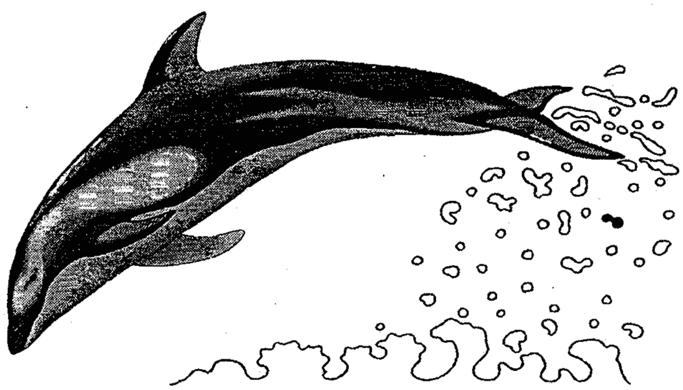
ENVIRONMENTAL ASSESSMENT OF FINAL RULE TO IMPLEMENT THE PACIFIC OFFSHORE CETACEAN TAKE REDUCTION PLAN, UNDER SECTION 118 OF THE MARINE MAMMAL PROTECTION ACT



Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Protected Resources
September 1997

TABLE OF CONTENTS

Environmental Assessment of Final Rule to Implement the Pacific Offshore Cetacean Take Reduction Plan, Under Section 118 of the Marine Mammal Protection Act

1.0. INTRODUCTION

1.1. Section 118 Requirements

In the 1994 amendments to the Marine Mammal Protection Act (MMPA), section 118 established the immediate goal that the incidental mortality or serious injury of marine mammals occurring in the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality rate goal (ZMRG) and serious injury rate within 7 years of enactment of this section (i.e., April 30, 2001). The amendments established a three-part strategy to govern interactions between marine mammals and commercial fishing operations. These include the preparation of marine mammal stock assessment reports, a registration and marine mammal mortality monitoring program for certain commercial fisheries (Category I and II), and the preparation and implementation of take reduction plans (TRP). Section 118(f) of the MMPA requires that the National Marine Fisheries Service (NMFS) develop and implement TRPs designed to assist in the recovery, or prevent the depletion of, strategic marine mammal stock(s) which interact with Category I or II fisheries. A strategic stock is (1) a marine mammal species that is listed as endangered or threatened under the U.S. Endangered Species Act (ESA); (2) a marine mammal stock for which the human-caused mortality exceeds the potential biological removal (PBR) level; or (3) marine mammal stock which is declining and likely to become listed as a threatened species under the ESA. The PBR level is the maximum number of animals, not including natural mortalities, that may be annually removed from a marine mammal stock while allowing that stock to reach or maintain its optimal population level.

The immediate goal of a TRP is to reduce, within 6 months of its implementation, the mortality and serious injury of strategic stock(s) incidentally taken in the course of commercial fishing operations to levels less than the PBR levels established for those stock(s). The long-term goal of a TRP is to reduce, within 5 years of its implementation, the incidental mortality and serious injury of marine mammals incidentally taken in commercial fishing operations to insignificant levels approaching a zero mortality and serious injury rate, taking into account the economics of the fishery, the available existing technology, and existing State or regional management plans (section 118(f)(2)). NMFS is currently in the process of developing a final definition of the ZMRG.

NMFS must establish take reduction teams to prepare draft TRPs. Team members must have expertise regarding the conservation or biology of the marine mammal species which the take reduction plan will address, or the fishing practices which result in the incidental mortality or serious injury of such species. Members shall include representatives of Federal agencies, each coastal State which has fisheries which interact with the species or stock(s), appropriate Regional Fishery Management Councils, interstate fisheries commission, academic and scientific organizations, environmental groups, all commercial and recreational fisheries groups and gear types which incidentally take the species or stock(s), Alaska Native organizations or Indian tribal organizations, or others as the Secretary of Commerce deems appropriate. Take reduction teams are not subject to the Federal Advisory Committee Act and meetings of the teams are open to the public with prior notice of the meetings made public in a timely fashion (section 118(f)(6)(C and D)).

Where the human-caused mortality and serious injury from a strategic stock is estimated to be equal to or greater than the PBR level, as determined under section 117 of the MMPA, and such stock(s) interacts with a Category I and II fishery, the TRT will submit a draft take reduction plan for such stock(s) to NMFS not later than 6 months after the team has been established. Such draft TRP will be developed by consensus. In the event consensus cannot be reached, the TRT shall advise NMFS in writing on the range of possibilities considered by the TRT, and the views of both the minority and majority. Not later than 60 days after the submission of the draft plan, NMFS will publish in the Federal Register the draft plan, any changes proposed by NMFS with an explanation of the reasons therefore, and proposed regulations to implement the plan if necessary, for public review and comment for a period not to exceed 90 days. Not later than 60 days after the close of the public comment period, NMFS will issue a final plan and implementing regulations (section 118(f)(7)).

TRPs must include a review of information in the final stock assessment reports (SAR) and any substantial new information that may have become available since the publication of the SARs, an estimate of the total number and, if possible, age and gender, of animals from the stocks that are being incidentally killed or seriously injured each year during the course of commercial fishing operations, recommended regulatory or voluntary measures for the reduction of the incidental mortality and serious injury, and recommended dates for achieving the specific objectives of the plan. In implementing a TRP prepared in accordance with section 118 of the MMPA, the NMFS may, where necessary to implement a TRP to protect or restore a marine mammal stock or species covered by such a plan, promulgate regulations under the MMPA. These regulations may include, but are not limited to, measures to:

(1) establish fishery-specific limits on incidental mortality and serious injury of marine mammals in commercial fisheries or restrict commercial fisheries by time or area;

(2) require the use of alternative commercial fishing gear or techniques and new technologies, encourage the development of such gear or technology, or convene expert sippers' panels;

(3) Educate commercial fishers, through workshops and other means, on the importance of reducing the incidental mortality and serious injury of marine mammals in affected commercial fisheries; and

(4) Monitor the effectiveness of measures taken to reduce the level of incidental mortality and serious injury of marine mammals in the course of commercial fishing operations.

NMFS and the TRTs will meet every 6 months, or at other intervals as NMFS determines are necessary, to monitor the implementation of the final TRP until such time as NMFS determines that the objectives of the TRP have been met. NMFS will amend the final TRP and implementing regulations if necessary.

1.2. Pacific Offshore Cetacean Take Reduction Plan

1.2.1. Development of Plan

Because the California/Oregon drift gillnet fishery for thresher shark and swordfish (CA/OR DGN Fishery) is classified as a Category I fishery under the MMPA and incidentally takes several marine mammal stocks at levels that are estimated to be above their PBR levels, NMFS convened the Pacific Offshore Cetacean Take Reduction Team (TRT or Team) on February 12, 1996 (61 FR 5385). NMFS chose the team members after extended interviews were conducted by a professional facilitator. Members on the TRT included representatives of the CA/OR DGN fishery, environmental groups, the California Department of Fish and Game, the Pacific States Marine Fisheries Commission, independent fisheries scientists and whale biologists, and NMFS. Representatives of other groups and agencies (i.e., recreational fishers and the Oregon Department of Fish and Wildlife) were interviewed but did not choose to participate on the team.

The team was charged to provide a draft Pacific Cetacean Take Reduction Plan (PCTRP) to NMFS by August 1996. The team held five meetings in locations near Los Angeles, San Diego, and San Francisco between February and June, 1996. Each meeting was open to the public and mediated by a professional facilitator. The TRT considered a full menu of potential take reduction strategies for inclusion in the draft PCTRP. The TRT reviewed the literature on incidental taking of marine mammals in drift gillnets and heard presentations on the status of strategic stocks incidentally taken by the fishery, the estimated annual taking of these stocks from observer data, and strategies currently used by the fishery to avoid taking marine mammals. In addition, the TRT reviewed extensive analyses of observer data (which was gathered over the past five fishing seasons) to determine if there were correlations between incidental take of cetaceans and fishing techniques, gear used, or oceanographic factors that might suggest appropriate take reduction strategies.

1.2.2. Elements of Take Reduction Team's Draft Plan

On June 27, 1996, the TRT reached consensus on a draft plan. The TRT believed that no single strategy could meet the goals of the MMPA. Therefore, the TRT identified four primary strategies which, if implemented as a package, the TRT expected would meet the 6-month goal of reducing the takes of strategic stocks to below PBR, and to some extent, the long term goal of attaining a ZMRG and serious injury rate for all marine mammal stocks. In addition, there is a section of the Plan that addresses possible contingency strategies, should the primary strategies prove less effective than anticipated and a section describing additional recommendations to NMFS regarding supplementary data gathering and study activities. Moreover, the PCTRP also includes: (1) a review of the current information on the status of the affected strategic marine mammal stocks; (2) a description of the CA/OR DGN fishery; (3) an analysis of data from NMFS's CA/OR DGN fishery observer program from 1990-1995; (4) recommendations to enhance NMFS's CA/OR DGN observer program; and (5) an evaluation of other potential strategies to reduce strategic stock bycatch in the fishery. The TRT assumed that each individual strategy would be refined or modified if necessary based upon the initial year results. The TRT submitted its draft PCTRP to NMFS on August 15, 1996. The strategies included:

Acoustic Devices -- NMFS and the fishery should initiate a multi-year experiment to test the effectiveness of acoustic devices (pingers) beginning in the 1996-97 fishing season, before a final PCTRP has been adopted by NMFS. The success of pingers in reducing overall cetacean incidental take during the fishing season August 15, 1996- January 31, 1997 should determine whether pingers are recommended as a mandatory strategy for reducing takes when the final PCTRP is in place.

Gear Modifications -- There should be fleetwide deployment of 6-fathom (36 feet) minimum buoy line extender length on a mandatory basis. NMFS and the TRT should review the efficacy of this strategy after the final PCTRP has been in place for at least 6 months to determine if the minimum extender length should be modified.

Skipper Education and Feedback -- NMFS should conduct skipper workshops on the PCTRP coupled with expert skipper panels to further generate and consider potential, additional take reduction strategies. Workshop attendance will be mandatory when the final PCTRP is implemented.

Reduction in the Number of Drift Gillnet Permits --The California Department of Fish and Game (CDFG) should continue its policy of not issuing new shark and swordfish drift gillnet permits to replace those that have lapsed. The Oregon Department of Fish and Wildlife should continue to issue only up to 10 unlimited landings permits. A permit buy-back program should be instituted for CDFG drift gillnet permit holders to encourage part-time skippers to leave the fishery permanently.

1.2.3. National Marine Fisheries Service's Proposed Changes to Draft Plan and 1997 PCTRT Recommendations

Under section 118(f)(7)(B) of the MMPA, NMFS must take the draft PCTRP submitted by the Pacific Cetacean TRT into consideration, and then publish the plan proposed by the team, any changes proposed by NMFS with an explanation of the reasons for the proposed changes in the FR, along with proposed regulations to implement the draft PCTRP. NMFS is adopting the primary strategies recommended in the draft PCTRP (see section 2.2: Alternative 2: Preferred Action and PCTRP, 1996) with only a minor change. On May 29-30, 1997, NMFS reconvened the PCTRT to review the final results from the 1996/1997 CA/OR DGN pinger experiment and evaluate the need for effort reduction and potential implementation mechanisms as recommended by the Team in the draft PCTRP (draft PCTRP 1996). The Team also reviewed at the meeting the status of the implementation of the final Plan and final Rule to implement the Plan, Skipper Education Workshops, the drift gillnet observer program, and draft 1997 SARs. On July 18, 1997, the Team submitted to NMFS recommendations on the final plan and rule (PCTRT 1997). NMFS is adopting the majority of the PCTRT's recommended changes and/or additions to the final rule (PCTRT, 1997). The following is a summary of Team's recommended changes and an explanation of NMFS's minor changes to these recommendations.

Depth of Fishing Requirement

In August 1996, the PCTRT recommended that NMFS establish a fleetwide 6-fathom minimum extender line (buoy line) requirement. At the May 1997 PCTRT meeting, the team concurred with NMFS's proposed rule requiring the use of extenders that are equal to or greater than 6 fathoms for all vessels in the CA/OR DGN fishery. The final rule prohibits the use of extenders that are less than 6 fathoms (36 feet; 10.9 m).

