

PART IV: ENVIRONMENTAL CONSEQUENCES

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In selecting the appropriate institutional, boundary, management, and regulatory alternatives for the proposed Cordell Bank National Marine Sanctuary, the National Oceanic and Atmospheric Administration evaluated the environmental consequences of their implementation. This section discusses these consequences including those resulting from the preferred alternative.

Section I: Environmental Consequences of Alternatives

A. Sanctuary Designation--The Preferred Alternative

The preferred alternative would permit the implementation of a coordinated and comprehensive management scheme resulting in the most cost-effective protection of Cordell Bank resources. This alternative would promote resource protection in three ways: (1) It would bolster the existing regulatory and resource protection regime. (2) It would establish a coordinated research program to expand knowledge of the Cordell Bank environment and resources and thus provide the basis for sound management. (3) It would include a broad-based interpretive program to improve public understanding of Cordell Bank's importance as the habitat for a unique community of marine organisms and of the need for a comprehensive management framework to protect this habitat.

1. Resource Protection Regime

The proposed designation will improve resource protection by instituting new regulatory measures and by supplementing present surveillance and enforcement actions. The proposed regulations are designed to protect Sanctuary resources from the harmful discharge of oil and other pollutants and to prevent damage to benthic organisms. The overall effect of these

regulations, narrowly focused on specific activities, will be beneficial. The impacts of each regulation are discussed below.

(a) Discharges

Discharges or deposits are prohibited within the Sanctuary with the exception of fish wastes, vessel cooling waters, marine sanitation device effluents, and other biodegradable effluents incidental to routine vessel operations. Discharges or deposits are prohibited outside of the Sanctuary if the substances or materials discharged enter the Sanctuary and injure its resources.

The regulation prohibiting the discharge of oil and related pollutants and of litter directly or indirectly into Sanctuary waters complements the existing regulatory system, enhances the area's overall appeal, and helps maintain the present good water quality in the Sanctuary. Although particular discharges, such as oil, are now generally regulated under the Clean Water Act (CWA), the Sanctuary regulation is designed specifically to protect the area's important living resources from the effects of all harmful effluents and solid wastes.

(1) Oil Spill Hazard

The major source of concern in protecting Cordell Bank's resources is tanker oil spills. From 1974 to 1981, there were 81 oil spills of more than 1,000 barrels in U.S. waters. Only six of these were on the West Coast--three in port and three at sea (The Futures Group, 1982). More recently, in late 1984, the tanker, Puerto Rican, was disabled about eight miles seaward of the Golden Gate by on-board explosions. The vessel eventually broke apart and discharged refined oil products within the boundary of the Point Reyes-Farallon Islands National Marine Sanctuary (PRNMS). The progress of this

incident demonstrates the seriousness of the potential hazard to Cordell Bank.

The Puerto Rican was disabled shortly before the predicted on-set of the Davidson current, which reverses the direction of California coastal currents from a southerly to northerly flow. The wind and current direction in the San Francisco Bight, however, was still to the south and initial trajectory estimates indicated that spills occurring in the area would move southward. It was therefore decided to tow the burning vessel out to sea, south of the Farallon Islands. The ship broke apart southwest of the Farallones and the resulting spill did move southward initially. Unexpectedly, wind and current direction changed and the spill moved rapidly north through the PRNMS and up to Bodega Bay and beyond. Some 48,000 barrels of hydrocarbons were released into the ocean from the Puerto Rican. Of this amount, only 1,460 barrels were recovered during cleanup operations (USCG, 1985)

Although Cordell Bank was not in the path of the spill from the Puerto Rican, it could be impacted by future spills in the area. Tankers and other ships entering the northern approaches to San Francisco Bay pass to the east of the Bank. A spill occurring northeast of the Bank during the period that the California current governs offshore circulation could be driven directly to the Bank and cause considerable damage to Bank resources.

