4. 0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES CONSIDERED

Reducing bycatch, bycatch mortality, and incidental catch in HMS fisheries, particularly the Atlantic pelagic longline fishery, was identified in the HMS FMP as a critical management goal that needed to be addressed pursuant to National Standard 9 of the MSA. The NS 9 guidelines set forth factors to consider to minimize bycatch and bycatch mortality to the extent practicable:

(A) Population effects for the bycatch species;
(B) Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem);
C) Changes in the bycatch of other species of fish and the resulting population and ecosystem effects;
(D) Effects on marine mammals and birds;
(E) Changes in fishing, processing, disposal, and marketing costs;
(F) Changes in fishing practices and behavior of fishermen;
(G) Changes in research, administration, and enforcement costs and management effectiveness;
(H) Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources;
(I) Changes in the distribution of benefits and costs; and,
(J) Social effects.

The HMS FMP and a final rule published on August 1, 2000 (65 FR 47214), provide detailed discussions of bycatch and incidental catch issues associated with the various HMS commercial and recreational fisheries. Further, these documents also note that additional actions beyond those included in the HMS FMP or final rule would be necessary to address these concerns. The recently completed 2004 BiOp, prepared in accordance with the ESA, advises further actions to reduce bycatch and bycatch mortality of sea turtles. The following sections evaluate a number of alternatives to meet these goals. All of the alternatives described in this document apply only to vessels and vessel operators participating in the Atlantic pelagic longline fishery.

4.1 BYCATCH AND BYCATCH MORTALITY MITIGATION MEASURES

As described in Chapter 2, the following are the alternatives considered for bycatch and bycatch mortality mitigation measures. Alternatives A6, A11, and A12 were considered but not further analyzed.

Alternative A1 — Maintain existing hook and bait restrictions in the Atlantic pelagic longline fishery; maintain existing time/area closures in the Atlantic pelagic longline fishery; maintain existing possession and use requirements for bycatch mitigation gear (dipnets and line clippers), as well as sea turtle handling and release guidelines as currently specified by NOAA Fisheries. (No Action)

Alternative A2 Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait.

Alternative A3 Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only one of the following combinations: i) 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait; **OR** ii) 18/0 or larger non-offset (flat) circle hooks and squid bait.

Alternative A4 Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only one of the following combinations: i)18/0 or larger circle hook with an offset not to exceed 10 degrees and whole mackerel bait; **OR** ii) 18/0 or larger non-offset circle hooks and squid bait; **OR** iii) 9/0 "J"-hooks with an offset not to exceed 25 degrees and whole mackerel bait.

Alternative A5 (a) Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger circle hooks with an offset not to exceed 10 degrees.

Alternative A5 (b) *Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks. (Preferred Alternative)*

Alternative A7 Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait.

Alternative A8 Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 20/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait.

Alternative A9 Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard

and/or using only one of the following combinations: i) 9/0 "J"-hook with an offset not to exceed 25 degrees and whole mackerel bait; **OR** ii) 18/0 or larger circle hook with an offset not to exceed 10 degrees with whole mackerel bait

Alternative A10 (a) Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only one of the following combinations: i) 18/0 or larger circle hook with an offset not to exceed 10 degrees with whole mackerel bait; **OR** ii) 18/0 or larger non-offset (flat) circle hook with squid bait.

Alternative A10 (b) *Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole mackerel and squid baits may be possessed and/or utilized with allowable hooks. (Preferred Alternative)*

Alternative A13 Close an area of the central Gulf of Mexico to pelagic longline fishing year-round (12 months).

Alternative A14 Prohibit the use of pelagic longline gear in HMS fisheries in an area of the Central Gulf of Mexico and the Northeast Coastal statistical reporting area year-round (12 months).

Alternative A15 Prohibit the use of pelagic longline gear in HMS fisheries in an area of the Central Gulf of Mexico and the Northeast Coastal statistical reporting area from May through October (6 months).

Alternative A16 *Require vessels with pelagic longline gear onboard to possess or use dipnets and line clippers that meet newly revised design and performance standards, plus require these vessels to possess, maintain, and utilize additional sea turtle handling and release gear and comply with handling and release guidelines as specified by NOAA Fisheries. (Preferred Alternative)*

Analyses in this chapter draw heavily upon the results of the 2001 - 2003 NED experiment to evaluate impacts on interactions with sea turtles and changes in the weight of target species catches. Except where indicated otherwise, the basis for the analyses contained in this chapter was derived directly from the results of the NED experiment (Watson *et al.*, 2003; Watson *et al.*, 2004a; Shah *et al.*, 2004).

Since publication of the DSEIS, the reduction rates calculated for various experimental treatments (hook and bait combinations) have been standardized to control for several variables including sea surface temperature, daylight soak time, total soak time, vessel effect, and pairing

effect in case of matched paired hook types per set. Individual year data were used for the sea turtle analyses because year was found to be a significant factor in the NED experiment. In calculating potential sea turtle interaction reductions, NOAA Fisheries has chosen to apply the least effective interaction reduction rate for each treatment from any year of the experiment. As a result, projected turtle interaction estimates may be higher than what might actually occur while employing any particular hook and bait combination. NOAA Fisheries is applying these precautionary reduction rates, as opposed to more optimistic rates that would provide lower projected interaction estimates, given the threatened and endangered status of loggerhead and leatherback sea turtles. In estimating reduction rates for target species, NOAA Fisheries provides ranges that incorporate catch rates from 2002 and 2003 derived from the experiment.

Ecological Impacts

The no action alternative, A1, would maintain current bycatch reduction and minimization measures and continue to provide some positive ecological impacts by helping to avoid and mitigate bycatch and bycatch mortality of species known to interact with pelagic longline gear. Existing hook and bait restrictions, which mandate use of non-stainless steel corrodible hooks throughout the fishery and a prohibition on the use of live bait in the western Gulf of Mexico help reduce bycatch and bycatch mortality of finfish and protected resources. In addition, since 1999, several area closures have been implemented including part or all of the Mid-Atlantic Bight, DeSoto Canyon, Charleston Bump, Florida East Coast, Northeastern, and NED. Federally permitted vessels, or vessels required to be permitted, for Atlantic HMS with pelagic longline gear onboard must also possess and use dipnets and line clippers that meet the current NOAA Fisheries design and performance standards, as well as maintain the requirement to comply with current handling and release guidelines. These measures were implemented to reduce bycatch mortality of incidentally captured sea turtles, marine mammals, and other incidentally captured species. Thus, alternative A1 would continue to provide some positive ecological impacts by facilitating the removal of fishing gear which is expected to increase post-hooking survival of many bycaught species. For sea turtles, fishing gear left in place may cause tissue damage, infection, and digestive tract blockage. Hooks may perforate internal organs or vessels and trailing line may encircle limbs, restrict circulation, cut deeply onto tissue, and can eventually cause loss of function. Ingested line may irritate the lining of the gastrointestinal tract and can cause death by intussusception (telescoping of the gut tube, cutting off its circulation) or torsion (involution) (Watson *et al.*, 2003).

Overall, however, the no action alternative could have substantial negative ecological impacts on sea turtles by allowing the bycatch and bycatch mortality of these protected species to continue at current rates. In addition, should the NED remain closed to U.S. flag longline vessels, there could be an increase in effort in this area by foreign-flag vessels operating under less restrictive measures. Furthermore, an unquantifiable number of U.S.-flag vessels that have traditionally fished in the NED would likely re-flag to other nations. This shift could result in these vessels operating under less stringent regulation, which may result in some additional bycatch of target and non-target species, including protected species.

The two sea turtle species most commonly caught in the pelagic longline fishery are the leatherback and loggerhead sea turtles, both of which are protected under the Endangered Species Act. Leatherback sea turtles are listed as endangered, and loggerhead sea turtles are listed as threatened. Although taken in much lower numbers, green, hawksbill, and Kemp's ridley sea turtles are also listed as either endangered or threatened. Estimated take data indicate that high numbers of leatherback and loggerhead sea turtles are currently being caught on pelagic longline gear, particularly in the Gulf of Mexico. Further information on sea turtle interactions and the ESA consultation history for this fishery are provided in Chapters 1, 3, and 4.3.