Pinger Requirement

In 1996, the PCTRT recommended that if the results from a pinger experiment indicate pingers are effective at reducing cetacean bycatch, then the use of pingers should be mandatory (PCTRP, 1996). In contrast, before final results from the 1996/1997 pinger experiment in the CA/OR DGN fishery were available, NMFS proposed the mandatory use of pingers in the proposed rule to implement the PCTRP. Between September 1996 and January 1997, NMFS and the fishery implemented a single-blind experiment through NMFS's Drift Gillnet Observer Program as recommended by the PCTRT (draft PCTRP, 1996). Preliminary final results from the experiment indicate that cetacean entanglement and pinger use is statistically dependent (Chi-square test, p=0.006) (NMFS unpublished data). The odds of entanglement decrease from 0.099/set without pingers to 0.022/set with pingers or a decrease of over 75 percent. Based on the dramatic results from the 1996/1997 pinger experiment, the Team recommended by consensus during its May 1997 meeting that the use of pingers be mandatory for all vessels in the CA/OR DGN fishery beginning in the 1997/1998 fishing season. The final rule requires the use of pingers in the fishery.

At its May 1997 meeting, the PCTRT also expressed concern about whether a sufficient supply of pingers would be available at the start of the swordfish fishing season (August 15). At this time, NMFS is aware of only one manufacturer that produces a pinger consistent with the specifications in the final rule. This manufacturer is currently producing these pingers and they should be available by October 1, 1997. In addition, information on the distribution of fishing effort in the CA/OR DGN fishery over the last few years indicates that the peak of fishing effort occurs after September 30 each year (CDFG unpublished data). Because cetacean entanglement is significantly correlated with fishing effort, the highest levels of incidental entanglement also occurs after September 30 (PCTRP 1996). For these reasons, although the PCTRT recommended that pingers be required in the fishery by August 15, 1997, the final rule requires the use of pingers by vessels in the CA/OR DGN fishery to begin on October 1, 1997.

Although the Team concurred with the pinger specifications and configurations in the proposed rule, they suggested that the final rule include a mechanism to allow for limited experimentation with alternative pinger specifications and configurations in the fishery. The Team recommended that any pinger experiment undergo peer review and the experiment should not detract from the NMFS's CA/OR DGN fishery observer program or the fishery's requirements to meet bycatch reduction goals of the MMPA.

In the proposed rule, NMFS stipulated that only "NMFS-approved pingers" could be used in the fishery and that if requested, NMFS may authorize the use of non-NMFS approved pingers for limited experimental purposes. The final rule stipulates specifications for pingers that are required to be used in the CA/OR DGN fishery. Since all pingers used in the fishery must meet these specifications, all references to "NMFS-approved pingers" have been removed from the final rule.

The PCTRT also recommended during its 1997 meeting that NMFS require manufacturers of pingers to provide independent certification that a new prototype meets the final rule's pinger specifications. The PCTRT made this recommendation because it thought the definition of the term "NMFS-approved pinger" was unclear in the proposed rule. Although the proposed rule described the sound specifications for pingers, NMFS agrees that the term "NMFS-approved" was unclear. Nevertheless, NMFS does not agree that manufacturers should have an "independent company" certify that new prototype pingers meet the required pinger specifications because independent companies would not necessarily be more credible at testing pinger sound characteristics. However, manufactures of new pinger prototypes will need to provide documentation that their pingers meet the specifications of the final rule. For these reasons, any reference to the term "NMFS-approved" has been removed from the final rule. The final rule does not require that manufactures of new prototype pingers have an "independent company" certify that their pingers meet the pinger specifications.

In order to better enforce the pinger requirement, the PCTRT recommended that NMFS require any driftnet vessel with swordfish or shark on board to have pingers. Although NMFS agrees that drift gillnet vessels that are at sea should be required to have pingers onboard, it believes that pingers should be on the drift gillnet vessel at all times, even when no shark or swordfish are on the boat. Regardless of whether drift gillnet sets catch swordfish or shark, these sets may still incidentally entangle cetaceans. For these reasons, the final rule stipulates that anytime a CA/OR DGN fishery vessel is at sea with a multifilament drift gillnet onboard it must carry a sufficient number of pingers to meet the configuration requirements setforth under the rule, even when no shark or swordfish are on the boat.

The draft PCTRP (1996) and proposed rule stipulated that pingers must be attached on both the floatline and leadline and spaced no more than 300 ft (91.44 m) apart. During the pinger experiment, pingers were attached to the floatlines and leadlines with approximately 1 and 6 ft (0.30 and 1.82 m) lanyards, respectively. Results from this experiment indicate that attaching pingers directly to buoy lines (i.e., extenders) may be a more efficient attachment method because it would facilitate pinger attachment. Pingers attached in this manner would not require individual attachment and removal to and from the floatline during each set because this would automatically occur during routine extender attachment/removal. For example, if extenders were attached to the net at 100 ft (30.48 m) intervals, one pinger could be attached to every third extender and the 300 ft (91.44 m) spacing requirement would be maintained. For these reasons, the final rule authorizes the placement of pingers on extenders as long as the 300 ft (91.44 m) spacing requirement is maintained near the floatline and pingers are no more than three feet above the floatline. In addition, this final rule authorizes pingers to be attached to the leadline with lanyards that are up to 6 ft (1.83 m) in length.

Skipper Education Workshop Requirement

In August 1996, the PCTRT recommended that NMFS conduct mandatory skipper workshops on the components of the PCTRP, together with expert skipper panels, to further generate and consider potential, additional take reduction strategies (draft PCTRP 1996). At its May 1997 meeting, the team concurred with the proposed rule's requirement that all vessel operators be required to attend a skipper workshop before initiating fishing each fishing season. After notification by NMFS, the final rule requires all CA/OR DGN vessel operators to have attended one Skipper Education Workshop after all workshops have been convened by NMFS in September 1997. CA/OR DGN vessel operators are required to attend Skipper Education Workshops at annual intervals thereafter, unless that requirement is waived by NMFS. NMFS will provide sufficient advance notice to vessel operators by mail prior to convening workshops.

1.3. Purpose and Need for Action

To implement specific sections of the PCTRP, regulations must be developed to reduce the incidental mortality and serious injury of strategic marine mammal stocks that are taken in the CA/OR DGN fishery for swordfish and thresher shark.

1.4. Scope

The immediate goal of the final rule is to reduce incidental mortality and serious injury of strategic marine mammal stocks occurring during the course of drift gillnet fishing operations in California and Oregon to levels less than the PBR levels established for each stock. The final rule will implement section 118(f)(9) of the MMPA, as amended (16 U.S.C. 1371(a)(5)(E) and 1387, Public Law 103-238) which provides for the promulgation of regulations to implement take reduction plans to protect or restore a marine mammal stock or species covered by such a plan. The rule will apply to all U.S. drift gillnet fishing vessels operating in waters seaward of the coast of California or Oregon, including adjacent high seas waters.

1.5. National Environmental Policy Act (NEPA) Scoping Meeting

NMFS is the federal lead agency for the purposes of this Environmental Assessment (EA). The environmental review process conducted by NMFS for the action was initiated by a Notice of Intent to prepare an Environmental Impact Statement (EIS) or EA for anticipated proposed rulemaking under the Take Reduction Plan provisions (section 118) of the MMPA published on May 30, 1996 (61 FR 27042). In addition to the written scoping comments solicited by NMFS, a public scoping meeting was held on June 25, 1996, in Santa Monica, California, to solicit comment on the range of issues to be addressed in the federal environmental review process. The following discussion summarizes the issues identified during the NEPA scoping process.

1.5.1. Issues Identified During Scoping

The scoping process resulted in requests that several environmental issues be analyzed in the EA. All potentially significant issues have been evaluated in this EA. A summary of significant issues identified during scoping follows:

- <u>Preparation of EIS</u> One commenter recommended that an EIS be prepared if any regulation to implement the Pacific Cetacean TRT would result in a reduction in fishing effort. At this time, NMFS is not proposing to restrict fishing effort in the CA/OR DGN fishery through regulation and, thus is preparing an EA. In the future, if NMFS promulgates regulations to reduce fishing effort in the fishery in order to achieve the goals of the MMPA, it will conduct additional environmental impact analyses at that time.

- <u>Stock Assessment Reports</u> Several commenters questioned the scientific credibility of the data used to calculate stock discreetness, stock abundance, and PBR levels in the stock assessment reports (SARs) (Barlow 1995). They believed that since the data were of questionable accuracy, the fishery was being unfairly penalized by the requirement to comply with a take reduction plan.

  The majority of the data used in the SARs were gathered and analyzed by NMFS between 1991-1995. In August 1995, after review by the Pacific Scientific Review Group and opportunity for public comment, NMFS published its final SARs for the Pacific Ocean. The information provided in the SARs provided the basis for determining which marine mammal stocks are "strategic" and require the development of a take reduction plan. Several stocks that the CA/OR DGN fishery interact with were designated as strategic in the SARs. Although NMFS recognizes that the data used in the SARs may be considered incomplete, it reflects the best information available at the time of publication of the SARs. The MMPA requires that SARs be reviewed on an annual basis for strategic stocks. NMFS is currently in the process of preparing new SARs for all the stocks that interact with the drift gillnet fishery using new data. Based on these new final SARs, NMFS will revaluate the impact of the drift gillnet fishery on marine mammal stocks and the need to develop and implement take reduction plans for stocks the fishery interacts with.

• Foreign Drift Gillnet Fishery Several comments believed that it was unfair of NMFS to not consider the impact of non-U.S. drift gillnet fisheries (e.g., Mexico) on the same marine mammal stocks that the CA/OR DGN fishery interacts. By disregarding the impact of these other fisheries, NMFS was unfairly penalizing the U.S. fleet. The TRT also recognized that the Mexican drift gillnet fishery probably interacts with some of the same marine mammal populations that NMFS is implementing a take reduction plan for in U.S. waters. The Mexican fishery may not have any protective measures in place for marine mammal stocks. Moreover, greater restrictions on U.S. fishers could result in a shift of the U.S. fishery to the waters of other countries such as Mexico. For these reasons, the TRT and some public commenters recommended that NMFS consider methods for resolving this issue and strongly encouraged international cooperation aimed at conserving these marine mammal populations.

The Mexican drift gillnet fishery fleet consists of approximately 15 vessels, targets primarily swordfish and thresher shark, and occurs generally within 30 miles off Baja California, Mexico (T. West, per. com.). Some of the landed fish are marketed in the United States (e.g., swordfish). The Pacific SARs did consider the impact of foreign fisheries on stocks that inhabit both U.S. and Mexico waters. For example, California/Oregon/Washington-Mexico humpback whale stock spends one-half of its time in Mexican waters, the PBR for that stock was reduced by 50 percent. No other strategic stocks that the CA/OR DGN fishery interacts with also occur in Mexican waters. Each year, the United States conducts bilateral meetings with Mexico to discuss various fisheries and conservation issues. When NMFS adopts a final PCTRP, the plan will be provided and discussed at these meetings.

• Contingency Plan One commenter urged NMFS to develop a strong contingency plan that would include the closure of the fishery if the recommended measures in the PCTRP failed to obtain the objectives of the MMPA. NMFS is implementing, by regulation, the measures recommended by the TRT to reduce the incidental mortality and serious injury of strategic marine mammal stocks in the CA/OR DGN fishery to below their PBR levels. NMFS will reconvene the TRT on an annual basis to review the effectiveness of these measures at reducing marine mammal bycatch in the fishery until the goals of the MMPA have been met. If at that time that the TRT reconvenes, the PCTRP objectives have not been met, the TRT will evaluate and recommend methods to reduce fishing effort, unless there are other appropriate measures available which could be reasonably expected to reduce strategic stock taking to below PBR levels in the next fishing season.

2.0. ALTERNATIVES

2.1. Alternative 1: Status Quo, or No Action Alternative

Under this Alternative, no regulations would be issued to require CA/OR drift gillnet fishers to change their fishing methods or techniques to reduce their incidental take of strategic marine mammal stocks. Fishers would continue to be required to register with NMFS to obtain an Authorization Certificate, carry biological observers if requested by NMFS, and report any incidental mortality or serious injury within 48 hours of returning to port from a fishing trip.

2.2. Alternative 2: Final Regulations (Preferred Action)

This Alternative would establish three mandatory requirements for all U.S. drift gillnet fishing vessels operating in waters seaward of the coast of California or Oregon, including adjacent high seas waters. This alternative would be implemented by the publication of regulations under section 118(f)(9) of the MMPA.

2.2.1. Minimum Extender Length

CA/OR DGN fishers use nets constructed from 3-strand twisted nylon, tied to form meshes. The meshes range from 16 to 22 inches stretched, and average 19 inches stretched (PCTRP, 1996). The top of the net (float line) is suspended in the water by lines (buoy lines or extenders) attached to buoys at the surface of the water. The float line may be set between 0 to 100 feet (PCTRP 1996) below the surface of the water, although it is usually set at least 18-26 feet below the surface (Hanan et al. 1993). This is referred to as the buoy line depth or "extender length." The bottom of the net is attached to a weighted lead line. The number of meshes between the float line and the lead line, is the depth of the net, which ranges from 100 to 150 meshes.