## (2) Oil Spill Impact on Seabirds

Oil spills in Cordell Bank waters could have a major impact on foraging seabirds. The major cause of immediate mortality among seabirds contaminated by oil is fouling of the feathers, which reduces flying and swimming ability and results in a loss of buoyancy and of thermal insulation. The ingestion of toxic hydrocarbons, sometimes by preening contaminated feathers, can produce physiological stress which may eventually result in death. If non-fatal

contamination occurs during the breeding season it may lead to reproductive failure. Birds that have ingested toxic elements may produce inviable eggs, and birds whose feathers are contaminated may transfer oil to eggs or chicks, thus reducing hatching or fledgling success (NOAA, 1980).

Diving birds and species that spend a considerable amount of time resting on the water are especially vulnerable to contact with spilled oil. The most vulnerable are murrelets, guillemots, auklets, murrelets, puffins, loons, grebes, scoters and cormorants. Shearwaters, fulmars, albatrosses, petrels, gulls and terns are also vulnerable but less so than diving birds. With the exception of grebes, all of these birds have been identified foraging in Cordell Bank waters (Webber and Cooper, 1983).

### (3) Oil Spill Impact on Marine Mammals

Pinnipeds exposed to oil spills may be adversely affected by hydrocarbons contacting their fur or skin or being ingested or inhaled. Oil contamination of their fur can cause loss of buoyancy and thermal insulation, as fouling of the feathers does with birds. Loss of insulation is probably more serious for pinnipeds than loss of buoyancy. Oil contamination of their fur is therefore especially harmful to fur seals which depend on their fur for insulation. Phocid seals rely on blubber and vascular mechanisms for thermal regulation and are thus more resistant to thermal loss caused by contact with oil (Geraci and St. Aubin, 1980). Of the pinnipeds in the Cordell Bank area, the northern fur seals and the California and Steller sea lions are fur seals; the northern elephant seals and harbor seals are phocids.

The ingestion of oil by pinnipeds is most likely to occur during feeding or as the animals clean their coats. The impact of such ingestion would probably depend upon the amount ingested, its toxicity, and the physical

condition of the pinnipeds. The long-term effects on pinnipeds of various levels of hydrocarbon bioaccumulation are unknown.

The adverse effects of oil spills on cetaceans are the result of oil contact with the skin or eyes, fouling of baleens and ingestion or inhalation. Because the skin of cetaceans is smooth and furless, oil is unlikely to adhere to it, although it may adhere to the callosities that occur on right and humpback whales. In a study of bottlenose dolphins to determine the effects of direct skin contact with spilled oil, it was found that exposure to crude oil for periods of up to 45 minutes produced short-term, morphological and biochemical changes to the skin, but recovery appeared to be rapid (Geraci and St. Aubin, 1982).

It has been assumed that cetaceans may suffer eye irritation as the result of contact with oil, but this assumption has not been scientifically confirmed. Baleen whales such as the humpback, blue and gray whales (all observed in Cordell Bank waters) are subject to baleen fouling as a result of exposure to spilled oil. This may impair their ability to feed, however, humpback whales have been observed feeding in oil-slicks without apparent immediate ill effects (NOAA, 1979).

The bioaccumulation of oil in both baleen and toothed cetaceans is most apt to occur as the result of eating contaminated food supplies. There is little likelihood that oil would be inhaled through the blow-hole although it is possible that toxic fumes might be inhaled in small quantities (Geraci and St. Aubin, 1980). Although the effects of hydrocarbon accumulation in cetaceans are unknown, it can be assumed that the longer an animal is exposed to spilled oil, the more likely it is to suffer adverse effects. Prolonged exposure is most apt to occur when contamination occurs in a feeding ground,

such as Cordell Bank.

In general, little is known about the ability of cetaceans to avoid oil spills. As noted above, humpback whales have been observed feeding in an oil slick. Bottlenose dolphins, however, can detect and will avoid thick oil accumulations but do not avoid thin oil sheens (Geraci and St. Aubin, 1982, 1983).