A total of 273 marine turtles (122 leatherback, 151 loggerhead) were observed caught in the Atlantic pelagic longline fishery in 2001, including 77 leatherback and 142 loggerhead sea turtles caught in the NED research experiment. A total of 335 marine turtles were observed caught in the Atlantic pelagic longline fishery in 2002, including 158 leatherback and 100 loggerhead sea turtles caught in the NED research experiment. Based on observer data, the agency estimates that 1208 leatherback and 312 loggerhead sea turtles were taken in this fishery in 2001, with an additional 962 leatherback and 575 loggerhead sea turtles being taken in 2002 (Garrison, 2003a).

A total of 16 marine mammals (8 Risso's dolphin, 6 pilot whales, 1 striped dolphin, and 1 Northern bottlenose whale) were observed caught in the Atlantic pelagic longline fishery in 2001, including six taken in the NED research experiment. A total of 24 marine mammals (10 Risso's dolphin, 10 pilot whales, one common dolphin, two unidentified dolphin, one unidentified mammal) were observed caught in the Atlantic pelagic longline fishery in 2002, including nine taken in the NED experiment fishery. Based on observer data, NOAA Fisheries estimates that 92.9 pilot whales and 83.6 Risso's dolphin were taken in this fishery in 2001, with 113.5 pilot whales and 87.2 Risso's dolphin estimated taken in 2002 (Garrison, 2003a).

Observer data for the Atlantic pelagic longline fishery from 1992 through 2002 indicate that bycatch of seabirds is relatively low. Since 1992, a total of 113 seabird interactions have been observed, with 78 seabirds observed killed in the Atlantic pelagic longline fishery. Eight greater shearwaters were observed taken in this fishery in 2001. Twenty-one seabirds of various species were observed taken in this fishery in 2002. No expanded estimates of seabird bycatch or catch rates are available for the pelagic longline fishery. Seabird interactions with the pelagic longline fishery are discussed in greater detail in Section 3.4.

Catches, landings, discards, and bycatch of both target and non-target species are discussed in Section 3.2 and Chapter 6.

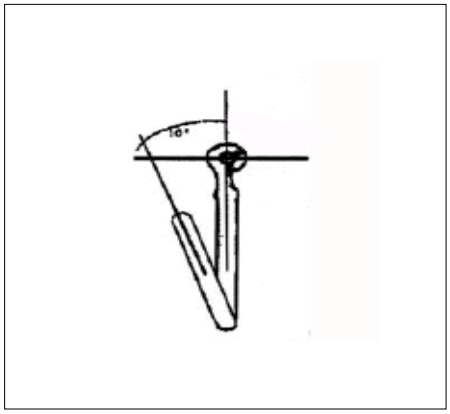
Alternative A2 would limit vessel operators participating in the pelagic longline fishery for Atlantic HMS operating outside of the NED, at all times, to possessing and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait. A photograph containing examples of 18/0 circle hooks can be seen in Figure 4.1, and a diagram showing a hook with a 10 degree offset can be seen in Figure 4.2. The offset measurement is

made at the barbed end of the hook and is relative to the shank of the hook..

Figure 4.1 **Examples of 18/0 Circle Hooks.**
Source: Watson et al., 2003

Figure 4.2 **Example of a Hook with a 10 Degree Offset.**
Source: Watson et al., 2003

Assuming similar reductions from gear modifications as reflected in



the NED research experiment, alternative A2 could reduce the take of leatherback and loggerhead sea turtles in the Atlantic pelagic longline fishery in areas outside the NED by at least 64.8 percent and 85.8 percent respectively. This would likely result in a reduction in the number of leatherback interactions from approximately 962 to 339 (962.3 * .352 = 338.7) and the number of loggerhead interactions from approximately 575 to 82 (574.6 * .142 = 81.6) annually. Reductions in interactions of this magnitude would have significant positive impacts on these sea turtle populations. Further, this alternative would likely reduce the mortality associated with the interactions by resulting in less injurious hooking locations and facilitating hook removal, therefore having a positive impact on the affected populations. A study conducted in the Azores and a separate Canadian study both found a significant difference in the hooking location between the "J"-hooks and circle hooks in sea turtles with the majority of circle hooks being lodged in the mouth versus being ingested or lodging in the throat (Watson *et al.,*

2004b; Javitech Ltd., 2002). In addition, because the hook point turns in toward the shank, the design of the circle hook reduces foul hooking, the primary type of interaction with leatherback sea turtles (Watson *et al.,* 2004b).

With regard to target species, data from the NED experiment generally indicate that hook and bait treatments that increase swordfish catch by weight tend to decrease tuna catch by weight, and visa-versa. The data indicate that under alternative A2, swordfish catch may increase by a range of 9.22 to 30.24 percent (by weight), while tuna catches may decrease by a range of 81.18 to 87.64 percent (by weight). While data indicate that there may be a connection between cooler water temperatures and catches of larger swordfish, it is not entirely clear whether this effect is derived solely from water temperatures or from a combination of factors including the availability of larger fish capable of taking large hooks/baits and an apparent preference of large fish for colder water. As the N. Atlantic swordfish stock rebuilds, the availability of larger swordfish should increase. Nevertheless, for pelagic longline fishing in warmer waters, these potential increases in swordfish catches and their attendant social and economic benefits are less certain and may decline to zero or even result in declining catches.

Under alternative A2, anticipated increases in swordfish catches may have positive ecological benefits by potentially decreasing the number of sets fishermen must make on a trip given improved hooking efficiency. Consequently, this potential decrease in the number hooks fished could result in a reduction of bycatch and bycatch mortality of species known to interact with pelagic longline gear, including protected species. Increased swordfish catches are not expected to result in adverse ecological impacts given that North Atlantic swordfish are managed under an international rebuilding plan with country specific quotas and the stocks are rebuilding. U.S. landings have been below ICCAT established quotas for the past few years, and increased landings that may result from this alternative would not be expected to cause the U.S. to exceed its ICCAT quota. Further, increased catches should better position the United States to retain its portion of the North Atlantic swordfish quota at ICCAT. Should recent U.S. North Atlantic swordfish quota underages or future quota be redistributed to other ICCAT nations that fish in less conservation oriented ways, there would likely be negative ecological impacts for many bycaught species. Decreased tuna catches by weight may have positive ecological benefits for tunas by leaving more sexually mature tunas in the ecosystem. Decreased tuna catches may have negative ecological impacts for species known to interact with pelagic longline gear if this results in increased fishing effort to offset reduced catches. Increased effort would likely result in increased bycatch and bycatch mortality of both target and non-target species, including protected resources.

Preliminary data analysis for 2002 and 2003 indicates a reduction in blue shark bycatch with 18/0 circle hooks with whole mackerel bait. The reduction rates were 40% for 2002 and 28% for 2003. Reductions in blue shark catch would likely provide an ecological benefit to this species. In addition, circle hooks would likely reduce the mortality associated with the incidental capture of the sharks by resulting in less injurious hooking locations and facilitating gear removal.

Alternative A2 would also likely increase survival of many other bycatch species because circle hooks are less likely to be ingested than "J"-hooks (Falterman and Graves, 1999; Falterman and Graves, 2002), therefore serious ingestion injuries are likely to occur less frequently. This appears to be true for many marine species and circle hook sizes (Lucy and Studholme, 2002). As such, this alternative has the potential to increase survival of a significant portion of the pelagic longline bycatch and have a positive impact on the populations of bycatch species. While the Agency does not have definitive data on the impact of circle hooks on marine mammals and seabirds, it is reasonable to assume that circle hooks would likely reduce the number of such interactions and their associated mortality (K. Wang, pers. comm., 2003) for reasons discussed above.