The regulations establish a minimum extender length of 6 fathom (36 feet) for all CA/OR DGN vessels. The final rule prohibits the use of extenders that are less than 6 fathoms (36 feet; 10.9 m).

2.2.2. Skipper Education Workshops

The regulations require all CA/OR DGN vessel operators to attend one Skipper Education Workshop, when notified by NMFS, before initiating fishing each fishing season. Workshops provide vessel operators with information relevant to how the PCTRP was developed and how to avoid marine mammal entanglement. The workshops also solicit feedback from participants on how to reduce incidental marine mammal mortality and serious injury. Workshops will be conducted at several locations in California that are accessible to the majority of drift gillnet fishers.

2.2.3. Pingers

The regulations establish the fleetwide use of pingers for all CA/OR DGN vessels. A pinger is an acoustic deterrent device which, when immersed in water, broadcasts a 10 kHz (+-2 kHz) at 130 dB (+- 4 dB) re 1 micropascal at 1 m with a pulse duration of 300 milliseconds (+- 15 milliseconds) and a pulse rate of 4 seconds (+- 0.2 seconds) and remains operational to a water depth of at least 100 fathoms (600 ft or 182.88 m). Under the final rule, pingers must be used on all vessels and during every set.

The participants in an acoustic workshop (Reeves et al., 1996), and the PCTRT, recommended that pingers be placed every 300 feet (91.44 m) on the leadline and floatline. The 300-foot interval was suggested because it had been effective at reducing harbor porpoise bycatch in the New Hampshire sink gillnet fishery. In addition, drift gillnets are often set with the floatline above the ocean thermocline and with the leadline below it, especially sets targeting swordfish. Since thermoclines act as barriers to sound transmission, they also recommended that the pingers placed on both lines be staggered such that the horizontal distance between a pinger on the floatline and a pinger on the leadline is 150 feet (45.72 m). For a typical 6000 ft (1828.80 m) net, 21 pingers on the floatline and 20 pingers on the leadline would be needed (41 total pingers). For these reasons, the final rule requires pingers to be attached to the floatline and leadline and spaced every 300 feet and configured as described above.

Pingers must also be maintained as operational and functioning when deployed under the final rule. To better enforce the pinger requirement, while at sea, drift gillnet vessels with multifilament gillnets onboard must carry enough pingers to meet the configuration requirements described above. In addition, the rule allows for limited experimentation in the fishery to test the effectiveness of pingers with alternative specifications and alternative pinger configurations on the net. Experimental protocols will undergo peer review to ensure scientific credibility. If better information on the hearing sensitivity of cetaceans incidentally taken in the CA/OR DGN fishery or if experimental results indicate that different pinger specifications/configurations would be more effective at reducing cetacean bycatch, NMFS may require that different pingers be used in the fishery

2.3. Alternatives Eliminated from Further Analysis

The TRT also evaluated several potential strategies for reducing cetacean bycatch in the CA/OR DGN fishery. They did not believe that these strategies would be effective at achieving the 6-month goal of the MMPA. Since these strategies were not considered viable, the TRT did not recommend that they be implemented at this time. They concluded that these strategies may be appropriate, after additional study and evaluation, if the primary strategies (Alternative 2) were ineffective at achieving the goals of the MMPA. A description and evaluation of these strategies may be found in sections IV and V of the PCTRP. A summary of these strategies is provided below.

2.3.1. Marine Mammal Limits/Restrict Fishing Effort

Utilizing data obtained from NMFS's CA/OR DGN Observer Program from the period between July 1990 and December 1995, the draft PCTRP (1996) presents the results from several statistical correlation analyses on the number of cetaceans incidentally entangled in the fishery and other observed variables (e.g. fishing block, area, month, year, depth, soak time, etc.) (PCTRP 1996). The only statistically significant correlations, on a vessel-by-vessel basis, were between total vessel effort and cetacean bycatch (r=0.74) and total vessel effort and strategic stock by-catch (r=0.45). Specifically, as fishing effort in the CA/OR DGN fishery increases, both incidental entanglement of either all cetaceans or only strategic stocks also increased. However, the data did not indicate any significant geographic concentration of marine mammal entanglement when the effects of "observer effort" were removed. Most of the observed marine mammal entanglement occurred during the months of October and November at a time of greatest fishing effort. Sections 2.3.1.1-4 discuss the impacts of various methods of restricting fishing effort in order to reduce the incidental take of cetaceans in the CA/OR DGN fishery.

2.3.1.1. Marine Mammal Limits

This strategy would establish a limit on the number of animals that could be incidentally killed or seriously injured from a strategic stock before other measures to reduce marine mammal mortality were implemented, such as reducing fishing effort. This could occur on a fleet-wide or vessel-specific basis. For example, on a vessel-specific basis, vessels that catch too many individuals from a strategic stock (e.g., a large percentage of that stock's PBR level) would be prohibited from fishing any further during that season. Alternatively, on a fleet-wide basis, once incidental taking of any strategic stock by the fishery reached its estimated PBR level, the entire fleet would be subject to greater restrictive measures such as restricting or terminating fishing effort for the remainder of the season.

Although "marine mammal limits" would promote a strong incentive to avoid marine mammal interactions, implementation of this alternative would require 100% observer coverage. At this time, NMFS does not have the resources to provide 100% observer coverage for this fishery. Furthermore, if this alternative was implemented on a fleet-wide basis, it may unfairly restrict the fishing effort of those members of the fleet that did not significantly impact strategic marine mammal stocks. For these reasons, this strategy is not considered viable at this time.

2.3.1.2. Set Quotas By Vessel

This strategy would establish a quota on the total number of sets that a vessel could set each year. Set quotas on a vessel basis could be based upon a percentage of the historical average for that vessel (e.g., last 5 years). Placing an individual quota on the number of sets vessels could make each year would allow fishing to be more evenly spaced over the season rather than having the "derby" phenomenon of areal or seasonal closures. If this strategy reduced fishing effort, it may consequently, result in reduced incidental take of strategic stocks. Furthermore, set quotas would spread the impact of the restriction evenly throughout the fleet. However, quotas would be complicated to calculate and difficult to enforce. Setting quotas on the total number of sets a vessel could make each season could result in a negative economic impact on the fishery if a fisher had already filled their vessel-quota and the fishing season remained open. Set quotas would be unfair to new fishers with fewer past years of fishing because their quotas would be relatively low. Placing a quota on the number of sets also does not reward fishers that have low marine mammal entanglement rates by allowing them to fish more. For these reasons, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time.

2.3.1.3 Temporal Closures

This strategy would establish in-season closures. This could be accomplished in several ways. For example, a certain number of days at the beginning and/or the end of the fishing season could be closed; (2) a certain number of days per month (e.g. full moon closures) could be closed; or (3) a period within the season that coincided with periods of higher historical incidental take could be closed.

Seasonal closures would reduce total fishing effort and potential take and would be easier for fishers to plan and work around than closures based upon set quotas or target catch limits per fleet. However, analysis of available data does not indicate any significant statistical correlations between incidental cetacean (or strategic stock) entanglement and year, month, or moon phases (PCTRP 1996). Entanglement of strategic stocks shows no consistent pattern with season when compared to observed effort or location of cetacean entanglement. Closures at either end of the fishing season could be unfair for fishers who fish intensively the first or last months of the season. This strategy might encourage effort during poor weather and place fishers at a greater safety risk or displace fishing effort to other times in areas with higher densities of marine mammals and have subsequently greater impacts on marine mammals. If implemented, seasonal closures would likely reduce income to fishers and be difficult to enforce. For these reasons, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time.

2.3.1.4. Area Closures

This strategy would temporarily or permanently close areas of the ocean where high levels of observed take had been observed either historically or on a real time basis. Fishing could also be restricted within specific water depths or distances from shore.

Area closures would reduce fishing effort in specific areas and incidental take of strategic stocks may be reduced too. However, analysis of available data does not indicate any significant statistical correlations between incidental cetacean (or strategic stock) entanglement and geographic area (see Figs.1-3, PCTRP 1996). This strategy would be difficult to enforce. Most importantly, area closures could potentially shift fishing effort to other areas with higher densities of marine mammals and have subsequently greater impacts on marine mammals. For these reasons, area closures are not likely to achieve the objectives of the MMPA and are not considered viable at this time.

2.3.2. Modify Gear

2.3.2.1. Reduce Length of Net

This strategy would require that a maximum net length be established. Reducing the length of the net would reduce fishing effort and potentially reduce strategic marine mammal entanglement because data indicate that more entanglements occur further away from boat.

Over 90 percent of the observed sets used nets between 900 and 1000 fathoms long. However, there was no significant relationship between net length and entanglement of cetaceans or strategic stocks (PCTRP 1996). Some drift gillnet vessels would not be affected by this strategy since their nets are already shorter. However, this strategy increases inefficiency because catch per unit effort would decline for those fishers that modified their net, and they may consequently increase their fishing effort to make up for this potential loss of target catch which could actually increase marine mammal mortality. This strategy may not be equitable since some fishers already have smaller nets. For these reasons, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time.

2.3.2.2. Reduce Depth of Net

This strategy would require a maximum number of meshes from the floatline to the leadline be established. The depth, or vertical length of drift nets varies considerably. The majority of nets are between 100 and 160 meshes in depth. No significant statistical relationship was found between net depth and entanglement of cetaceans or strategic stocks (PCTRP 1996). Reducing the depth of the net may reduce fishing effort and thus may consequently reduce marine mammal entanglement. However, since this strategy would reduce fishing efficiency, without increasing the price per fish to fishers, fishing effort may actually increase to compensate for potentially lost catch. Although this strategy would be easy to enforce since net depth could be measured dockside, nets would need to be modified at some cost. For these reasons, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time.

2.3.3. Change Fishing Techniques

2.3.3.1. Adjust Percentage of Net Slack

This strategy would regulate the percent slack that could be used while fishing. Percent slack is the percentage of slack created in the net by meshes on the hanging line. The majority of slack percentages observed in the drift gillnet fishery were between 35% and 50% inclusive (PCTRP 1996). A chi-square test for the categories 30+ to 45 and 45+ to 60 showed that there was borderline significant difference ($P = 0.09$) for all species cetaceans. Further analysis showed this difference was due to effort and not slack. The same analysis applied to only strategic stocks revealed no significant relationship.

Slack ratios are easily changed, at nominal cost, during the off season when fishers normally repair and recondition their nets for the following season. However, it if a net is less likely to entangle a marine mammal, it is also less likely to entangle more target species. Drift gillnet fishers feel that slack ratios closer to 40% are less likely to entangle marine mammals than slack ratios closer to 50%. However, analysis of observer data showed some statistical significance in reduced cetacean entanglement with slack percentages ranging from 45% to 60% (PCTRP 1996). Thus, requiring that fishers use a less efficient (with respect to target catch) slack ratio may increase inefficient fishing and result in an actual increase in fishing effort. For these reasons, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time.

2.3.3.2. Restrict Soak Time

This strategy would reduce the amount of time that gear can be deployed in the water column on any given day or on each set. It would reduce the amount of time of each set, and thus reduce fishing effort for each set (PCTRP 1996). This may reduce marine mammal take if it was known at what time of night mammals become entangled in nets, would be easy to implement since no gear change is required, and would be equitable across the fleet. However, enforcement of this strategy would be difficult. A restriction on soak time could affect quantity and type of catch of target fish, thereby resulting in a negative economic impact. Since restricting soak time encourages inefficient fishing, it may result in increased fishing effort. For these reasons, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time.

2.3.4. New Technology

2.3.4.1. Breakaway Panels

This strategy would require that all drift gillnets insert breakaway panels in their nets. This strategy was suggested because it has worked with set gillnets in California. The application of break-away panels to drift gillnets is inappropriate because of general differences between the two gear types (PCTRP 1996). Therefore, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time

2.3.4.2. Conversion of the Fleet to Other Gear Types

This strategy would require that all vessels convert their drift gillnet gear to an alternative fishing gear such as longline or harpoon. Currently, swordfish are harvested commercially with longline gear in many parts of the world and by harpoon in southern California. Longline gear and harpooning for swordfish have not had the degree of cetacean incidental taking than drift gillnetting. However, longlining in other parts of the Pacific does result in the incidentally taking other protected marine species (e.g., sea turtles) (PCTRP 1996). Converting a vessel from drift gill net to longline would be extremely expensive and time consuming for each gillnet vessel owner. In some instances, vessels would be unsuitable for such a conversion. This strategy would probably preclude a significant number of existing fishers who cannot afford such a conversion. At this time, California law prohibits landing catch from longlining and Oregon law limits longline to 20 permitees. Harpoon conversion is relatively simple in comparison to converting to longlining. Many fishers already have the equipment required for harpooning. The harpoon fishery is limited and would be unable to support the number of fishers that would be displaced by a drift gillnet fishery closure. For these reasons, this strategy is not likely to achieve the objectives of the MMPA and is not considered viable at this time.