#### (4) Oil Spill Impact on Pelagic and Benthic Biota

The impact of an oil spill on Cordell Bank fishing stocks and benthic fauna would depend largely upon the type of oil involved and on the timing of the spill with respect to reproduction and larval development. The lethal toxicity of oil ranges from .1 to 100 parts per million of soluble aromatics for adult marine organisms. Larvae are usually 10 to 100 times more sensitive than adults. Sublethal effects have been demonstrated with aromatic compounds in concentrations as low as 10 to 1,000 parts per billion (Johnston, 1979). The impact of a spill is thus apt to depend on the magnitude of egg and larval mortality. Because the early life stages are often pelagic, they are more susceptible to the effects of a surface slick.

Heavier hydrocarbon elements are characterized by aromatics of higher molecular weight and lower water solubility. These elements may be avoided by adult finfish, but benthic organisms such as those populating Cordell Bank are highly susceptible to their lethal effects. The sublethal effects of hydrocarbons on marine organisms include the disruption of normal feeding behavior, breeding, and locomotion; interference with thermo-regulation; reduced resistance to stress; and diseases caused by the intake of carcinogenic or potentially metagenic chemicals (MMS, 1986). Some organisms, however, may have the ability to compensate for minor toxic stress and may

thus be able to tolerate low concentrations of toxic hydrocarbons.

(5) Impact of Regulation on Human Activity

In addition to its applicability to oil discharges, the regulation prohibiting discharges would prohibit the disposal of litter and other solid wastes, such as fishing lines and non-biodegradable plastic or metal objects, which animals and birds in the Sanctuary could eat or in which they could become entangled. The regulation would also prohibit sewage outfall discharges, dumping and the disposal of dredge material within the Sanctuary.

The impact of this regulation on vessel operations is expected to be minor. The regulation of oil discharges in the CWA would be extended to prohibit all harmful discharges, including discarded fishing gear and other non-biodegradable solid wastes. Potentially harmful solid wastes would have to be retained on vessels until they can be disposed of properly. These restrictions are not expected to cause any hardship to vessel operators. Fish parts, bait, waste waters incidental to routine vessel operations, marine sanitation wastes and other biodegradable wastes are specifically exempted from the regulation. The disposal of dredged material in Cordell Bank waters has not been proposed in the past and does not now occur. Furthermore, the area seems unlikely to become attractive for this purpose in the future. The application of this regulation to such dumping codifies the existing situation and should have no adverse impact.

(b) Removing, Taking, or Injuring Sanctuary Resources

The regulation prohibiting removing, taking or injuring, or attempting to remove, take, or injure benthic invertebrates or algae is designed to protect sensitive Bank resources. This regulation does not apply to accidental removal, injury, or takings during normal fishing operations. Permits may be

granted for research, educational, salvage or Sanctuary management purposes pursuant to Sanctuary regulations. The regulation is not expected to affect significantly activities in the Sanctuary.

(c) Hydrocarbon Activities

Although Cordell Bank is excluded from the 5-year plan for outer continental shelf (OCS) leasing, if hydrocarbon exploration and development were permitted at a later date, such operations could threaten Bank resources. Hazards to living resources from oil exploration or development operations can result from the on-site discharge of drill cuttings and drilling muds which may adversely affect benthic biota or from accidental oil spills which may adversely affect fishery resources, marine mammals, and seabirds as well as benthic organisms.

Drilling muds consist of naturally occurring minerals such as barite, simple chemicals such as sodium hydroxide and potassium chloride, and complex organic compounds such as lignosulfonates and formaldehydes. Department of the Interior OCS Order Number 7 forbids the discharge of drilling muds containing toxic substances into ocean waters.

In 1983, the Marine Board of the National Research Council conducted a study of drilling discharges. The study found that these discharges present minimal risk to the marine environment. The Marine Board did note, however, that drilling discharges do have an impact on the immediate benthic environment (National Research Council - Marine Board, 1983). However, more recent research (EPA, 1985) has shown significant benthic impacts from platform discharges up to two miles from drilling sites.

Fluids and the lighter elements in drilling discharges are rapidly dispersed in the water column. The heavier elements, over 90 percent of the



discharged material, settle to the bottom, usually in a plume extending in the direction of prevailing bottom currents. The potential impacts on marine organisms resulting from the discharge of drilling muds and cuttings are: 1) decreased primary production caused by increased turbidity which reduces light levels; 2) interference with filter feeding caused by high particulate loads; 3) burial of benthic communities; and 4) injury resulting from the acute or chronic toxic effects of drilling mud constituents. In areas of strong currents, such as Cordell Bank, drilling muds would normally be dispersed rapidly over large areas and thus have a reduced impact (MMS, 1984).

