the total population, would be at a level and over a large enough area that the continued existence or recovery of the species involved would be at risk.

MODERATE

Impacts result in a local (e.g., single colony) population decline due to direct mortality, reduced survivorship, declines in reproduction, and/or a shift in distribution. The decline, which could involve from 1 to 5 percent of the total population, could increase the length of time projected for full recovery and removal from the endangered species list, depending on the species involved. Effects are expected to continue for 1-5 years.

LOW

Impacts result mainly in local (e.g., a small area around a platform, a limited stretch of beach or, rocky shore), short-term (a few days to a few weeks) changes in behavior (e.g., disruption of foraging) and/or displacement from roosting or foraging habitats due to disturbance. Mortality, if any, would be limited to the loss of a few animals up to 1 percent of the total population of the species or stock. A small number of animals would also suffer from sublethal effects. Effects are expected to continue for less than 1 year. Projected recovery time and removal from the endangered species list would not be affected.

Impacts below these levels, involving no death or life-threatening injury of any threatened or endangered organism, no displacement from preferred habitat, and no more than minor disruption of behavioral patterns, are defined as negligible. For purposes of this document, high and moderate impacts are considered to be significant; low impacts are considered to be insignificant.

5.2.9.1 IMPACTS OF THE PROPOSED ACTION ON THREATENED AND ENDANGERED MARINE MAMMALS

Section 5.2.8.1 describes the potential impacts of the Proposed Action on marine mammals in the project area. The primary impact-producing activities associated with the Proposed Action include delineation drilling operations with associated support activities and are common to all the units. The major impact agents expected from these proposed activities are noise and disturbance and drilling discharges. The potential use of explosives in the abandonment of the delineation wells also raises the possibility of lethal impacts to marine mammals.

Blue Whale. Marine mammal responses to noise and disturbance are discussed in section 5.2.8.1. The minor and temporary increases in sound levels produced during the delineation drilling activities are unlikely to affect blue whale movements through the