3.0. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. Status of Protected Marine Populations

3.1.1. Marine Mammals

The following is a brief presentation of information on status of each marine mammal stock that has been observed incidentally taken in the CA/OR drift gillnet fishery for thresher shark and swordfish between 1990-1996. Information is also provided on other sources of human-caused incidental taking. The presented information may be found in the U.S. Pacific Marine Mammal Stock Assessments (Barlow et al., 1995).

Short-Finned Pilot Whale (Globicephala macrorhynchus). For the purposes of the SARs, short-finned pilot whales in the Pacific U.S. Exclusive Economic Zone (EEZ) of Washington, Oregon, and California are considered one "stock." Short-finned pilot whales were once common off the coast of southern California. However, few sightings have been made between 1984-1992, despite increased survey efforts. Because no current estimates of short-finned pilot whale abundance are available, no PBR level can be calculated. The average annual estimated mortality (1991-1993) for short-finned pilot whales in the CA/OR DGN fishery is 36 animals. Historically, short-finned pilot whales were also taken incidental to the squid purse seine fishery off southern California. However, the level of this taking is unknown and no recent reports of mortality have been received. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Since the status of the stock with respect to its Optimal Sustainable Population level is unknown and there are documented incidental takes of this stock, this stock is considered "strategic."

Baird's Beaked Whale (Berardius bairdii) The SARs considered Baird's beaked whales in the EEZ waters off the coasts of California, Oregon, and Washington as one stock. Sightings of Baird's beaked whale have been rare, even during ship and aerial transect surveys. The best population estimate currently available is 38 animals (C.V.=1.03). The PBR for this stock is only 0.2 animals per year (or one animal every 5 years). Two Baird's beaked whales were observed incidentally taken in the CA/OR drift gillnet fishery in 1994 (none observed taken 1991-1993). Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Since the average annual incidental mortality (1991-1993) of this stock exceeds its PBR level, this stock of Baird's beaked whale is strategic.

Mesoplodont Beaked Whales (Mesoplodont spp.) Due to the difficulty in identifying the species of Mesoplodont beaked whales and rarity of sightings, nearly no species-specific information is currently available. For these reasons, the SARs considered all Mesoplodont beaked whales as one stock in the EEZ waters off the coasts of Washington, Oregon, and California. The best available population estimate is 250 animals (C.V.=0.83). The estimated PBR for this groups of species is 1.4 Mesoplodont beaked whales per year and the estimated average annual mortality of Mesoplodont beaked whales in the CA/OR drift gillnet fishery is 7.7 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Since the estimated average annual incidental mortality of Mesoplodont beaked whales exceeds its PBR, this group of species is classified as strategic.

Cuvier's Beaked Whales (Ziphius cavirostris) The SARs considered the Cuvier's beaked whales in the EEZ waters off California, Oregon, and Washington as one stock. Sightings of Cuvier's beaked whale off the U.S. west coast have been infrequent. Based on the best available data, the best population estimate for this stock of Cuvier's beaked whale is 1,621 animals. The estimated PBR for this stock is 8.9 animals per year and the average annual estimated mortality (1991-1993) in the CA/OR drift gillnet fishery is 24 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Since the estimated annual average incidental mortality of this stock of Cuvier's beaked whale exceeds its PBR level, it is considered strategic.

Pygmy Sperm Whale (Kogia breviceps) For the purposes of the SARs, pygmy sperm whales found with the EEZ off the coasts of Washington, Oregon, and California are considered one stock. Sightings of Kogia species are very rare. The best estimate of population abundance for this stock is 870 animals (C.V.=0.80) and its estimated PBR is 4.8 animals per year. The average annual estimated mortality (1991-1993) in the CA/OR drift gillnet fishery is 5.7 animals. Since the average annual incidental mortality is greater than the PBR for this stock of pygmy sperm whale, it is considered strategic. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable.

Sperm Whale (Physeter macrocephalus) The SARs considered sperm whales in the EEZ off the coasts of California, Oregon, and Washington as one stock. The SARs concluded that the most precise estimate of population abundance size for this population is 756 animals. The PBR calculated for this stock is 1.0 animals per year and estimated average annual incidental mortality (1991-1993) in the CA/OR drift gillnet fishery is 17 animals. However, this sperm whale stock's PBR level is based on a predicted population abundance size that is probably an underestimate because it does not include sperm whales known to occur in Oregon and Washington, and the population survey was conducted at a time of year when sperm whales are least abundant in California waters. In addition, the seasonal appearance of sperm whales along the U.S. West Coast suggests that the stock range is larger than the area in which the population surveys occurred. If population abundance size is underestimated, then the calculated PBR level for this sperm whale stock is overestimated because of the smaller population abundance level and safety factor (0.1) utilized to calculate PBR. Because sperm whales are listed as an endangered species under the Endangered Species Act (ESA), this stock is considered as strategic stock in the SARs. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Although there are no confirmed reports of sperm whales begin killed by ship strikes, additional mortality from ship strikes may occur and go unreported.

Humpback Whale (Megaptera novaeangliae) The SARs considered humpback whales that migrate between the United States and Mexico as one stock. The most precise and least biased estimate of this stock's population abundance is 597 animals. The estimated PBR is 0.5 whales per year (or 1 animal every 2 years). One humpback whale was observed taken in the CA/OR drift gillnet fishery in 1994. Because the humpback whale is listed as an endangered species under the ESA, the stock is classified as strategic in the SARs. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Strikes by ships have been implicated in the deaths of at least two humpback whales in California. Additional mortality probably goes unreported.

Bottlenose dolphin - offshore stock (Tursiops truncatus) The SARS considered offshore bottlenose dolphins found in the waters off California, Oregon, and Washington as one stock. The best population abundance estimate for this stock is 2,382 animals. The estimated PBR level for this stock is 18 animals a year. The average annual estimated mortality (1991-1993) of this stock in the CA/OR DGN fishery is 7.7 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. There has been one documented incidental taking of an offshore bottlenose dolphin in the California anchovy, mackerel, and tuna purse seine fishery. This stock is not classified as strategic under the MMPA.

California sea lion (Zalophus californianus californianus) The U.S. California sea lion population is distributed between the U.S./Mexico border and extend northward into Canada. The population abundance estimate for this stock is between 161,066 to 181,355 animals and the estimated PBR is 5,052 animals per year. In 1993, the CA/OR DGN fishery and the nearshore set gillnet fishery for angel shark, halibut, white seabass, and white croaker incidentally took an estimated 2,093 California sea lions. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Logbook information indicate that mortality of California seal lions also currently occurs in several California purse seine fisheries. California sea lions are also injured by marine debris. The stock is not classified as "strategic" under the MMPA.

Common dolphins - short and long beaked (Delphinus delphis) Common dolphins off California are classified into two stocks, the short-beaked California, Oregon, Washington stock and the long-beaked California stock. The best abundance estimates for these stocks is 225,821 short-beaked common dolphins and 9,492 long-beaked common dolphins with a PBR of 1,792 animals and 56 animals, respectively. The average estimated annual mortality (1991-1993) for short-beaked common dolphins in the CA/OR DGN fishery is 310 animals and for long-beaked common dolphins is 17 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Common dolphins are also incidentally killed in the California near-shore set gillnet fishery for halibut, flounder, angel shark, yellowtail, white seabass, and white croaker.

Dall's porpoise (Phocoenoides dalli) The SARs designated Dall's porpoise in California, Oregon, Washington as one stock. The best estimate of population abundance for this stock is 78,422 Dall's porpoise. The estimated PBR for this stock is 589 animals. The average estimated annual mortality (1991-1993) for Dall's porpoise in the CA/OR DGN fishery is 36 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. Logbook data indicate that additional incidental mortality of Dall's porpoise occurs in the groundfish trawl fishery, the salmon troll fishery, and the salmon set and drift gillnet fishery. This stock is not designated as "strategic" under the MMPA.

Northern right whale dolphin (Lissodelphis borealis) The SARs designated Northern right whale dolphins found in the waters of California, Oregon, Washington as one stock. The estimated population abundance for this stock is 21,332 animals and the estimated PBR is 151 animals. The average annual estimated mortality (1991-1993) for Dall's porpoise in the CA/OR DGN fishery is 46 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. This is not a strategic stock under the MMPA.

Northern elephant seal (Mirounga angustirostris) The U.S. breeding population of northern elephant seals is considered one stock in the SARs. The best estimate of population abundance for this stock is 73,500 animals with a PBR of 1,743 animals. The estimated average annual mortality (1991-1993) of northern elephant seals in the CA/OR DGN fishery is 116 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. The set gillnet fishery in California also incidentally takes northern elephant seals, however, this fishery has diminished significantly in recent years. The stock is not considered "strategic" under the MMPA.

Pacific white-sided dolphin (Lagenorhynchus obliguidens) Pacific white-sided dolphins found in California, Oregon, and Washington are considered one stock in the SARs. The population abundance estimate for this stock is 121,693 animals and the estimated PBR is 829 animals per year. The estimated average annual mortality (1991-1993) in the CA/OR DGN fishery for this stock is 28 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. This is not a strategic stock under the MMPA.

Risso's dolphin (Grampus griseus) Risso's dolphins in California, Oregon, and Washington waters are considered one stock in the SARs. The best estimate of population abundance for this stock is 32,376 animals with a PBR estimate of 224 animals per year. The average annual estimated mortality (1991-1993) for this stock is 39 animals. Similar drift gillnet fisheries for swordfish and sharks occurs along the coast of Baja California, Mexico, and may take animals from the same population. However, species-specific mortality information is unavailable. This stock is not considered strategic under the MMPA.

3.1.2. Sea Turtles

Numerous human-induced factors have adversely affected sea turtle populations in the North Pacific and resulted in their threatened or endangered status (HSTRT, 1992; Eckert, 1993; Wetherall et al., 1993, NMFS and USFWS, 1996a,b,c,d). For instance, on their nesting beaches, sea turtles are vulnerable to exploitation for their meat, eggs, hides, and other products for commercial and subsistence purposes. Coastal development, dredging, vessel traffic, erosion control, sand mining, vehicular beach traffic, and artificial beach lighting have resulted in degradation or destruction of sea turtle nesting, breeding and/or foraging habitats. Human-induced changes in natural predators' feeding behaviors may also contribute to increased predation on sea turtle nests and eggs. Chemical pollution may adversely affect sea turtles in their terrestrial or marine habitats. Fibropapilloma disease has increased in recent years and poses a threat to some sea turtle populations. Fibropapilloma tumors eventually grow large enough to obstruct vision, become extensive in the mouth and throat, or affect internal organs (Balazs, 1991). Sea turtles that encounter and ingest ocean debris (e.g., plastics) are known to be adversely affected. Finally, documented incidental capture and mortality by purse seines, gillnets, trawls, longline fisheries, and other types of fishing gear also adversely affect sea turtles. Currently, the relative effect of each of these sources of impact on sea turtles is difficult to assess. However, there are indications that there are an increasing number of Asian longline tuna vessels operating in the Pacific (NMFS/USFWS, 1995). The relative incidental takes of sea turtles by this longline fleet is likely to be high.

The U.S. longline fishery in the western Pacific targets swordfish, tuna, and other larger pelagics and operates primarily out of Hawaii. This fishery's incidental takes includes several sea turtle species including loggerhead turtles, green turtles, leatherback turtles, Hawksbill turtle, and the olive ridley turtle. Whether the loggerheads and leatherbacks incidentally taken in the Hawaii longline fishery and the CA/OR DGN fishery are part of the same turtle populations is unknown. A recent evaluation of the impact of the Hawaiian longline fishery on turtles estimated that 109 leatherback encounters and 3.0 leatherback mortalities (95% confidence limits, 0.0-13.0) may occur each year in the fishery (NMFS, 1996). Furthermore, an analysis of the impact of the Hawaiian longline fishery on loggerhead turtles estimated that 261 loggerhead entanglements and 50 loggerhead mortalities occur each year (NMFS, 1996).

The following is a brief presentation of information on status of the sea turtle populations that have been observed incidentally taken in the CA/OR drift gillnet fishery for thresher shark and swordfish between 1990-1994.