Alternative A3, would limit vessel operators participating in the pelagic longline fishery for Atlantic HMS operating outside of the NED, at all times, to possessing and/or using no more than one of the following hook and bait combinations: i) 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait; **OR** ii) 18/0 or larger non-offset (flat) circle hooks and squid bait. This alternative would likely have significant positive ecological impacts by reducing the take of leatherback and loggerhead sea turtles in the Atlantic longline fishery in areas outside the NED by a range of 64.8 to 63.9 percent and 85.8 to 64.6 percent, respectively. Assuming similar reductions from gear modifications as reflected in the NED research experiment, this alternative would likely reduce the number of leatherback sea turtle interactions in the Atlantic pelagic longline fishery from approximately 962 to between 315 (see calculations in A2) and 347 (962.3 * 0.361) = 347.4) annually, respectively. Thus, this alternative would likely reduce the number of loggerhead sea turtle interactions in this fishery from approximately 575 to between 82 (see calculations in A2) and 203 (574.6 * 0.354 = 203.41) annually, respectively.

Depending on the hook and bait combination chosen and the target species of a given trip, this alternative may have positive, negative, or a mix of impacts on target species. In general, data from the NED research experiment indicate that hook and bait treatments which increase swordfish catch by weight tend to decrease tuna catch by weight, and visa-versa. Alternative A3 provides the flexibility to select between two hook and bait combinations, prior to departing on a trip, that are effective at catching either swordfish or tunas, with either choice being effective at reducing interactions with endangered and threatened sea turtles. However, it would not allow fishermen, while at sea, to switch to the other hook and bait combination to fish opportunistically or to adjust to market conditions. The data indicate that alternative A3, option i, may increase swordfish catch by a range of 9.22 to 30.24 percent (by weight), but may decrease tuna catches by a range of 81.18 to 87.64 percent (by weight). Data further show that alternative A3, option ii, may potentially increase tuna catches by a range of 20.24 to 29.22 percent (by weight), while swordfish catches are anticipated to decrease by a range of 28.54 to 32.58 percent (by weight). See alternative A2 for further details on swordfish catches and potential for decrease in catch in warmer waters. Potential tuna increases are less certain based on the limited tuna catch data obtained during the NED research experiment.

Similar to alternative A2, alternative A3, option i, which is anticipated to increase swordfish catches, may have positive ecological benefits by potentially decreasing fishing effort and therefore reducing bycatch and bycatch mortality. As explained under the discussion of ecological impacts for A2, supra, potential increases in catches of swordfish under alternative A3, are not anticipated to result in adverse ecological impacts, and may better position the U.S. to retain its portion of the North Atlantic swordfish quota at ICCAT. Similar to alternative A2, alternative A3, option i may have positive ecological impacts for tunas due to decreased tuna catches (by weight), but could also have negative ecological impacts for species known to interact with pelagic longline gear by potentially resulting in increased fishing effort to offset reduced catches. As discussed in alternative A2, supra, alternative A3 option i may reduce the incidental capture and mortality of blue sharks and have similar ecological impacts.

Under alternative A3, option ii, decreased swordfish catches (by weight) may have positive ecological impacts by potentially leaving more large fecund fish in the ecosystem and speeding achievement of full recovery. Decreased swordfish catches may have negative ecological impacts if it results in increased effort to offset reduced catches, therefore, potentially resulting in increased bycatch and bycatch mortality of both target and non-target species, including protected resources. Decreased swordfish catches may also have negative ecological impacts by decreasing overall U.S. catches and possibly resulting in the transfer of U.S. quota to other ICCAT member nations, whose longline fleets may not fish as ecologically responsibly as U.S. vessels. Minor increased longline tuna catches (by weight) should have minor or no adverse ecological impact, depending on species. Increased tuna catches (by weight) may have positive ecological impacts by potentially decreasing fishing effort and therefore reducing bycatch and bycatch mortality of both target and non-target species, including protected species. Atlantic tunas are managed internationally, with the United States representing only a small fraction of catches for non-bluefin tuna species and adhering to international catch limits. For bluefin tuna, pelagic longlines are not an allowed target gear. For species that are not overfished or experiencing overfishing, increased catches should have no discernible impact. For species that are overfished or experiencing overfishing, minor increases in tuna catches (by weight) may have negligible adverse ecological impacts due to the small numbers of fish harvested by this gear-type relative to the landings of other nations. The actual impacts of alternative A3 would likely fall somewhere in between those described for options i and ii, as not all fishermen would choose the same hook and bait combination for every trip.

Preliminary data analysis for 2002 and 2003 shows no reduction in blue shark catch with 18/0 circle hooks with squid bait. As with alternative A2, alternative A3 would likely increase survival of sea turtle and other bycatch species. See the circle hook discussion for alternative A2, supra, for further explanation. In conjunction with alternative A16, this alternative would likely decrease the bycatch mortality of many incidentally captured species. This alternative, if implemented with other gear requirement or closure alternatives, could significantly reduce the aggregate number of sea turtle interactions in the fishery as a whole.

However, during the public comment period, several commenters expressed concern that this alternative may have the unintended consequence of increasing sea turtle interactions Atlantic-

wide. U.S. pelagic longline sea turtle bycatch is relatively small in comparison to Atlantic-wide interactions, thus exporting circle hook technology to foreign nations is critical to sea turtle protection efforts. Commenters stated that this alternative could have substantial economic impacts and that if U.S. vessels suffer major economic losses and go out of business, foreign vessels would likely increase their fishing effort and not use circle hooks. See Appendix C1 for summary of comments and responses.

Alternative A4 would limit vessel operators participating in the pelagic longline fishery for Atlantic HMS operating outside of the NED, at all times, to possessing and/or using no more than one of the following hook and bait combinations: i)18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait; **OR** ii) 18/0 or larger non-offset circle hooks and squid bait; **OR** iii) 9/0 "J"-hook with an offset not to exceed 25 degrees and whole mackerel bait. This alternative would likely have significant positive ecological impacts by reducing the number of interactions with leatherback sea turtles in areas outside the NED by a range of 63.9 percent (18/0 non-offset circle hook with squid bait) to 65.6 percent (9/0 "J"-hook with whole mackerel bait). Assuming similar reductions from gear modifications as reflected in the NED research experiment, these reductions equate to leatherback sea turtle interactions declining from approximately 962 to between 347 and 331, on an annual basis, depending on hook treatment applied.

This alternative would likely reduce the take of loggerhead sea turtles in areas outside the NED by a range of 85.8 percent (18/0 offset circle hook with whole mackerel) to 64.6 percent (18/0 non-offset circle hook with squid), with a 70.9 percent benefit anticipated with use of the 9/0 "J"-hook with whole mackerel bait. Based on these estimated reductions, the number of loggerhead sea turtle interactions is expected to decline from approximately 575 to between 82 and 203, with use of the18/0 offset circle hook with whole mackerel or 18/0 non-offset circle hook with squid, respectively, or approximately 167 with use of the 9/0 "J"-hook with whole mackerel.

Depending on the hook and bait combination chosen and the target species of a given trip, this alternative may have positive, negative, or a mix of impacts on target and non-target species. Alternative A4 provides the flexibility to select between three hook and bait combinations (options i, ii, and iii), prior to departing on a trip, that are effective at catching either swordfish or tunas, with all choices being effective at reducing interactions with endangered and threatened sea turtles. However, it would not allow fishermen, while at sea, to switch to other hook and bait combinations to fish opportunistically or to adjust to market conditions. With regard to target species, the ecological impacts of alternative A4, option i, would be similar to those discussed under alternatives A2 and A3, option i, and those of alternative A4, option ii, would be similar to alternative A3, option ii. Alternative A4, option iii, would be expected to have similar impacts as alternative A3, option i, but may be more pronounced as data from the NED research experiment indicate that use of the "J"-hook and whole mackerel bait may increase swordfish catch by 63 percent and decrease tuna by 90 percent.