A considerably greater hazard to marine resources than the discharge of drilling wastes is presented by accidental oil spills. The most severe impacts on marine environments would result from large, acute oil spills (greater than 1,000 barrels) usually associated with well blowouts or tanker accidents (MMS, 1984). Subsurface well blowouts could be particularly hazardous to a submerged reef ecosystem like Cordell Bank because of their potential for depositing high concentrations of toxic substances in the water column. This process was demonstrated by the IXTOC well blowout, which occurred in June, 1979, in Mexican waters of the Gulf of Mexico. The IXTOC blowout released some 10,000 barrels (one barrel holds 42 gallons) of oil per day into the ocean for nine months, thus providing scientists with their first major opportunity to study the transport of oil from a subsurface spill (MMS, 1986).

Although most spilled crude oil initially floats, approximately 1% - 5% of the volume of a surface slick will occur in the water column as a result of dissolution, dispersion, sinking, or sedimentation in the vicinity of the spill. Additional oil may be retained in the water as the result of a less

known mechanism, the formation of a subsurface oil plume. Because the oil in such a plume remains below the surface it may have a different chemistry than the surface slick and be more toxic to marine organisms. In the case of the IXTOC blowout, it was found that a subsurface plume of oil droplets, extending from the wellhead and generally aligned with the surface slick, contained high concentrations of low molecular weight aromatics, alkyl benzenes and naphthalene compounds which are acutely toxic to marine organisms (MMS, 1986). The adverse effects of oil spills on marine biota are discussed above (see (d) Discharges).

In addition to the acute effects of large oil spills on marine ecosystems, such spills may have long-term effects on surviving marine organisms. Sublethal and long-term hydrocarbon impacts on ecosystems are associated with low oil concentrations in marine environments which may result from the evaporation, degradation, and dispersion of hydrocarbons following a large spill or from chronic, low-level, small spills (less than 1,000 barrels). Of the two, chronic small spills may pose a greater hazard to marine ecosystems than isolated large spills.

Oil spills are caused by pipeline leaks and breaks and barge and tanker accidents as well as by well blowouts and other platform accidents. However, during the period 1964 - 1980, inclusive, sixty-five percent of oil spills associated with drilling and production problems were caused by blowouts. During these 17 years, a total of 102,382 barrels were discharged into marine waters as a result of blowouts at offshore wells in the Gulf of Mexico, while about half that amount, 55,213 barrels, was spilled as a result of non-blowout associated incidents (The Futures Group, 1982).

Massive spills caused by well blowouts have been highly publicized, but

such spills are rare. The OCS spill-rate for platform spills of more than 1,000 barrels is one per billion barrels produced (MMS, 1986). Most blowouts have been relatively minor, especially in recent years. From 1964 to 1981, 99.5% of the spill volume caused by blowouts in the Gulf of Mexico was spilled in the years, 1964 through 1971. After 1971 the volume of blowout-produced spills was negligible, yet there was no reduction in the number of blowout spills (The Futures Group, 1982). The OCS spill-rate for small platform or pipeline spills is 379 spills per billion barrels produced or transported. Ninety-nine percent of these spills are less than 50 barrels and 89% are less than one barrel (MMS, 1986).

Although the offshore oil industry has been successful in reducing the volume of oil spills, the record indicates that, if oil development were to take place in the area of Cordell Bank, spills from blowouts and platform accidents are likely to occur, although the volume spilled would probably be minor.

Under the preferred alternative, if future Five-Year OCS Leasing Plans allow leasing within the Sanctuary such oil and gas activities could be regulated by the Sanctuary program. Moreover, if exploration and development activities were to occur in the area or beyond the Sanctuary, they could be monitored to assess the likelihood of spills. Precautions could then be taken to minimize spill-risk and to improve contingency planning to reduce the impact of any spills that did occur.