Loggerhead Turtle (Caretta caretta) Throughout its range, the loggerhead turtle is listed as a threatened species under the Endangered Species Act. The loggerhead is a circumglobal species inhabiting continental shelves, bays, estuaries and lagoons in the subtropical, temperate and occasionally tropical waters (MMS, 1992; NMFS, 1991; Eckert, 1993). Juvenile and subadult loggerheads are omnivorous, foraging on pelagic crabs, molluscs, jellyfish, and vegetation captured at or near the surface (Eckert 1993). The maximum recorded diving depth for loggerhead is 233 meters (Sakamoto et al. 1990 cited in Eckert 1993). Average carapace length for adult females is 90-95 cm (Dodd 1988 cited in Eckert 1993). The primary threats to the loggerheads in the Pacific are incidental mortalities associated with commercial fisheries (NMFS and USFWS, 1995a).

Loggerheads were commonly taken in pelagic north Pacific driftnets, indicating that they inhabit open ocean areas of the Pacific (Gjernes et al. 1990, Balazs and Weatherall 1991 cited in NMFS and USFWS 1995a). In the Pacific basin, nesting is restricted to the western region, primarily Japan and Australia (NMFS and USFWS 1995a); no nesting occurs on U.S. beaches. In the eastern Pacific, the largest known aggregations of loggerheads are of juveniles (mean shell length=60 cm) (Bartlett 1989 cited in NMFS and USFWS 1995a) off the west coast of Baja California, Mexico, some 10,000-12,000 km from the nearest significant nesting beaches in Japan and Australia. Estimates of abundance of these foraging populations have been as high as 300,000 loggerheads (Pitman 1990, Bartlett 1989 cited in NMFS and USFWS 1995a) and sightings are usually confined to the summer months in the eastern Pacific, peaking in July-September off southern California and southwestern Baja California, Mexico (NMFS and USFWS 1995a). Sakamoto et al. (1990) report that the maximum dive depth recorded for loggerhead turtles is 233 m.

Southern California is apparently the northern extent of its range (Stebbins 1966, Stinson 1984, Guess 1981a,b cited in NMFS/USFWS 1995a), however, in 1991 a loggerhead stranded dead in Alaska and occasional sightings occur off Washington (Eckert, 1993), although most sightings are from off California (Stinson, 1984). Most of the sightings in U.S. West Coast waters are of juveniles (20-60 cm shell length) (NMFS and USFWS 1995a). Although life history information is limited, Pacific basin loggerheads' developmental habitats appear to be widely separated from rookery sites. One hypothesis is that west Pacific hatchlings may become entrained in the central ocean gyre, and ultimately drift south with the California Current to Mexico. Loggerhead turtles have been observed incidentally taken in the CA/OR DGN fishery offshore southern California.

CA/OR Drift Gillnet Fishery

The NMFS's Southwest Region has implemented an Observer Program in the CA/OR DGN fishery since July 1990. This program has been administered under the authority of sections 114 and 118 of the MMPA to record incidental marine mammal taking, collect biological samples, and record other bycatch information. Between July 1990 and December 1995, seven loggerhead turtles were observed incidentally entangled, six of which were released alive (NMFS unpublished data) (NMFS unpublished data). The 5-year (1991-1995) estimated annual average entanglement and mortality rates in the CA/OR DGN fishery are 10 (CV=0.40, 95% C.I. 2.16 - 17.84) and 1 (CV=0.93, 95% C.I. 0.0 - 2.82) loggerheads, respectively. All seven of the loggerhead sea turtles that were observed incidentally entangled in the CA/OR DGN fishery occurred in waters south of 34° latitude (Point Conception, California) and during the months of June, July, August, and January. Average carapace length was 45.4 cm (range, 32 - 59 cm). Since carapace lengths of loggerheads entangled in the CA/OR DGN fishery were within the range of sizes for juvenile loggerheads that annually occur off Baja California, the loggerheads entangled in the fishery were probably juveniles.

Three unidentified, hard-shelled sea turtles were also observed entangled during this period in the DGN fishery, of which two were released alive. All of these unidentified sea turtles were entangled south of Point Conception and in the vicinity of where the identified loggerheads were observed entangled. Furthermore, the only other turtle species that has been observed entangled in the fishery is the leatherback (a soft-shelled turtle). Thus, the unidentified turtles were likely loggerheads.

Leatherback Turtle (Dermochelys coriacea) The leatherback turtle is listed as an endangered species under the Endangered Species Act throughout its range. Leatherbacks, the largest of the sea turtles, have a circumglobal distribution and commonly range farther north than other sea turtles, probably because of their ability to maintain warmer body temperature over longer time periods and the widely dispersed nature of their primary food source cnidarians (jellyfish, siphonophores) and tunicates (salps, pyrosomas) (Eckert, 1993). Adult leatherbacks are assumed to inhabit primarily open ocean waters. Leatherbacks have been reported on two occasions to dive to depths exceeding 1000 meters. However, the leatherback's routine dive depth and duration have been recorded between 50-84 meters and 4-14.5 minutes, respectively (Lutz and

Musick, 1997). Primary threats to leatherbacks in the Pacific are incidental take in coastal and high seas fisheries, and the killing of nesting females and eggs at the nesting beaches (NMFS/USFWS 1995b).

In the eastern Pacific, leatherbacks have been sighted as far north as Alaska (NMFS/USFWS 1995b). However, this is considerably north of their expected range and occurrences in Alaskan waters are probably associated with warm water years or El Nino events. The occurrence of leatherbacks off the Pacific Northwest usually coincides with the arrival of albacore during late summer months. Leatherbacks are sometimes seen in coastal waters, but they are essentially pelagic and dive to great depths (NMFS, 1991). Current evidence suggests that adults migrate between temperate and tropical waters to optimize foraging and nesting (Eckert, 1990). However, specific leatherback foraging grounds have not been identified (NMFS, 1991).

Nesting occurs on beaches of 40° North to 35° South Latitude (Sternberg, 1981) and no nesting occurs on U.S. beaches. Until recently, about 50 percent of the global population of female leatherbacks nested along the Pacific coast of Mexico (NMFS/USFWS 1996b). The Pacific coast of Mexico is generally regarded as the most important leatherback breeding ground in the world. Nesting is seasonal in Mexico, extending from November to February (Eckert 1993). Pritchard (1982a) estimated that 75,000 females nested annually in Michoacan, Guerrero, and Oaxaca, Mexico. Today these nesting populations are significantly reduced (NMFS/USFWS, 1996b). For instance, since 1986, a monitoring program at a major nesting beach in Mexiquillo, Mexico, has documented an approximate 90 percent decline in the number of leatherback nesters in the past decade (Sarti, 1996). Although the reason for the leatherback decline is unclear, the collection of eggs and incidental catch in the now-defunct high seas driftnet fishery in the 1980's are most likely contributing factors (Sarti, 1996).

Leatherback nesting also occurs in the western Pacific, including China, Southeast Asia, Indonesia, and Australia (Recovery Plan) and limited nesting occurs on insular central and south Pacific islands. Nesting in the western Pacific peaks in May and June in China, June and July in Malaysia, and December and January in Queensland (Eckert 1993). Leatherbacks are in serious decline at all major Pacific basin rookeries (NMFS/USFWS 1995b).

The seasonal presence of adult females at major Pacific basin rookeries suggests that leatherbacks migrate between nesting and non-nesting areas (NMFS/USFWS 1995b). Eastern Pacific migratory corridors probably exist along the western U.S. and Mexico west coasts. Stinson (1984) concluded that the leatherback was the most common sea turtle north of Mexico and noted that their appearance in southern California coincides with the summer arrival of the 18-20°C isotherms. Leatherbacks have been sighted as far north as Alaska on the U.S. west coast. Aerial surveys in California, Oregon, and Washington have shown that most leatherbacks occur in slope waters, while fewer occur over the continental shelf (Eckert, 1993). The data indicate that during the summer and fall when sea surface temperatures are highest, leatherbacks occur north of central California (Dohl et al., 1983; Brueggeman 1991 cited in Eckert 1993).

Leatherback sightings peak in August along the coast of California, which may reflect a southward movement of adults for winter breeding in Mexico (NMFS/USFWS 1995b). Leatherbacks are the most frequently sighted marine turtle off the northern and central California coastline (Dohl et al., 1983). From 1986 to 1991, 96 leatherbacks were sighted within 50 km of Monterey Bay, the majority of these sightings occurring in August (Starbird et al. 1993 cited in NMFS/USFWS 1995b). Leatherback sea turtles have been observed incidentally taken in the CA/OR DGN fishery.

CA/OR Drift Gillnet Fishery

Under the NMFS's Observer Program between July 1990 and December 1995, 15 leatherbacks were observed incidentally entangled in the CA/OR DGN fishery, 5 of which were released alive (one leatherback of unknown condition was also released (NMFS unpublished data)). The estimated 5-year (1991-1995) average annual entanglement and mortality rates in the CA/OR DGN fishery are 20 (CV=0.26; 95% C.I. 9.81 - 30.19) and 11 (CV=0.36; 95% C.I. 3.28 - 18.76) leatherbacks per year, respectively. All of the leatherbacks that were observed incidentally entangled in the CA/OR DGN fishery during the period occurred in waters north of 34° latitude and during the months of September, October, and January. Carapace length of leatherbacks observed entangled in the fishery ranged from 132 cm to 213 cm. Since these carapace lengths of leatherbacks were within the range of sizes for subadults (75-154 cm) and adult leatherbacks (>=154 cm), the leatherbacks entangled in the fishery were probably subadults and adults.

3.1.3. Sea Birds

There have been few observations of sea birds incidentally taken in the CA/OR DGN fishery. For example, during 1990, 1992, and 1994, only one sea bird (unidentified) was observed taken in each of the years and during 1991, 1993, and 1995, no sea birds were observed taken.

3.1.4. Salmonids

In recent years, because of the critically low population sizes of some salmon stocks and threats to their continued existence, certain stocks in Washington, Oregon, and California have been listed as endangered or threatened species under the Endangered Species Act. The CA/OR DGN fishery does not take any listed or non-listed salmon stocks.

3.2. Description of the CA/OR Drift Gillnet Fishery

Under section 118 of the MMPA, drift gillnet fishing that targets swordfish and thresher shark by vessels who land their catch in California ports, and drift gillnet fishery that targets swordfish by vessels that land their catch in Oregon ports, are categorized together as one fishery. No Federal fishery management plan is in place for either fishery.

3.2.1. California Drift Gillnet Fishery

The California drift gillnet fishery (CADGN) is managed by the California Department of Fish and Game and regulated by laws passed by the California legislature as specified in the California Fish and Game Code (PCTRP 1996). This is a limited entry fishery, the number of permittees limited by statute. Fishers are required to possess a valid drift gillnet permit in order to fish. A general gill and trammel net permit is also required which are renewed annually and are only transferable under limited conditions. In addition, fishers are required to maintain and submit a logbook (§8026 Fish and Game Code and §106 of California Code of Regulations, Title 14) detailing their fishing activities.

The CADGN fishery developed rapidly in the late 1970's off southern California. The fishery originally targeted common thresher shark, but swordfish and shortfin mako shark soon became important components of the catch. Today, the CADGN fishery operates primarily in California between San Diego and Cape Mendocino, mostly within 200 miles from shore (LMR 1994), and swordfish constitutes the majority of the catch. During years of El Niño events, the vessels have ranged northward off Oregon (LMR 1994). The majority of the CADGN total fishing effort is concentrated in the southern California bight.

At least 90% of CADGN fishers form code groups; an association of individuals that communicate via radio, exchanging information on the location of target fish species, fishing conditions, presence and location of marine mammals and other pertinent information. In California there are five major code groups, with seven to 15 vessels participating in each group. Code groups enable each vessel to find productive fishing locales and avoid unproductive fishing areas and dangerous sea conditions.

Vessel size in the CADGN fishery currently ranges from 30-75 feet, with more than 40% of the vessels greater than 50 feet. Fishers use nets constructed from 3-strand twisted nylon, tied to form meshes. The meshes range from 16 to 22 inches stretched, and average 19 inches stretched. Although termed "gillnets", the nets actually entangle fish, rather than trap them by the gills. Nets are also size selective; large fish such as swordfish get entangled while smaller fish pass through the mesh. Net length ranges from 750 to 1000 fathoms and averages 960 fathoms. The top of the net is attached to a float line by hanging lines laced through several meshes and tied at intervals of 8 to 24 inches. The number of meshes per hanging determines the slack or tautness of the net. The bottom of the net is attached to a weighted lead line. The number of meshes between the float line and the lead line, is the depth of the net, which ranges from 100 to 150 meshes. The float line is usually at least 18 to 26 feet below the surface of the water to allow small boats to pass over the net and to allow marine mammals to swim over the net (LMR 1994). The lines that attaches the buoys to the floatline, and dictate the depth the net is fished, are referred to as buoy lines or extenders. Nets are often set perpendicular to currents, or across temperature, salinity or turbidity fronts. Nets are typically set in the evening, allowed to soak overnight, then retrieved in the morning. The average soak time is 10.5 hours. The vessel remains attached to one end of the net during the soak period, drifting with the net.