With regard to bycatch, the use of circle hooks under alternative A4, options i and ii, is expected to have a positive ecological impact by reducing interactions and post-release mortality of sea turtles, mammals, seabirds, and other bycatch species. Alternative A4, option i, may also reduce the incidental capture and mortality of blue sharks. The "J"-hook combination (option iii), if selected, would not be expected to mitigate sea turtle bycatch or bycatch mortality below current levels. See circle hook discussion under alternative A2 for further details.

Alternative A5 (a), which was described as alternative A5 in the DSEIS, would limit vessel operators participating in the pelagic longline fishery for Atlantic HMS operating outside of the NED, at all times, to possessing and/or using only 16/0 or larger circle hooks with an offset not to exceed 10 degrees. This alternative would likely have positive ecological impacts by reducing interactions with leatherback sea turtles. Because the gap between the hook point and shank is smaller on a 16/0 circle hook, the 16/0 circle hook is expected to be at least as efficient, if not more efficient, at reducing foul hooking than 18/0 or larger circle hooks (Watson *et al.*, 2004b). Further, there is no apparent difference in hooking location between 16/0, 18/0, and 20/0 circle hooks (Bolten *et al.*, 2002; Javitech Ltd, 2002). For the 16/0 circle hook, an estimated reduction in leatherback sea turtle interactions of 57 percent or greater is possible (Watson *et al.*, 2004b). NOAA Fisheries is choosing to apply a more biologically conservative reduction rate of 50 percent when estimating future leatherback sea turtle interactions for this alternative, which is derived from the least effective circle hook treatment tested during the NED research experiment. This more precautionary rate is being applied given the threatened and endangered status of loggerhead and leatherback sea turtles

Available data indicate that this alternative would not likely reduce interactions with loggerhead sea turtles (Watson *et al.*, 2004b; Bolten *et al.*, 2002). However, a summary of U.S. pelagic longline observer data from the Gulf of Mexico, 1992 - 2002, indicates that no loggerhead sea turtle has been observed captured on circle hooks (Garrison, 2003b). In addition, as discussed under alternative A2, circle hooks are expected to improve significantly the probability of survival by resulting in less injurious hooking locations, such as the beak or mouth rather than the throat or stomach (Watson *et al.*, 2004b; Bolten *et al.*, 2002; Javitech Ltd., 2002). As there is no apparent difference in hooking location between 16/0, 18/0, and 20/0 circle hooks, the 16/0 hook is expected to reduce substantially loggerhead sea turtle mortalities. In addition, the release gear and safe handing protocols discussed in preferred alternative A16 will likely further reduce mortalities.

Based on the above, alternative A5 (a) is likely to reduce the number of leatherback interactions in areas outside the NED from an estimated 962 to approximately 481. Loggerhead interactions in areas outside the NED are projected to remain at approximately 575 annually, but this alternative is anticipated to decrease post-release mortality of both species.

Available information suggests that little or no impact on tuna catches will occur, although some unquantifiable increase in catches is possible (Watson, *et al.*, 2004b; J. Watson pers. comm., 2003). As such, this alternative would not likely have any ecological impacts, either positive or negative, on tuna populations. Available information also suggests that swordfish catch may

decrease by 10 to 20 percent under this alternative (J. Watson pers. comm., 2003). Decreased swordfish catches would be expected to have ecological impacts similar to those discussed under alternative A3, option ii. This measure would likely increase survival of species known to interact incidentally with pelagic longline gear for the reasons discussed under alternative A2.

Alternative A5 (b), a preferred alternative, modifies alternative A5 from the DSEIS in response to public comment. This alternative would limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole finfish and squid baits may be possessed and/or utilized with these allowable hooks. For the same reasons as alternative A5 (a), this alternative is expected to have positive ecological impacts by resulting in a 50 percent reduction in interactions with leatherback sea turtles, reduced foul hooking, and lower post-release mortality rates. No reduction in loggerhead sea turtle interactions is expected. However, because this alternative would require non-offset 16/0 circle hooks, it would be expected to result in fewer loggerhead sea turtle mortalities than alternative A5 (a), because non-offset 16/0 hooks are less likely to engage in the throat or gut than offset hooks (J. Watson pers. comm., 2004). In addition, the release gear and safe handling protocols discussed in preferred alternative A16 will likely further reduce mortalities.

Based on the above, alternative A5 (b) is likely to reduce the number of leatherback sea turtle interactions in areas outside the NED from an estimated 962 to approximately 481. Loggerhead sea turtle interactions in areas outside the NED are projected to remain at approximately 575 annually, but this alternative is expected to decrease post-release mortality of both species. When alternative A5 (b) is applied in combination with alternatives A10 (b) and A16, these alternatives are expected to decrease interactions and mortalities for leatherback sea turtles and mortalities for loggerhead sea turtles. Additional rulemaking and management measures will be required in this fishery pursuant to the 2004 BiOp. See Section 4.3 for further information on the 2004 BiOp.

As with alternative A5 (a), little to no impact on tuna catches is anticipated, thus no ecological impacts, positive or negative, are expected on tuna populations. Swordfish catch might possibly decrease by 10 to 20 percent, and this would result in ecological impacts on swordfish similar to those discussed under alternative A3, option ii. This alternative would likely increase survival of species known to interact incidentally with pelagic longline gear for the reasons discussed under alternative A2.

During the public comment period, members of the U.S. pelagic longline fishing industry expressed considerable support for alternative A5 (a) (DSEIS alternative A5), because it provides an opportunity to fish for a wider variety of species commonly targeted outside the NED by allowing for some choice in baits and hook sizes. Commenters stated that showing that U.S. vessels can implement bycatch reduction measures and remain financially solvent is critical to ensure that such bycatch technologies can be “exported” to foreign nations. Commenters stated that “exportability” of circle hook and release gear technology is the single most important

element of this rule, because U.S. pelagic longline sea turtle bycatch is relatively small compared to Atlantic-wide sea turtle interactions. By successfully demonstrating that U.S. vessels can remain financially solvent while reducing sea turtle interactions and bycatch mortality, other foreign fishing nations are more likely to adopt similar measures, and thereby provide truly meaningful protection to sea turtles throughout their ranges. In response to public comment, the Agency modified DSEIS alternative A5 as alternative A5 (b) to provide for more flexibility in the gear requirements while ensuring sufficient reductions in sea turtle interaction and mortality. See Appendix C1 for summary of comments and responses.

Alternatives A7 - A10 (b) would re-open the NED to pelagic longline fishing for Atlantic HMS subject to certain hook and bait requirements and would maintain the current requirements for possession or use of non-stainless steel corrodible hooks for vessels participating in this fishery. Under these alternatives, approximately 12 vessels would be expected to return to the NED. A December 3, 2003, agreement between Canada and the United States, which allows U.S. fishermen to apply for a license to access Canadian waters and ports, could facilitate additional fishing effort in the NED. However, data over the last six years indicate that less than 12 vessels, on average, fished in the NED. This statement holds true in examining the three years prior to the NED experiment as a unit, the three years of the experiment as a unit, or all six years combined. In addition, an increase in effort is not expected because the NED is a distant water fishery, thus not all pelagic longline vessels (e.g., smaller vessels) could participate in that fishery. As the fishery is under a limited access system, the overall number of permitted vessels would not increase, and there are upgrading restrictions in place. Because vessel monitoring systems (VMS) are required on pelagic longline vessels fishing for HMS, the Agency will have an enhanced ability to monitor changes in the movement of the fleet. If a significant increase in the number of vessels occurs, the Agency will take other action as necessary. Alternatives A7 - A10 (b) would likely have moderate negative ecological impacts as compared to maintaining the existing NED closure (No Action), but significant ecological benefits when viewed against historical fishing activity in the NED.