(e) Enforcement

The impact of enhanced surveillance and enforcement efforts focused on Sanctuary resources should be beneficial. What is proposed is a coordinated emphasis on resource protection at Cordell Bank rather than an elaborate

surveillance and enforcement presence.

## 2. Research and Interpretation

The impacts resulting from implementation of the research and interpretation program are also expected to be positive. The research program will result in a coordinated mechanism for studying Cordell Bank's resources and developing effective management strategies. The interpretive program is designed to enhance public awareness of the Bank's resources and the importance of protecting such special marine areas.

The research program would provide a coordinated effort to obtain vital baseline and monitoring data on the resources and on human activities at Cordell Bank. Information on water quality and circulation, species density and diversity, fisheries resources and marine mammals and seabirds would be used in assessing the health of the Bank environment and the effects of human activity in the area. This would improve management's ability to develop long-term planning for the Sanctuary and would provide data useful in responding to oil spills.

The interpretive program would improve public awareness of the importance and fragility of Cordell Bank's resources and thus engender support for resource protection efforts. The program would provide audiovisual material, exhibits, and other information products for individuals, schools and interested groups.

## 3. Boundary Alternatives

All three boundary alternatives would protect the benthic organisms on Bank surfaces. The first alternative, however, would incorporate Cordell Bank itself and a large area around the Bank that is used by marine mammals and birds during migration or for feeding and resting. The area also supports

seabirds feeding and resting in these waters. Finally the first alternative would be contiguous with the Point Reyes-Farallon Islands National Marine Sanctuary boundary and would facilitate management and enforcement activities throughout the area.

The second and third alternatives on the other hand would not provide sufficient habitat protection to migrating and foraging marine mammals and seabirds. In addition the boundaries of the these two alternatives would leave unprotected gaps between the Cordell Bank National Marine Sanctuary and the adjacent Point Reyes-Farallon Islands National Marine Sanctuary.

#### 4. Management Alternatives

Both management alternatives have the same impact in terms of resource protection and research. The preferred alternative, however, offers better opportunities for interpretation and is far more cost-effective.

#### B. The Status Quo Alternative

Under the status quo alternative, Cordell Bank will not have the degree of management, protection or public understanding warranted by the significance of its marine resources. In the existing regime, management is provided by individual Federal agencies, each of which is responsible for regulating specified activities under the authority of statutes directed to specific and sometimes narrow objectives. These regulatory activities are not performed in the context of a comprehensive management plan, and no organizational structure exists to coordinate research and regulation. There is no systematic environmental monitoring program nor is there a mechanism for applying research findings to the resolution of management issues.

The Magnuson Fishery Conservation and Management Act (MFCMA) provides for enforcement of Fishery Management Plans (FMP's) prepared by the Pacific

Fishery Management Council and approved by the National Marine Fisheries Service. Fishing in Cordell Bank waters is regulated by the groundfish and salmon Fishery Management Plans. In the FMP's, the Council establishes catch limits for groundfish and specifies the duration of the fishing season and catch and size limits for salmon. Commercial fishing-gear restrictions are specified for both the groundfish and salmon fisheries. These fishing-gear restrictions prohibit gill-net fishing above 38° north latitude, the northern part of the Bank. Below this line gill-net fishing is prohibited by California and enforced by the CF&G.

Although the existing regime provides protection to Cordell Bank from the effects of overfishing, it is inadequate in preventing adverse effects to Bank resources from other activities. The CWA prohibits the discharge of oil and other hazardous substances "which may affect natural resources....under the exclusive management authority of the United States" (33 U.S.C. 1251-1367). The CWA also provides for the establishment of the National Contingency Plan to contain, disperse, or remove oil and hazardous substances after a spill (see Part II, Section III). The CWA thus furnishes some protection to marine resources from the harmful effects of effluent discharges.

The CWA, however, provides for a maximum penalty of only \$10,000 for a single discharge incident without the initiation of a civil action. This does not provide a sufficient deterrent for protecting important Sanctuary resources; \$50,000 is the maximum penalty allowed under the Marine Protection, Research and Sanctuaries Act (MPRSA). Moreover, under the status quo, there would probably be no specialized effort by the U.S. Coast Guard to enforce the CWA in the Cordell Bank area as distinct from other offshore waters.