Since 1982, CADGN fishing seasons have become shorter, and area restrictions have increased in response to concerns for other fish species, marine mammals, and conflicts with recreational and harpoon fishers. At the present time, the CADGN season is closed from February 1st through April 30th. From May 1st through August 14th, drift gillnets cannot be used to take shark or swordfish in ocean waters within 75 nautical miles (nm) from the mainland coastline between the westerly extension of Oregon-California boundary and the western extension of the U.S.-Mexico boundary. However, a permittee may land swordfish or thresher shark if the fish were taken in waters more than 75 nm from the mainland shore. From August 15th through January 31st, swordfish can be taken within 75 nm, pursuant to additional area restrictions specified in the California Fish and Game Code (section 8575 and 8575.5). The majority of fishing effort takes place from October through December.

Overall, fishing effort has declined since the mid 1980's. In the 1986-87 season, there were 11,000 sets (equivalent to days fished), while in the 1994-95 and 1995-96 season there were 3,689 and 3,755 sets, respectively. The decrease in effort coincides with increasing regulations and laws, and a decrease in the number of active permittees. Legislation, passed in the early 1980's, established the fishery as a limited entry fishery with a maximum of 150 permits. Since the actual number of permittees at that time exceeded 150, new entrants were not allowed. However, an additional 35 permits, referred to as experimental swordfish permits, were established in 1984 for taking swordfish north of Point Arguello. In the 1986-87 season, there were over 210 active permittees (those that caught and landed fish) participating in the fishery, while in the 1994-95 season, there were 124 active permittees with 31% making three or less landings. Recently the 35 experimental swordfish permits were combined with the 150 permits. However, not all available permits have been re-issued (through attrition, retirement, death etc.). At the current time, there are 157 eligible permittees for the 1996-97 season. However, the number of vessels fishing "full-time" is estimated at about 90 boats (LMR 1994) because a portion of the fleet only lands the minimum annual amount of swordfish to maintain their drift gillnet permits.

No new drift permits will be issued; current permits will only be issued to prior drift gillnet permittees who possess a general gillnet and trammel net permit (which has its own set of requirements), and who possess a valid CADGN permit, or a valid swordfish limited entry experiential fishery permit during the previous season (providing the permit was not revoked), and who landed at least 2,500 pounds of swordfish, or 1,000 pounds of shark, or landed shark or swordfish for which the permittee was paid $1,000. The fee for renewal is currently $330 (there is an additional fee to maintain the general gill and trammel net permit). Permits can be transferred, but only when: 1) the permittee has held the permit for 3 years; or 2) the permittee is injured or has a serious illness and hardship will result if the permit cannot be transferred; or 3) a marriage is dissolved and the permit is held as community property; or 4) the permittee has died and surviving family wishes to transfer the permit. Permits may only be transferred to a person who holds a commercial fishing license and a general gill and trammel net permit. Finally, permits can be revoked or suspended by the director upon conviction for willful violation of California Fish and Game code.

California DGN fishery landings for swordfish, common thresher shark, and mako shark vary from season to season. Swordfish comprise the majority of the catch in the fishery and demand the highest price per pound. In the past five years, DGN landings of swordfish have ranged from 953,000 (1994-95) to 2,015,800 (1993-94) pounds, an average of 1.5 million pounds per season. Landings of common thresher shark have averaged 395,400 pounds while mako shark have averaged 178,300 pounds. While swordfish, common thresher shark, and mako shark annually represent over 90% of the total catch by the California DGN fishery, other species commonly caught include opah, big-eye thresher, louvar, and tunas (Doyle et al., 1993). A small percentage of the annual catch also includes various other shark species, barracuda, Pacific bonita, dolphinfish, mackerel, sardines, and white seabass. Over the past five years, California's DGN fishery has averaged $7.2 million in ex-vessel value from landings of swordfish, common thresher and mako (excluding the other species). The majority of swordfish landed commercially in California ports are landed by drift gillnet vessels (82% in 1993). Longline and harpoon vessels land a much smaller percentage of the total swordfish landed in California ports, 10 and 8 percent, respectively.

California's DGN fishery not only provides jobs for skippers and their crew, but also contributes to the employment of persons in related industries, such as shipyard, fuel docks, dock facilities, insurance companies, wholesale and retail fish markets, fish shippers, restaurants, and the trucking industry. In addition, California's consumers are provided with fresh, high-quality local seafood. Based on multipliers of ex-vessel values, the total economic value of the California drift gillnet fishery is estimated to be in excess of $36 million dollars per year.

3.2.2. Oregon Drift Gillnet Fishery

Before 1995, drift gillnet vessels originating from California ports fished for swordfish off the coast of California and Oregon (outside 3 miles of the coast since 1987) (PCTRP 1996). Oregon did not benefit economically because no swordfish could be landed in the state prior to 1995. For these reasons, in 1995 a new developmental fishing program was enacted by the Oregon state legislature. This law allowed the Oregon Fish and Wildlife Commission to adopt regulations which allow the Oregon Department of Fish and Wildlife (ODFW) to implement a developmental gillnet fishing program. Consequently, in 1995 the ODFW issued (by lottery) ten "unlimited" landing permits which allowed gillnet fishers to land swordfish in Oregon ports. Another 44 "limited" delivery permits were issued which allowed fishers to make up to 5 deliveries in Oregon ports in 1995. Despite the issuance of 54 permits, only two swordfish landings were made in 1995. In the second year of the program, interest in the developmental permits decreased significantly. In 1996, only 15 applications for a swordfish developmental fisheries permit were received by ODFW. By lottery, ten permits were issued for "unlimited" swordfish landings; another five "limited" permits were issued (five deliveries only). In both years interest in the Oregon program from fishers that did not already have a CADGN permit was low. For example, in 1995, 20 out of 54 permittees did not already have CADGN permits. In 1996, only 3 out of 15 permittees did not also have a CADGN permit.

Potentially, the number of developmental fishing permits that could be issued by ODFW is currently unlimited. However, ODFW's current policy is that only ten permits with "unlimited" landing ability will be issued each year and interest in the program appears to have decreased during its second year since only two landings were made in 1995 and only 15 people applied for permits in 1996. Developmental fishing gillnet permits are not transferable. Several other terms and conditions apply to these permits such as only swordfish can be landed in Oregon ports. ODFW has the authority to stipulate additional conditions such as requiring the use of "pingers" or minimum length of extenders for boats that land swordfish in Oregon ports.

4.0. ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

The impact of all major Federal actions must be considered prior to implementation to determine whether the action will significantly affect the quality of the human environment. In this section, an analysis of the environmental and socio-economic impacts of alternatives considered in this environmental assessment is presented.

4.1. Alternative 1: No Action Alternative

This Alternative is not considered viable because NMFS is required under section 118(f) of the MMPA to develop and implement PCTRPs designed to assist in the recovery, or prevent the depletion of, strategic marine mammal stock(s) which interact with Category I or II fisheries. Furthermore, where necessary to implement a PCTRP to protect or restore a marine mammal stock or species covered by such a plan, NMFS may promulgate regulations under the MMPA.

Currently, no regulations exist that will provide the level of protection necessary to reduce the incidental mortality and serious injury of strategic marine mammal stocks taken in the CA/OR DGN fishery to below the PBR levels established for these stocks. Under this Alternative, no regulations would be published to implement the PCTRP. Consequently, the fishery would need to voluntarily change its current level of fishing effort or method of fishing to ensure that its level of incidental mortality and serious injury of strategic stocks was reduced to below PBR levels within 6 months of NMFS's adoption of a final PCTRP. The environmental consequences of not issuing regulations to reduce the level of morality and injury of strategic marine mammal stocks in the CA/OR DGN fishery would depend on how the participants in the fishery responded. If fishers reacted by voluntarily changing its fishing methods or level of effort, the goals of the MMPA may be met. However, if fishers did not voluntarily change and current levels of incidental mortality and serious injury levels in the fishery remained the same, depletion of strategic stocks would be likely to occur. If no new regulations were promulgated, no additional socio-economic impacts to the CA/OR DGN fishery would occur because the fishery would not be required to change its fishing techniques or modify gear.

4.2. Alternative 2: Final Rule (Preferred Action)

This alternative would be most consistent with the statutory requirements to reduce strategic stock mortality and serious injury incidental to operations of the CA/OR DGN fishery to below PBR levels within six months of the final PCTRP's implementation and with the recommendations of the TRT.

4.2.1. Impacts to Marine Mammals

4.2.1.1. Extenders

The regulations establish a minimum extender length requirement of >=6 fathoms (36 feet). Traveling whales and dolphins tend to swim near the surface because it is energetically more efficient than traveling at deeper depths (PCTRP 1996). Lowering the net allows these animals a window to swim through with reduced risk of entanglement. Lowering the net has proven to reduce the bycatch of marine mammals in other gillnet fisheries. Experiments in both the North and South Pacific (Hembree and Harwood, 1987; Perrin et al, 1994) have been conducted to test the effects of setting drift gillnets lower in the water column. These tests compared nets set at the surface with nets deployed several meters below the water line. These experiments showed either a statistically significant reduction or a strong trend in reduction in cetacean bycatch.

Since 1990, biological observers have been placed on CA/OR DGN vessels to record marine mammal mortality, net characteristics, and other variables. Recent analysis of these data indicates that there is a significantly lower bycatch rate for all cetaceans when extender lengths are ≥36 feet as compared to shorter lengths (PCTRP, 1996). A chi-square test was performed on the extender length categories 10+ to 20, 20+ to 30, 30+ to 40, 40+ to 50, and 50+ to 60 feet. This analysis showed that the level of cetacean entanglement was dependent on extender length used ($p<0.001$). For example, the odds of cetacean entanglement decreased 25% for extender lengths of 36 fathoms or greater. In addition, observers recorded approximate horizontal and vertical positions of entangled marine mammals in the net. Analysis of the vertical location of marine mammal entanglements in the net showed that the deepest third of the net (vertically) entangles less than the upper two-thirds of the net. Furthermore, anecdotal information provided by CA/OR DGN skippers on damage to nets suggests that a preponderance of cetaceans are caught in the upper third of the net. For these reasons, the regulatory requirement of a minimum 6-fathom extender length should reduce incidental mortality and serious injury of cetaceans by at least 25% in the fishery.

4.2.1.2. Workshops

The regulations require CA/OR DGN vessel operators to attend one Skipper Education Workshop, when notified by NMFS, before October 1, 1997, and at other intervals deemed necessary by NMFS thereafter. Skipper Education Workshops will provide CA/OR DGN vessel operators with information relevant to avoiding marine mammal takes and elicit feedback on how to reduce mortality. Workshops will be conducted by NMFS at several locations in California that are accessible to the majority of CA/OR DGN fishers. The first part of each workshop would be a educational presentation. A critical component of implementing the final PCTRP is the communication of the PCTRP, including its mandates, objectives, and requirements, to the fishery participants. Participants in the CA/OR DGN fishery need to be aware of the PCTRP and its components in order to implement required changes in fishing methods or gear. Since NMFS is unable to provide 100 percent observer coverage of all fishing vessels, each vessel operator should be fully aware, before initiating a fishing trip, of the mandates under which the PCTRP was developed, the process by which the team developed a take reduction strategy, the requirement that all fishers implement the required strategies, and the importance of meeting the objectives of the PCTRP in order to avert more severe management measures, such as time and/or area closures. In addition, workshops will include presentations on how population estimates, PBR, and mortality estimates are estimated, information on gear, fishing practices, and potential strategies that have been identified that may reduce takes, and tips for identifying the strategic stocks. Outreach materials will be provided to workshop participants that explain PCTRP development and implementation process and summarize the major components of the final PCTRP. Participants will also be provided with marine mammal identification guides to aid in correctly identifying animals entangled in nets. Information provided to fishers at the workshop should assist in the implementation of the requirements of the TRP and consequently, reducing marine mammal bycatch.

The second part of the workshops would be interactive between vessel operators and workshop leaders and elicit feedback from fishers on how they avoid incidental marine mammal interactions. The information gathered during this part of the workshop will be considered by NMFS and the TRT when it reconvenes.