Alternative A7 would limit vessels with pelagic longline gear onboard in the NED, at all times, to possessing and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait. The expected number of sea turtle interactions in the NED for any particular hook and bait treatment is calculated by multiplying the projected effort (in number of hooks) by the sea turtle CPUEs for specific treatments tested in the NED research experiment. The number of hooks is estimated by multiplying the projected number of vessels returning to the NED by the average number of annual sets per vessel in the NED prior to the experiment and the average number of hooks per set in the NED prior to the experiment (12 vessels * 41.34 sets * 847.24 hooks per set = 420, 298.82 hooks). Using the above approach, alternative A7 would be expected to reduce the number of leatherback sea turtles caught in the NED from a projected 108 - 212 to approximately 47, and the number of loggerhead sea turtles from a projected 168 - 212 to approximately 18. These interactions are in addition to those occurring outside the NED.

Alternative A7 would likely reduce post-release mortality of and facilitate hook removal from sea turtles and other bycatch species, decrease blue shark bycatch, decrease tuna catches (by weight), and increase swordfish catches (by weight), thus having ecological impacts similar to those discussed under alternative A2. See alternative A2 for further details on circle hooks and target and non-target species catches, including potential for decreased swordfish catches in warmer waters.

Alternative A8 would limit vessels with pelagic longline gear onboard in the NED, at all times, to possessing and/or using only 20/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait. Using the same estimation process as alternative A7, this alternative would be expected to reduce the number of leatherback sea turtles caught in the NED from a projected 108 - 212 to approximately 30, and the number of loggerhead sea turtles caught from a projected 168 - 212 to approximately 15. These interactions are in addition to those occurring outside the NED. Because of the use of circle hooks, alternative A8 is expected to reduce post-release mortality of and facilitate hook removal from sea turtles and other bycatch species. See circle hook discussion for alternative A2, supra, for further explanation. Preliminary data analysis for 2003 also indicates a reduction in blue shark bycatch of 37 percent with 20/0 circle hooks with whole mackerel bait.

Data from the NED experiment indicate that alternative A8 may increase swordfish catch by approximately 5.8 percent (by weight) and decrease tuna catches by 92.9 percent (by weight), which would result in ecological impacts similar to those discussed under alternative A2. Increased swordfish catches under alternative A8 are less certain, given that these increases were not shown to be statistically significant. See alternative A2 for further details on swordfish catches and potential for decrease in catch in warmer waters.

Alternative A9 would limit vessels with pelagic longline gear onboard in the NED, at all times, to possessing and/or using no more than one of the following hook and bait combinations: i) 9/0 "J"-hook with an offset not to exceed 25 degrees and whole mackerel bait; **OR** ii) 18/0 or larger circle hook with an offset not to exceed 10 degrees with whole mackerel bait. Under options i and ii, respectively, the estimated number of leatherback sea turtles caught in the NED would be reduced from a projected 108 - 212 to 71 and 47, and the estimated number of loggerhead sea turtles caught from a projected 168 - 212 to 53 and 18. These interactions would be in addition to those occurring outside the NED. The actual reduction in interactions for both species would likely fall somewhere in between the estimated ranges as not all fishermen would be expected to outfit with the same gear configuration.

If alternative A9, option ii (circle hooks), is utilized, there would likely be a positive impact on sea turtles and other bycatch species from a reduction in post-release mortality and the facilitation of hook removal. There may also be a reduction in the incidental capture and mortality of blue sharks. The "J"-hook and whole mackerel bait (alternative A9, option i) would not be expected to mitigate bycatch or bycatch mortality of other species below current levels. See alternative A2 for further details on circle hooks and bycatch.

Alternative A9 provides the flexibility to select a hook and bait combination, prior to departing on a trip, that is effective at catching either swordfish or tunas, with either choice being effective at reducing interactions with endangered and threatened sea turtles. This alternative may increase swordfish catch by approximately 9 - 63 percent (by weight) and may decrease tuna catches by approximately 81 - 90 percent (by weight), if fishermen deploy the 18/0 circle hook treatment or the 9/0 "J"-hook treatment, respectively. See alternative A2 for further details on swordfish catches and potential for decrease in catch in warmer waters. These increased swordfish catches and decreased tuna catches would be expected to have ecological impacts similar to those discussed under alternative A2.

Alternative A10 (a), which was described as alternative A10 in the DSEIS, would limit vessels with pelagic longline gear onboard in the NED, at all times, to possessing and/or using no more than one of the following hook and bait combinations: i) 18/0 or larger circle hook with an offset not to exceed 10 degrees and whole mackerel bait; **OR** ii) 18/0 or larger non-offset (flat) circle hook and squid bait. Under options i and ii, respectively, the estimated number of leatherback sea turtles caught in the NED would be reduced from a projected 108 - 212 to between 47 and 76, and the number of loggerhead sea turtles from a projected 175 - 193 to between 18 to 60. These interactions would be in addition to those occurring outside the NED. The actual reduction in interactions for both species would likely fall somewhere in between the estimated ranges as not all fishermen would be expected to outfit with the same gear configuration. In addition, this alternative would likely have a positive impact on sea turtles and other bycatch species from a reduction in post-release mortality and the facilitation of hook removal, and may reduce the incidental capture and mortality of blue sharks. See circle hook discussion for alternative A2, supra, for further explanation.

Alternative A10 (a) provides the flexibility to select a hook and bait combination, prior to departing on a trip, that is effective at catching either swordfish or tunas, with either choice being effective at reducing interactions with endangered and threatened sea turtles. Swordfish catch may change by a range of approximately +30.24 to -32.58 percent (by weight), depending on whether fishermen equip and deploy option i or option ii, respectively. See alternative A2 for further details on swordfish catches and potential for decrease in catch in warmer waters. Data indicate that tuna catches may change by approximately -87.64 to possibly as much as +29.22 percent (by weight), depending on whether fishermen equip and deploy option i or option ii, respectively. Potential tuna increases are less certain based on the limited tuna catch data obtained during the NED experiment. The actual impacts would likely fall somewhere in between the above ranges as not all fishermen would choose the same hook and bait combination for every trip. Increased or decreased swordfish and tuna catches (by weight) would be expected to have ecological impacts similar to those discussed under alternative A3.

During the public comment period, several commenters stated that limiting vessels to one hook/one bait type per trip would not allow vessels to adapt to changing conditions on longer trips and would result in economic losses. Commenters stated that an unintended environmental consequence of this could be increased overall sea turtle interactions if the circle hook

technology is not “exportable” to foreign nations. See Appendix C1 for summary of comments and responses.

Alternative A10 (b), a preferred alternative, modifies alternative A10 from the DSEIS in response to public comment. This alternative would limit vessels with pelagic longline gear onboard in the NED, at all times, to possessing and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole mackerel and squid baits could be possessed and/or utilized with allowable hooks. This alternative would likely reduce the number of leatherback sea turtles caught in the NED from a projected 108 - 212 to 107 and the number of loggerhead sea turtles from 175 - 193 to 60. These interactions would be in addition to those occurring outside the NED. The actual reduction in interactions for both species would likely fall somewhere in between the estimated ranges as not all fishermen would be expected to outfit with the same gear configuration. In addition, this alternative would likely have a positive impact on sea turtles and other bycatch species from a reduction in post-release mortality and the facilitation of hook removal, and also may reduce the incidental capture and mortality of blue sharks. See circle hook discussion for alternative A2, supra, for further explanation. When alternative A10 (b) is applied in combination with alternatives A5 (b) and A16, these alternatives are expected to decrease interactions and mortalities for leatherback sea turtles and mortalities for loggerhead sea turtles. Additional rulemaking and management measures will be required in this fishery pursuant to the 2004 BiOp. See Section 4.3 for further information on the 2004 BiOp.
Alternative A10 (b) provides additional flexibility in possessing onboard and utilizing specific hooks and baits that are effective at catching target species, with each combination being effective at reducing interactions with endangered and threatened sea turtles. Under this alternative, swordfish catch may change by a range of approximately +30.24 to -32.58 percent (by weight), depending on which hook and bait combinations are employed. See alternative A2 for further details on swordfish catches and potential for decrease in catch in warmer waters. Data further indicate that tuna catches may change by approximately -87.64 to possibly as much as +29.22 percent (by weight), depending on which hook and bait combinations are employed. Potential tuna increases are less certain based on the limited tuna catch data obtained during the NED experiment. Ecological impacts of increased or decreased swordfish and tuna catches (by weight) under this alternative would be expected to have ecological impacts similar to those discussed under alternative A3, options i and ii. The actual impacts would likely fall somewhere in between as not all fishermen would choose to employ the same hooks and baits on each trip.