Neither the CWA nor Title I of the MPRSA provide for the regulation of casual litter. Thus, there is no restriction on the disposal of non-biodegradable solid wastes that may injure Cordell Bank resources. Animals and birds may eat or become entangled in floating or submerged wastes such as plastic packing materials or discarded fishing lines.

Under the Outer Continental Shelf Lands Act, the Secretary of the Interior has the responsibility for regulating activities associated with oil and gas leasing. The leasing decisions of the Secretary have indicated the sensitivity of the Department of the Interior to environmental concerns and Cordell Bank, within the approximate fifty-fathom contour, is excluded from the Five-Year Outer Continental Shelf Leasing Plan. The area beyond the fifty-fathom depth contour, however, is not excluded. There is also no guarantee that any part of Cordell Bank will be excluded from future OCS Leasing Plans.

The MMPA and the ESA prohibit the "taking" of marine mammals and threatened or endangered species. The Migratory Bird Treaty Act prohibits the hunting of seabirds. The term "taking" has been interpreted broadly by the administering agencies, so that the ESA and MMPA provide considerable protection. However, the potential threats to marine mammals and endangered species range from direct injuries to a specific animal or population to indirect or cumulative degradation of their habitats. Neither the MMPA nor the ESA fully prevent such degradation of habitats.

Section 7(a) of the ESA does provide protection against actions which jeopardize endangered species or their critical habitats, but this section applies only to activities authorized, funded or carried out by Federal agencies, not to private or state actions. There is no explicit provision for

the designation or protection of marine mammal habitats under the MMPA.

A portion of the habitat used by marine mammals and seabirds foraging on Cordell Bank is protected under the National Marine Sanctuary Program. The nearby PRNMS provides protection for marine habitats used by mammals and seabirds, but Cordell Bank, which is an important feeding ground for many of the same mammals and seabirds and which also supports a unique combination of benthic organisms, is not similarly protected under the present regime.

Although the present management regime appears to be effective in regulating fisheries, it is inadequate in protecting Cordell Bank habitats from the effects of waste discharges. It is also weak in providing long-term protection from the effects of hydrocarbon development activities. Moreover, because the agencies that now have regulatory responsibility in the area act independently on the basis of their own statutory mandates, there is little likelihood that the present management regime could organize the research and monitoring program needed to identify environmental changes or that it would respond adequately to increased human activity on the basis of ecosystem or habitat issues.

Finally, no literature or other educational information on Cordell Bank and its habitat values is available to the general public. Recreational fishermen and nature enthusiasts who visit the Bank thus have little or no knowledge of its geology or of the complex communities of invertebrates that inhabit its upper reaches. Nor do they realize the value of Bank waters to the mammals and birds that feed there or pass through in transit. The non-fishing public is barely aware of the Bank's existence. Consequently, there is no informed public that can appreciate the worth of its resources and support efforts to protect them.



## Section II: Unavoidable Adverse Environmental or Socioeconomic Effects

No unavoidable adverse environmental or socioeconomic impacts due to implementation of the management plan are foreseen. In fact it is possible that there will be a positive local socioeconomic impact due to increased awareness of Cordell Bank's ecological value and visitation by the public.

## Section III: Relationship Between Short-term Uses of the Environment and the Maintenance and Enhancement of Long-term Productivity

Sanctuary designation emphasizes the importance of the natural resources of Cordell Bank. The quality of the Cordell Bank environment is still pristine and the healthy and diverse natural ecosystem is unaltered. Designation will enhance public awareness of the area and provide long-term assurance that its natural resources will be available for future use and enjoyment. Implementation of the preferred alternative ensures that changes in use patterns which degrade the Bank environment are monitored.

The interpretation, research and resource protection programs will provide information, management and protection that develops a foundation for wise public use of the area and results in long-term productivity. Similarly, information collected in the research program will assist Federal managers in making better management decisions. Better management will in turn help resolve use conflicts and mitigate the adverse effects of human activities.