The participation of vessel operators in the Skipper Education Workshops should facilitate the successful implementation of the PCTRP and accompanying regulations, and consequently reduce the incidental mortality and serious injury of strategic stocks, and other marine mammal species, in the fishery. Furthermore, the interactive portion of the workshop should contribute to the development of additional measures to further reduce interactions between the marine mammals and the fishery.

4.2.1.3. Pingers

Acoustic warning devices ("pingers") mounted on nets were shown to be effective at reducing the bycatch of harbor porpoise in bottom-set gillnets in the Gulf of Maine (Kraus et al. 1995) and along the Olympic Peninsula, WA (Gearin et al., 1996.). The pingers used in the Gulf of Maine experiment broadcasted a sound level of 132 dB re 1 μPa at 1 meter and a sound frequency of 10 kHz. The pulse duration and pulse rate of the pingers was 300 milliseconds and 1 pulse per 4 seconds, respectively. Scientists do not know why pingers worked in those tests, but pingers were clearly effective in achieving a large (approximately 90%) decrease in harbor porpoise mortality in short-term experiments.

A workshop of cetacean and acoustic experts was convened in Seattle on March 20-22, 1996, to consider the general topic of using acoustic deterrents to reduce marine mammal/human interactions (MMC 1996 et al. 1996). Workshop participants concluded that the results of previous pinger experiments (e.g., New England) were encouraging and that an experiment in the CA/OR DGN fishery should be initiated immediately. The workshop participants recommended that the pingers used in the New England sink gillnet fishery (~10 kHz at 132 dB re 1μ Pa at 1 meter), should be adequate for experimental use in the CA/OR DGN fishery and also recommended several specifications and protocols for pinger experiments in westcoast driftnet fisheries.

Between September 1996 and January 1997, NMFS and the fishery implemented a single-blind experiment through NMFS's Drift Gillnet Observer Program as recommended by the PCTRT (draft PCTRP, 1996). This experiment used pingers with the same sound characteristics as the pingers used in the New England sink gillnet fishery experiment (e.g., broadband signal centered on 10 kHz with a source level of 132 dB re 1μ Pa at 1 meter) (PCTRP, 1996; NMFS, 1997a). Preliminary final results from the pinger experiment indicate that cetacean entanglement and pinger use is statistically dependent (Chi-square test, p=0.006) (NMFS, unpublished data). Out of 420 observed sets during the pinger experiment, 25 sets were observed with cetacean entanglement; 4 of these sets had pingers and 21 did not have pingers. The odds of entanglement decreased from 0.099/set without pingers to 0.022/set with pingers. The results from this experiment indicate that the use of pingers significantly decreases cetacean entanglement by over 75 percent in this fishery. For these reasons, the regulations establish the fleetwide use of pingers for all CA/OR DGN vessels and should substantially decrease incidental strategic stock, and overall cetacean, mortality and serious injury bycatch in the fishery.

Although scientific results clearly indicate that pingers significantly reduced harbor porpoise bycatch in the New England sink gillnet fishery (Reeves et al., 1996) and cetacean bycatch in the CA/OR DGN fishery, scientists do not know why they worked (NMFS, 1997a). Several mechanisms are possible. For example, pingers may operate as acoustic alarms alerting animals to the presence of fishing gear on the assumption they will avoid the gear if made aware of its presence. Alternatively, the sounds emitted by pingers may repel marine mammals away from the gear. Another possibility is that the pingers disperse the prey upon which marine mammals forage and thus, affect marine mammal behavior indirectly.

The state of knowledge about marine mammal hearing abilities and behavior in response to various types of sound is limited (Reeves et al., 1996), although the sound frequency of pingers required in the final rule (10 kHz) is thought to be within the hearing range of most cetacean species incidentally taken in the CA/OR DGN fishery (MMC, 1996). Nevertheless, pingers were not originally designed to annoy (harass) marine mammals. Pingers produce relatively weak sound pulses of 132 dB re 1 μPa at 1 m which attenuate to ambient noise levels at a distance of only 300 m (984.3 ft) from the source (NMFS, 1997).Each pinger sound source is designed to ensonify a radius of 300 meters, with the sound attenuating to 15 dB re 1 μPa above ambient level at 100 meters. In contrast, "acoustic harassment devices" were specifically designed to emit much louder acoustical pulses (e.g., 187-218 dB re 1 μPa at 1 m) strong enough to keep pinnipeds away from nets and aquaculture facilities (Richardson et al., 1995; NMFS, 1997). Some high intensity acoustic harassment devices may be detectable several kilometers from the source (NMFS, 1997). No marine mammals will be injured or experience temporary threshold shifts in their hearing from the sounds produced by pingers. In addition, since the CA/OR DGN fishery is broadly distributed up to 200 nautical miles offshore California and Oregon, and is not concentrated in one local area, the likelihood that pingers used in the fishery will displace marine mammals from significant feeding or breeding areas, or migrator corridors is low.

4.2.2. Impacts to Non-target Finfish

Most non-target finfish species are unlikely to be significantly affected by the introduction of pingers to the marine environment because most fish can sense only low and medium frequency signals (10-1000 Hz). However, clupeids (American shad, Atlantic herring, blueback herring, alewives) are believed to sense and may be averse to the frequencies (10,000 Hz) emitted by the pingers. Krause et al. (1995) found that more herring were caught in the nets without pingers. Anecdotal evidence from the Gulf of Maine sink gillnet fishery suggests that gillnets with pingers catch significantly reduced numbers of Atlantic herring or shad and this displacement may be an important mechanism that serves to reduce porpoise bycatch.

4.2.3. Impacts to Sea Turtles

4.2.3.1. Extenders

Loggerhead Turtles

Extenders <36 feet in length were used on 1,337 observed sets under the NMFS's Observer Program for the CA/OR DGN fishery from July 1990 to December 1995 (NMFS unpublished data). Extenders >=36 feet in length were used on 2,648 sets observed during this period. Because 4 loggerheads were observed incidentally entangled on the sets that deployed <36 foot extenders, the estimated entanglement rate with <36 foot extenders is 0.003 loggerheads/set (4/1,337). Three loggerheads were observed entangled during sets that deployed extenders >=36 feet during the same period and the estimated entanglement rate on sets that used >=36 foot extenders is 0.001 loggerheads/set (3/2,648). In other words, sets that use the >=36 foot extenders entangle two less loggerheads every 1,000 sets. Based on an expected annual average effort of 4,000-4,500 sets per year in the fishery (Julian and Beeson, in press), and since the final rule establishes a minimum extender length requirement of >=6 fathoms (36 feet), the estimated future annual entanglement of loggerheads is 4.5 loggerheads (4,500 x 0.001). If a 14% mortality rate is valid (1 moribund/7 total entangled), the estimated annual mortality with the >=36 foot extender requirement would be <1 loggerhead turtle. Furthermore, over 70 percent of the loggerheads observed entangled were found in the top one-third of the net. For these reasons, requiring that the floatline be set ≥6 fathoms below the surface of the water will likely allow the majority of loggerheads to swim over the net and avoid entanglement and mortality.

Leatherback Turtles

Thirty-three percent (5 out of 10) of the leatherbacks were entangled in the upper one-third of the net during the drift gillnet observer program between July 1990 and December 1995 (NMFS, unpublished data). Because 7 leatherbacks were observed entangled on the sets that deployed <36 foot extenders, the estimated entanglement rate with <36 foot extenders is 0.005 leatherbacks/set (7/1,337). Furthermore, since 10 leatherbacks were observed entangled during sets that deployed extenders >=36 feet during the same period, the estimated entanglement rate on sets that used >=36 foot extenders is 0.004 leatherbacks/set (10/2,648). Therefore, one less leatherback turtle is entangled every 1,000 sets that use extenders that are >=36 feet in length. Based on an expected annual average effort of 4,000-4,500 per year in the fishery (Julian and Beeson, in press) and the final rule's depth-of-fishing requirement, the estimated future annual entanglement of leatherbacks is 18 (4,500 x 0.004). Moreover, if a 57% mortality rate is valid (8 moribund/14 total entangled), the estimated annual mortality with the >=36 foot extender requirement would be 10.3 leatherback turtles. For these reasons, requiring that the floatline be set at least 6 fathoms below the surface of the water should allow some leatherbacks to swim over the net and avoid entanglement.

4.2.3.4. Skipper Education Workshops

During Skipper Education Workshops, NMFS will explain the current status of sea turtles, current impact of the fishery on listed sea turtles, the anticipated impacts of the PCTRP implementation on sea turtles, and steps vessel operators can take to minimize impacts to turtles. For example, any live turtle entangled can be carefully removed from the net to avoid injury. This should further minimize impacts to sea turtles.

4.2.3.3. Pingers

An Environmental Assessment on use of acoustic pingers as a management measure in commercial fisheries to reduce marine mammal bycatch (NMFS, 1997) concluded that pingers should not have an impact on sea turtles because the frequencies being used for pingers are outside the sea turtle's hearing range. Tests done on green and loggerhead turtles indicate that they can detect frequencies from 50-900 Hz. Since the final rule requires that pingers have a performance standard of 10 kilohertz, sea turtles are not likely to hear the pingers.

4.2.4. Socio-Economic Impacts

4.2.4.1. Extenders

Feasibility

Requiring a minimum extender length of 6 fathoms is practical since it is already a common mode of operation for many members of the west coast fleet. There are no safety problems envisioned under this alternative. Fishers can readily modify their extenders to comply with the strategy using materials currently available and at minimal costs.

Target Catch Rate

Swordfish represent the majority of the landings in the CA/OR DGN fishery and demand the highest price per pound out of all the finfish species landed by the fleet (see section 3.2.1, and Hanan et al. 1993). At this time, the affect of requiring a minimum extender length of ≥6 fathoms on swordfish catch is unknown. Following the thermocline, swordfish migrate vertically to shallower waters at night and return to deeper waters during the day (LMR 1994). Depth of the thermocline varies annually, seasonally, daily and geographically and often dictates the water depth at which the net is fished. The fishing strategy of the CA/OR DGN fishery is to straddle the thermocline, where they believe most of the swordfish are located, with the net (LMR 1994). Moreover, CA/OR drift gillnets are usually fished with the floatline (top of net) at least 18 to 26 feet below the surface of the water to allow small boats to pass over them (Hanan and Holt 1993) and to avoid interactions with marine mammals (LMR 1994).

Analysis of data from the NMFS CA/OR DGN Fishery Observer Program (1990-1995) indicates that the majority of observed sets used extender lengths of 36 feet, but extender lengths ranged from 0 to 100 feet (PCTRP 1996). The use of the various extender lengths does not appear to be concentrated in one fishing location. For example, the geographic distributions of observed sets using extenders <36 feet compared to sets using extenders ≥36 feet are similar for the period (NMFS unpublished data). Also, a substantial portion of the total fishing effort in the past two drift gillnet fishing seasons used extenders that were <36 feet in length. For instance, during the 1994/1995 and 1995/1996 fishing seasons, 41 percent (1,455 out of 3568 sets) and 49 percent (1,748 out of 3566 sets) of logged fishing days involved sets using extenders <36 feet, respectively (California Fish and Game, unpublished data). An analysis of NMFS observer data (1990-1995) indicates that the catch rate of swordfish from observed sets using extenders <36 feet versus sets using extenders ≥36 feet was 2.1 and 2.3 swordfish/set, respectively (NMFS unpublished data). Thus, swordfish catch rates appear to be similar for extenders that are <36 feet or ≥36 feet.

In southern California waters (below 35° N) where the majority of the thresher shark is caught by the CA/OR DGN fishery, analysis of observer data collected from the fishery (1990-1995) indicates that the catch rate of thresher shark from observed sets using extenders <36 feet versus sets using extenders ≥36 feet was 3.79 and 3.70 thresher/set, respectively (NMFS unpublished data). Using the best available data, these catch rates are not statistically different for the different extender length categories ($p=0.8651$).

Despite the use of smaller extender lengths, whether swordfish or thresher shark are actually caught at shallower depths when <36 foot extenders are deployed is unknown because information on the position of the swordfish or thresher shark in the net from those sets is not available. The sets that used extenders that were <36 feet, could have actually entangled swordfish or thresher shark deeper in the net (below 35 feet from the water surface). In addition, the potential loss of target catch from the 6-fathom extender requirement may be offset by the reduction in marine mammal entanglement because costs due to net damage or loss would be less. For these reasons, the best available information indicates that requiring ≥6 fathom extender lengths will most likely not have significant impacts on swordfish or thresher shark catch in the CA/OR DGN fishery.