The management measures analyzed in alternative A10 (b) were largely supported by the U.S. pelagic longline fishing industry, because they provide more flexibility regarding allowable baits and hooks than those in alternative A10 (a). Under this alternative, vessels fishing in the NED will be better able to adapt to changing conditions on longer trips to the NED, improve the profitability associated with those trips, and ensure significant reductions in sea turtle interactions. According to many commenters, this is important for sea turtles, because economic losses by U.S. pelagic longline vessels would diminish the “exportability” of circle hook technology to foreign fishing nations. The successful and timely imposition of the management measures in alternative A10 (b) by U.S. vessels may provide the impetus for other foreign

fishing nations to adopt similar measures, and thereby provide truly meaningful protection to sea turtles throughout their ranges.

Time and area closures under alternatives A13, A14, and A15 would have varying degrees of ecological impacts. To help identify potential benefits and impacts of the various alternatives, a summary table was created to show the percentage change in sea turtle interactions, targeted species catch, and blue and white marlin discards for each of the three alternatives (Appendix 1, Table 1). The methods and data used to generate the percentages in Table 1 are discussed separately below for each alternative.

The analyses for the time/area closure alternatives use data from the Pelagic Observer Program (POP, 2001 - 2002) and the mandatory fishery logbook system (FLS, 2001 - 2002). Data from the observer program is referred to in the text as "observed", and data from the logbook system is referred to as "reported" or "logbook" data. A Geographic Information System (GIS) program was used to plot all observed (POP) and reported (FLS) effort and catches of protected species (loggerhead, leatherback, green, hawksbill, and Kemp's ridley sea turtles) and targeted species (swordfish, yellowfin and bigeye tuna). Blue and white marlin discards were also examined. Data presented for targeted species and for billfish are from the FLS only. Spatial analyses were performed to determine the number of each species observed and reported caught inside each time/area closure in comparison to the rest of the Atlantic and Gulf of Mexico, excluding the NED. The NED data were not included in the analysis because the area has been closed to commercial pelagic longlining since June, 2001, when a research experiment was initiated to study methods of mitigating sea turtle bycatch. Since the data from the NED were part of an experimental design and not part of normal commercial pelagic longlining operations, the data were not considered appropriate for inclusion in the current analysis.

NOAA Fisheries compared observed and reported catch and catch per unit effort (CPUE) in each of the proposed time/area closure alternatives to catch and CPUE fleet-wide, excluding the NED, rather than just to areas adjacent to the time/area closure. This approach was used because an analysis of the mobility of the pelagic longline (PLL) fleet, completed in 2001 for implementation of a Vessel Monitoring System (VMS), indicated that PLL vessels are just as likely to fish in areas away from their homeport as they are to fish in areas immediately adjacent to their homeport (NMFS, 2001). Because vessels do not necessarily fish in or next to their homeport but are mobile and capable of moving considerable distances, this analysis considers catches fleet-wide rather than just from areas adjacent to the closure.

Data were analyzed with and without redistribution of effort. The analysis 'without redistribution of effort' assumes that all fishing effort in the time/area closures is removed, and that none of the fishing effort is redistributed to open areas of the Atlantic or Gulf of Mexico. The number and percent reduction in catch of both protected and targeted species in this analysis thus represents the highest expected reduction. The redistribution of effort analysis on the other hand, assumes that all effort currently in the time/area closures will be redistributed to open areas of either the Atlantic, the Gulf of Mexico, or both. In reality, the actual result may lie between these two estimates. While some fishermen will continue fishing in open areas of the Atlantic

and Gulf of Mexico, others may choose to leave the fishery entirely as a result of the closure. Thus the actual percentage reduction resulting from the time/area closure will likely fall between the results of the redistribution and no redistribution of effort estimates.

For the redistribution of effort analysis, NOAA Fisheries assumed that if effort is redistributed, it may be distributed to any open area of the Atlantic or the Gulf of Mexico for the same reasons described above. The data from the POP and FLS databases were thus compared to catches in all open areas of the Atlantic, excluding the NED, and all open areas of the Gulf of Mexico.

Alternative A13 would prohibit the use of pelagic longline gear year-round by all U.S. flagged-vessels targeting HMS in a portion of the central Gulf of Mexico where large numbers of sea turtles have been observed and reported caught. This closure would encompass approximately 25,489 nm^2 and would be defined as the area within the following coordinates, beginning with the northeastern corner and proceeding clockwise: 28°09' N. latitude (Lat.), 88°12' W. Long.; 27°06' N. Lat., 88°12' W. Long.; 25°46' N. Lat., 90°24' W. Long.; 26°15' N. Lat., 93°01' W. Long.; 26°51' N. Lat., 93°01' W. Long.; 28°09' N. Lat., 90°10' W. Long. (Appendix 1, Figure 1). Overview maps of all observed and reported sets and sea turtle interactions are provided in Appendix 1, Figures 2 - 3.

Alternative A13 time/area closure without redistribution of effort

The effectiveness of the central Gulf of Mexico time/area closure was evaluated by determining the percent reduction in bycatch of protected species for each month and cumulatively for the year based on both observer and logbook data for the combined years 2001 - 2002. Data were also analyzed to determine the impact on catches of targeted species such as swordfish, yellowfin and bigeye tuna, as well as blue and white marlin discards.

Data from the observer program indicate that 41 percent of leatherback sea turtles (36 of 88) observed caught in the Gulf of Mexico from 2001 - 2002, were caught inside the time/area closure (Appendix 1, Tables 2 - 3, Figure 4). Based on logbook data, 47 percent of leatherback sea turtles (155 of 331) were reported caught inside the time/area closure during the same time period (Appendix 1 Figure 5). Based on both observer and logbook data for 2001 - 2002, and without redistribution of fishing effort, the time/area closure would be expected to reduce the catch of leatherback sea turtles by 41 - 47 percent (Appendix 1, Tables 2 - 3), thus having a positive ecological impact.

Of the observed loggerhead sea turtle interactions, 17 percent (7 of 41) were inside the time/area closure from 2001 - 2002, and 9 percent (9 of 96) of logbook reported catches were inside the time/area closure. Thus, based on both observer and logbook data, the catch of loggerhead sea turtles would potentially be reduced by 9 - 17 percent (Appendix 1, Tables 2 and 4).

The number of other sea turtles (green, hawksbill, and Kemp's ridley) observed and reported caught between 2001 - 2002 in the Gulf of Mexico was low. All of the observed (2 of 2) and reported (5 of 5) sea turtles were caught inside the time/area closure. The time/area closure

would thus be expected to reduce the number of other sea turtle takes by 100 percent (Appendix 1, Tables 2 and 5).

Twenty-one percent of all reported swordfish (17,167 of 82,984), 38 percent of all yellowfin tuna (42,648 of 113,155), and 12 percent of all bigeye tuna (3,613 of 29,885) caught in the Atlantic and Gulf of Mexico were caught in the time/area closure. Therefore, without redistribution of effort, the time/area closure would be expected to reduce the catch of these species by these percentages. Only logbook data were available to evaluate reduction in catch for these species in the time/area closure (Appendix 1, Tables 12-16).

For blue and white marlin, dead discards, live discards, and combined live and dead discards were estimated in the time/area closure in comparison to the rest of the Atlantic and Gulf of Mexico. For blue marlin, 57 percent of all dead discards (296 of 523), 29 percent of live discards (376 of 1,304), and 37 percent of combined live and dead discards (672 of 1832) in the Atlantic and Gulf of Mexico were located in the time/area closure (Appendix 1, Table 18). For white marlin, 39 percent of all dead discards (279 of 433), 26 percent of live discards (410 of 1,183), and 30 percent of combined live and dead discards (689 of 1613) in the Gulf of Mexico were located in the time/area closure (Appendix 1, Table 22).