An evaluation of the use of ≥6 extender lengths before and after August 15 in the CA/OR DGN fishery indicates no significant seasonal trends during the 1994/1995 and 1995/1996 fishing seasons (CDFG unpublished data). The use of the extender lengths <6 fathoms does not appear to be concentrated in one fishing location. In addition, despite the use of smaller extender lengths, whether finfish species other than swordfish or thresher shark are actually caught at shallower depths when <36 foot extenders are deployed is unknown because information on the position of fish in the net from those sets is not available. Furthermore, the potential loss of fish catch from the 6-fathom extender requirement may be offset by the reduction in marine mammal entanglement because costs due to net damage or loss would be less. For these reasons, requiring ≥6 fathom extender lengths will most likely not have significant impacts on other, non-swordfish species targeted by the CA/OR DGN fishery.

Thresher Shark Vessels

Avaiable information indicates that a small portion of the of the CA/OR DGN fleet (e.g., approximately 10 vessels) uses fishing strategies/gear that may not require pingers to be placed on both the floatlines and leadlines. Specifically, this sector of the fleet: (1) targets only thresher shark; (2) fishes in shallow water near the coast (e.g., 3-40 miles (4.83-64.36 km) from shore); (3) uses a smaller net (e.g., 600 fathoms (3600 feet or 1097 m) long, 45-80 meshes deep); (4) does not fish on a thermocline; (5) uses smaller boats (e.g., 30-40 feet (9.12-12.19 m) long); and (6) makes short trips (1-2 days). Since the majority of these relatively small vessels are unobservable, marine mammal interaction data on these vessels is not available at this time. NMFS will reexamine the categorization and definition of the CA/OR DGN fishery in 1998 when it annually reexamines its classification of fisheries to determine whether this portion of the fleet should be classified differently. Furthermore, NMFS will request that the PCTRT at its next meeting evaluate whether certain vessels targeting only thresher shark should be classified as another fishery and/or have different requirements under the PCTRP (March 1998).

4.2.4.2. Skipper Workshops

Skipper workshops would be conducted by NMFS. Therefore, the only cost incurred by the fisher would be travel and time to attend the workshops. However, since workshops would be offered at several locations near the main drift gillnet fishing ports in California (e.g., Crescent City, Morro Bay, Moss Landing, Los Angeles, San Diego), the cost for travel should be minimal. The skipper workshops would be offered during the non-fishing season, thus there should be no loss in fishing time. Any cost for travel to workshops should be offset by the reduction in marine mammal entanglement, and subsequent reduction in costs due to net damage or loss.

4.2.4.3. Pingers

Feasiblity

Deploying pingers on drift gillnets is feasible. The final rule's 300-foot spacing requirement on the floatline and leadline will require up to 41 pingers for mile-long nets (maximum net length by state law). Pingers can be snapped with clips, lanyards, or any other method of attachment onto each line as the net is payed and removed from each line during net retrieval. Deployment of pingers on to the floatline will be easier than placing and removing pingers from the leadline. The final rule allows pingers to be attached to buoys to further facilitate pinger placement on the floatline. However, because as the net is payed out the leadline is buried by slack in net, the net reel may need to be slowed or stopped to safely attach and detach pingers to/from the leadline. However, during the 1996/1997 pinger experiment in the fishery, fishers became very proficient at placing and removing pingers from both the floatline and leadline after about 10 sets. Thus, over time, attachment/removal of pingers should not substantially increase the time it takes to set the net.

Safety

Placement and retrieval of pingers on leadlines and floatlines should be safe. For example, drift gillnet fishers routinely snap buoys to the floatline as the net is payed out and unsnap these buoys during net retrieval and many drift gillnet fishers attach chemical light-sticks to the floatline as it is payed out to attract swordfish. Since various types of fishing gear are commonly attached to the floatline, attaching pingers to this line should be safe. Nevertheless, there may be some hazard to the fisher when placing pingers on the leadline since this line is covered with slack when the net is payed out. Slowing down or stopping the net reel when pingers are placed/removed should increase the level of safety.

Costs

Currently, the cost of pingers is approximately $40/pinger. Thus, the total cost for a set of 41 pingers for a mile-long net would cost approximately $1,640.00. Smaller nets would not require as many pingers and thus total costs would be less. The cost of pingers will most likely be higher in the future when the pingers are sold by distribution companies and not available directly from the manufacturer. Nevertheless, the cost of the pingers could be offset by the reduction in marine mammal entanglement, and subsequent reduction in costs due to net damage or loss.

Target Catch

A pinger experiment conducted in the New Hampshire sink gillnet fishery resulted in very significant reductions in the bycatch of harbor porpoise and no significant reductions in the target fish species (haddock, cod, pollack, and flounder). Although the hearing capacity of swordfish is unknown, since tuna do not have the capacity to hear 10 KHz, by analogy, swordfish also are not likely to hear the sound produced by pingers that will be used in this experiment. Sharks are apparently do not detect sounds above 1 kHz, and their best sensitivity is to sound signals <300 Hz (ARPA, 1995). Furthermore, pingers should not affect the target species' prey, because squid do not hear sounds.

Data collected from the 1996/1997 pinger experiment in the CA/OR DGN fishery indicate that the observed catch rate for swordfish caught in sets that used pingers is 1.8 swordfish/set and for sets that did not use pingers the rate is 2.1 swordfish/set. Analysis of the pinger experiment data indicates that pinger use and swordfish catch are not statistically dependent (p=0.094) (NMFS unpublished data). Thus, pingers do not appear to affect swordfish catch rates in the fishery and no decrease in the catch of the primary target species is expected.

Pinger Durability

Deployment of pingers during the 1996/1997 pinger experiment demonstrated that pinger performance is dependent on following manufacturer's operating instructions and minimizing exposure of battery packs to saltwater. For example, during the first few weeks of the pinger experiment, silicon grease was not applied to O-rings prior to pinger placement which resulted in a limited number of pingers leaking and becoming nonfunctional. Also, because the pingers used in the experiment were not designed with on/off switches, the experimental protocol included the removal of battery packs after each set to preserve battery life. This procedure greatly increased the probability that the pinger battery packs would be exposed to saltwater and malfunction. However, NMFS found that battery life is much longer than originally estimated and does not foresee the need to remove the batteries after every set. Reducing battery exposure to saltwater will substantially decrease pinger malfunction. For these reasons, NMFS recommends the preamble to the final rule that if drift gillnet fishers use pingers that do not have on/off switches, fishers follow manufacturer's deployment instructions closely and minimizing the frequency of battery pack removal (i.e., just keep them pinging for the entire trip) to reduce its potential exposure to seawater and possible pinger malfunction.

During the 1996/1997 pinger experiment, a few pingers had gas build-up from battery exposure to saltwater. This resulted in the cap "popping off" as the cap was being unscrewed to remove the battery pack. The pingers themselves were intact and undamaged (no cracks) and the threads to the pinger and cap were undamaged (no cracks). The only damage was to the battery pack and the leads (e.g., contact points between the battery pack and the pinger's electronics). The company that produced the pingers used in the experiment is aware of this issue and is taking steps to develop a better pinger that does not leak or is less susceptible to water damage. The use of pingers that have on/off switches, or the practice of not removing battery packs after every set (just let them ping), and applying silcon grease on the o-rings as recommended by the company should greatly reduce the probability of this occurring in the future. This incident presented only a minor possibility of injury and if the above recommendations for pinger use are followed, the possibility of injury would be reduced even further. Pingers with on/off switches would be more expensive.

5.0. FINDING OF NO SIGNIFICANT ENVIRONMENTAL IMPACT

For the reasons discussed in this Environmental Assessment, the National Marine Fisheries Service has determined that approval and implementation of the final regulations to implement the Pacific Cetacean Take Reduction Plan through the establishment of: (1) a minimum extender length of equal to or greater than 36 feet; (2) fleetwide use of pingers; and (3) mandatory skipper panels, would not significantly affect the quality of the human environment, and that the preparation of an environmental impact statement on these actions is not required by Section 102(2) of the National Environmental Policy Act or its implementing regulations.

DATE:

REFERENCES

ARPA. 1995. Final Environmental Impact Statement/Environmental Impact Report for the California Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program. Prepared by Advanced Research Projects Agency, Arlington, VA. April 1995.

Barlow, J., R. L. Brownell Jr., D.P. DeMaster, K.A. Forney, M.S. Lowry, S Osmek, T.J. Ragen, R.R. Reeves, and R. J. Small, 1995. U.S. Pacific Marine Mammal Stock Assessments. NOAA Technical Memorandum NMFS.

Dohl, T.P., R.C. Guess, M.L. Duman, and R.C. Helm. 1983. Cetaceans of central and northern California, 1980 - 1983: status, abundance, and distribution. Prepared for Minerals Management Service, Los Angeles, CA. Published by University of California, Santa Cruz.

Eckert, K.L. 1990. Five-year status reviews of sea turtles listed under the Endangered Species Act of 1973: leatherback sea turtle (*Dermochelys coriacea*). Draft report. U.S. Fish and Wildlife Service.

Eckert, K.L. 1993. The Biology and Population Status of Marine Turtles in the North Pacific Ocean. NOAA-TM-NMFS-SWFSC-186.

Gearin, P. J., M.E. Gosho, L. Cooke, R. DeLong, J. Laake, and D. Green. 1996. Acoustic alarm experiment in the 1995 northern Washington marine setnet fishery. Unpublished Report available from National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115.

Hanan, D.A., D.B Holts, and A.L. Coan, Jr. 1993. The California drift gill net fishery for sharks and swordfish, 1981-82 through 1990-1991. California Department of Fish and Game. Fish Bulletin 175

Hembree, D. and M:B. Harwood. 1987. "Pelagic Gillnet Modification Trials in North Australian Seas", Report of the International Whaling Commission 37:369-373.

Krause, S., A. Read, E. Anderson, K Baldwin, A. Solow, T. Spradlin and J. Williamson. 1995. A field test of the use of acoustic alarm to reduce incidental morality of harbor porpoise in gillnets. Draft Final Report available from New England Aquarium, Central Wharf, Boston, MA 02110.

LMR Fisheries Research, Inc. 1994. A review of the California swordfish industry. California Seafood Council, Santa Barbara, CA. December 1994. 15 pp.

Marine Mammal Commission. 1996. Acoustic Deterrence of Harmful Marine Mammal-Fisheries Interactions: Proceedings of a Workshop held in Seattle, Washington, U.S.A., 20-22 March 1996. Report submitted to the National Marine Fisheries Service, Silver Spring, MD. October 1996.

Minerals Management Service. 1992. Outer Continental Shelf Natural Gas and Oil Resource Management. Comprehensive Program, 1991 - 1997. Final Environmental Impact Statement. U.S. Dept. Interior. April 1992. 4 vols.

National Marine Fisheries Service. 1991. Draft Legislative Environmental Impact Statement on the Proposed Regime to Govern Interactions Between Marine Mammals and Commercial Fishing Operations. NMFS. NOAA. Department of Commerce. June 1991.

National Marine Fisheries Service. 1997. Draft Environmental Assessment: Use of Acoustic Pingers as a Management Measure in Commercial Fisheries to Reduce Marine Mammal Bycatch. NMFS, Office Of Protected Resources, Silver Spring, MD.

NMFS/USFWS. 1995a. Recovery Plan for U.S. Pacific Populations of the Loggerhead Turtle (Caretta caretta). National Marine Fisheries Service, Silver Spring, MD.

NMFS/USFWS. 1995b. Recovery Plan for Pacific Populations of the Leatherback Turtle (Dermochelys coriacea). National Marine Fisheries Service, Silver Spring, MD.

PCTRP. 1996. Draft Pacific Cetacean Take Reduction Plan. Draft plan submitted to the National Marine Fisheries Service and prepared by the Pacific Offshore Cetacean Take Reduction Team. August 1996. 75 pp.

Perrin, W. F., G.P. Donovan, and J. Barlow (eds.) 1994; Gillnets and Cetaceans, International Whaling Commission, special issue 15, Cambridge, 629 pp.

Pritchard, P. 1982. Nesting of the leatherback turtle *Dermochelys coriacea* in Pacific Mexico, with a new estimate of the world population status. Copeia 4:741-747.

Richardson, J.W., C.R. Green, Jr., C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, Inc. San Diego. 576 pp.

Stebbins, R.C. 1966. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Co. Boston, MA. 279pp.

Sternberg, J. 1981. The Worldwide Distribution of Sea Turtle Nesting Beaches. Sea Turtle Rescue Fund/Center for Envir. Education. Washington D.C.

Stinson, M.L. 1984. Biology of sea turtles in San Diego Bay, California and in the northeastern Pacific Ocean. M.S. thesis, San Diego State University, CA, 578pp.