Alternative A13 time/area closure with redistribution of effort

The ecological effects of redistribution of fishing effort were evaluated for this, and all subsequent alternatives, by determining the percent reduction in total observed and reported bycatch of sea turtles and catch of targeted species inside and outside of the time/area closure in the Atlantic and Gulf of Mexico. The method used to calculate percent changes in catch rates for each species with redistribution of effort is discussed below. Results for the redistribution of effort analyses for the observer and logbook data are presented in separate tables.

NOAA Fisheries examined monthly catches (number of each species) and effort (number of hooks) in each proposed time/area closure in comparison to all remaining areas open to pelagic longlining in the Atlantic and Gulf of Mexico, excluding the NED, based on observer and logbook data for the fishery. The number of each species caught in the open areas outside the proposed time/area closures (column E in all redistribution of effort Tables), was calculated by subtracting the number caught in the closed area from the observed or reported catch in the combined Atlantic and Gulf of Mexico (B-D). The catch-per-unit-effort (CPUE) for the species in the remaining open area was calculated by dividing the number of each species caught in the open area (E) by the number of hooks fished in the open area (calculated by subtracting the number of hooks in the closed area from those in the Atlantic and Gulf of Mexico; A-C). The open-area CPUE was multiplied by the number of hooks that were used in the closed area to determine the number of additional sea turtles or targeted species that would be caught in the open fishing areas by the displaced effort (C*F), which was added to the existing open area catch (E+G) to give a new open area total catch (I). The estimated total catch (I) was subtracted from the original total number caught in the Atlantic and Gulf (B-H) to estimate the change in number of each species that would be caught as a result of the relocated effort. Column J shows the

cumulative number of individuals avoided caught by the time/area closure. Columns K and L show the percentage reduction in overall catch by month and cumulatively as a result of the closure, respectively. The total percent reduction in catch was calculated by dividing the sum of column J (cumulative catch avoided by month) by the sum of column B (number of individuals caught in the Atlantic and Gulf of Mexico, excluding the NED).

The redistribution of effort analysis indicates that the overall bycatch of leatherback and other sea turtles would be reduced by the central Gulf of Mexico time/area closure, whereas the catch of loggerhead sea turtles would increase. Based on observer data, 16 percent fewer leatherbacks (14 of 88) would have been caught between 2001 - 2002 with the time/area closure in effect (Appendix 1, Tables 2 and 6), and based on the logbook data, 19 percent fewer leatherbacks (104 of 197) would have been caught during the same time period with the time/area closure in effect (Appendix 1, Tables 2 and 7), thus resulting in a positive ecological impact.

For loggerhead sea turtles, the redistribution of effort analysis indicates that the number of loggerheads caught would have increased 5 percent based on the observer data (2 additional interactions) and 38 percent (36 additional interactions) based on the logbook data. The increase in loggerhead interactions is likely the result of higher catch rates in the Atlantic than in the Gulf of Mexico. The increase in loggerhead interactions stemming from this closure likely would have a negative ecological impact with regard to loggerhead sea turtles.

Data from both the observer program and logbooks indicate that 100 percent of other sea turtles were caught inside the time/area closure (Appendix 1, Tables 2, 10, and 11). Thus, even with redistribution of effort, the time/area closure would have resulted in a 100 percent reduction in bycatch of other sea turtles.

Logbook data indicate that redistribution of effort in the Gulf of Mexico would have resulted in a 17 percent increase in swordfish catch from 2001 - 2002 (Appendix 1, Tables 12 and 14), a 2 percent decrease in yellowfin tuna catch (Appendix 1, Tables 12 and 15), and an increase of 32 percent in bigeye tuna catch (Appendix 1, Tables 12 and 16).

For blue marlin, logbook data indicate that dead discards would have decreased by 30 percent with redistribution of effort, whereas live discards would have increased by 10 percent. Combined live and dead discards would have decreased 1 percent (Appendix 1, Tables 17 and 20 - 22). White marlin dead discards would have decreased by 5 percent, but live and combine live and dead discards would have increased by 17 and 10 percent, respectively (Appendix 1, Tables 17 and 23 - 25).

Alternative A14 would prohibit the use of pelagic longline gear year-round by all U.S. flagged-vessels targeting HMS in an area comprised of both the central Gulf of Mexico closure described in alternative A13, and portions of the Northeast Coastal Statistical reporting area (NEC). These closures encompass approximately 56,471 nm^2 (25,489 nm^2 in the Gulf of Mexico and 30,982 nm^2 in the NEC) in aggregate. The GOM portion of the closure would encompass approximately 25,489 nm^2 and would be defined as the area within the following coordinates,

beginning with the northeastern corner and proceeding clockwise: 28°09' N. Lat., 88°12' W. Long.; 27°06' N. Lat., 88°12' W. Long.; 25°46' N. Lat., 90°24' W. Long.; 26°17' N. Lat., 93°03' W. Long.; 26°51' N. Lat., 93°03' W. Long.; 28°09' N. Lat., 90°10' W. Long. The NEC closure would encompass approximately 30,982 nm^2 and would be defined as the area within the following coordinates 41 °08' N. Lat., 66°06' W. Long.; 38°37' N. Lat., 65°16' W. Long.; 37°25' N. Lat., 69°18' W. Long.; 39°55' N. Lat., 70°05' W. Long. (Appendix 2, Figures 1 and 2).

It should be noted that observer coverage in the NEC area was sparse in the two years for which data were available. Only one percent (18 of 1633) of all observed sets were observed in the NEC from 2001 - 2002 with 5 percent (7 of 131) of all observed sea turtle interactions occurring in the NEC. By contrast, 6 percent (1,281 of 20,584) of all logbook reported sets and 19 percent (82 of 1,281) of all reported sea turtle interactions from 2001 - 2002 were in the NEC. Although both observer and logbook data are presented for the following alternatives (A14 and A15), the FLS data is considered to be more representative of the actual effort and rate of sea turtle interaction in the NEC time/area closure.

Alternative A14 time/area closure without redistribution of effort

The effectiveness of the combined central Gulf of Mexico and NEC time/area closure was evaluated by determining the percent reduction in bycatch of protected species for each month and cumulatively for the year based on both observer and logbook data for the combined years 2001 - 2002. Data were also analyzed to determine the impact on catches of targeted species such as swordfish, yellowfin and bigeye tuna, as well as blue and white marlin discards.

Data from the observer program indicate that 43 percent of leatherback sea turtles (38 of 88) observed caught in the Atlantic and Gulf of Mexico from 2001 - 2002, were caught inside the time/area closure (Appendix 2, Tables 1 - 2). Based on logbook data, 58 percent of leatherback sea turtles (192 of 331) were reported caught inside the time/area closure during the same time period. Thus, based on both observer and logbook data for 2001 - 2002, and without redistribution of fishing effort, the time/area closure would be expected to reduce the catch of leatherback sea turtles by 43 - 58 percent.

Of the observed loggerhead sea turtle interactions, 34 percent (14 of 41) were inside the time/area closure from 2001 - 2002, and 56 percent (54 of 96) of logbook reported catches were inside the time/area closure. Thus, based on both observer and logbook data, the catch of loggerhead sea turtles would potentially be reduced by 34 - 56 percent (Appendix 2, Tables 1 and 3).

For other sea turtles (green, hawksbill, and Kemp’s ridley), 100 percent of the observed (2 of 2) and 50 percent of the reported (5 of 10) sea turtles were caught inside the time/area closure. The time/area closure would thus be expected to reduce the number of other sea turtle takes between 50 - 100 percent (Appendix 2, Tables 1 and 4).

For targeted species, 21 percent of all reported swordfish (17,185 of 82,984), 38 percent of all yellowfin tuna (42,810 of 113,155), and 12 percent of all bigeye tuna (3,613 of 29,885) caught in the Atlantic and Gulf of Mexico were caught in the time/area closure. Therefore, without redistribution of effort, the time/area closure would be expected to reduce the catch of these species by these percentages. Only logbook data were available to evaluate reduction in catch for these species in the time/area closure (Appendix 2, Tables 11 - 15).

For blue and white marlin, dead discards, live discards, and combined live and dead discards were estimated in the time/area closure in comparison to the rest of the Atlantic and Gulf of Mexico. For blue marlin, 57 percent of all dead discards (300 of 523), 30 percent of live discards (389 of 1,304), and 38 percent of combined live and dead discards (689 of 1832) in the Atlantic and Gulf of Mexico were located in the time/area closure (Appendix 2, Table 17 - 20). For white marlin, 42 percent of all dead discards (301 of 712), 30 percent of live discards (484 of 1,593), and 34 percent of combined live and dead discards (785 of 2,302) in the Gulf of Mexico were located in the time/area closure (Appendix 2, Tables 21 - 24).

Alternative A14 time/area closure with redistribution of effort

The redistribution of effort analysis indicates that the overall bycatch of leatherback, loggerhead and other sea turtles would be reduced by the central Gulf of Mexico and NEC time/area closure. Based on observer data, 10 percent fewer leatherbacks (9 of 88) would have been caught between 2001 - 2002 with the time/area closure in effect (Appendix 2, Tables 1 and 5), and based on the logbook data, 37 percent fewer leatherbacks (123 of 331) would have been caught during the same time period with the time/area closure in effect (Appendix 2, Tables 1 and 6).

Based on observer data, the redistribution of effort analysis indicates that 7 percent fewer loggerheads (3 of 41) would have been caught. Based on logbook data, 35 percent fewer (34 of 96) loggerheads would have been caught.

Data from the observer program indicate that 100 percent (2 of 2) fewer other sea turtles would have been caught, and logbook data indicate that 28 percent (3 of 10) fewer sea turtles would have been caught with the time/area closure in effect (Appendix 2, Tables 1, 9, and 10). Thus, even with redistribution of effort, the time/area closure would have resulted in a 28 - 100 percent reduction in bycatch of other sea turtles.

Logbook data indicate that redistribution of effort in the Atlantic and Gulf of Mexico as a result of the closure would have resulted in an 18 percent increase in swordfish catch from 2001 - 2002 (Appendix 2, Tables 11 and 13), 2 percent decrease in yellowfin tuna catch (Appendix 2, Tables 11 and 14), and 33 percent increase in bigeye tuna catch (Appendix 2, Tables 11 and 15).

For blue marlin, logbook data indicate that dead discards and combined live and dead discards would have increased by 31 percent and 3 percent respectively with redistribution of effort, whereas live discards would have decreased by 8 percent (Appendix 2, Tables 16 and 19 - 21). White marlin dead discards would have increased by 10 percent, but live and combined live and

dead discards would have decreased by 9 and 3 percent respectively (Appendix 2, Tables 16 and 22 - 24).

Alternative A15 would prohibit the use of pelagic longline gear in the central Gulf of Mexico and the NEC for six months (May through October). The same data used in Alternative A14 (GOM and NEC closure year-round) were used in this alternative, except that the data were analyzed only for the specified months. Separate summary tables of number and percentage reductions in sea turtle interactions and catches of targeted species are presented in Appendix 3.

Alternative A15 time/area closure without redistribution of effort

Based on both observer and logbook data, leatherback sea turtles interactions would be reduced 35 percent (31 of 88 based on observer data, and 115 of 331 based on logbook data), loggerhead sea turtle interactions would be reduced 29 percent (12 of 41) based on observer data and 44 percent (42 of 96) based on logbook data, and other sea turtle interactions would be reduced 0 percent based on both observer and logbook data (Appendix 3, Tables 1 - 4).

Based on logbook data, the catch of swordfish, yellowfin tuna, and bigeye tuna would be reduced by 15 percent, 25 percent, and 8 percent, respectively (Appendix 3 Tables 11 - 12). Blue and white marlin dead and live discards combined would be reduced by 34 percent and 31 percent, respectively (Appendix 3, Tables 16 - 17).

Alternative A15 time/area closure with redistribution of effort

With redistribution of effort, leatherback sea turtle interactions would be reduced by 14 percent (12 of 88) based on observer data, and 24 percent (79 of 331) based on logbook data. Loggerhead sea turtle interactions would be reduced 18 percent (7 of 41) based on observer data, and 34 percent (32 of 96) based on logbook data. For other sea turtles, the number of interactions would be reduced 0 percent based on the observer data, and would have increased 11 percent (1 additional interaction of 10 reported) based on logbook data (Appendix 3, Tables 5 - 10).

Based on analysis of logbook data with redistribution of effort, swordfish catch would have increased 5 percent (additional 4,440 swordfish caught), yellowfin tuna catch would have increased 3 percent (additional 3,022 caught), and bigeye tuna would have increased 17 percent (additional 5,082 caught) (Appendix 3, Tables 13 - 15).

Blue marlin combined live and dead discards would have decreased 8 percent (150 of 1832)(Appendix 3 Tables 18 - 20), and white marlin live and dead discards would have decreased 1 percent (25 of 2,302).

Alternative 16**,** a preferred alternative, would require vessel operators aboard all federally permitted vessels, or those required to be permitted, for Atlantic HMS with pelagic longline gear onboard to possess and use line cutters and dipnets meeting newly revised design and

performance standards as well as require these vessels to possess, maintain, and utilize additional equipment to facilitate the removal of fishing gear from incidentally captured sea turtles. This additional equipment would include: A- (1) long-handled line cutter; B- (1) long-handled dehooker for ingested hooks; C- (1) long-handled dehooker for external hooks (the long-handled dehooker for ingested hooks used for item B will also satisfy this requirement); D- (1) long-handled device to pull an "Inverted V" (if 6' J-style dehooker is used for item C, it will also satisfy this requirement); E- (1) dipnet; F- (1) standard automobile tire; G- (1) short-handled dehooker for ingested hooks; H- (1) short-handled dehooker for removing external hooks (the short- handled dehooker for ingested hooks used for item G will also satisfy this requirement); I- (1) long-nose or needle-nose pliers; J- (1) monofilament line cutter; K- (1) bolt cutter; and, L- (2) types of mouth openers/mouth gags as discussed in Appendix B1.

Items A - D would be required for sea turtles not boated. Items E - L would be required for sea turtles boated. Design standards, example models, example sources, and estimated costs for each piece of equipment can be seen in Appendix B1. This equipment would be required to be used in accordance with the handling and release guidelines specified by NOAA Fisheries (See Appendix B2). Relative to the no action alternative, A1, the use of these additional tools to remove hooks and lines would likely reduce serious injury and post-release mortality of sea turtles, marine mammals, and other incidentally caught species. The proper use of these gears is essential to maximize pelagic longline gear removal from sea turtles thereby maximizing post-hooking survival of these species. Therefore, NOAA Fisheries anticipates making available educational and outreach materials demonstrating the proper use of sea turtle careful release and disentanglement gears. Furthermore, in a future rulemaking, the Agency will likely consider educational workshops or training programs to promote the effective use of these gears.

When alternative A16 is applied in combination with alternatives A5 (b) and A10 (b), these alternatives are expected to decrease interactions and mortalities for leatherback sea turtles and mortalities for loggerhead sea turtles. Additional rulemaking and management measures will be required in this fishery pursuant to the 2004 BiOp. See Section 4.3 for further information on the 2004 BiOp.

During the public comment period, most commenters supported alternative A16, stating that it would better ensure survival of sea turtles incidentally captured in pelagic longline gear. Some commenters indicated that a "turtle teather" should be required, rather than recommended, gear. However, further refinements in the design standards and procedural protocols for use of this gear are still being developed. After further development and testing, NOAA Fisheries will reconsider this as a possible gear requirement.

Under all of the above alternatives, NOAA Fisheries does not expect any adverse impacts to EFH. The HMS FMP and Amendment 1 to the Atlantic Billfish FMP state that Atlantic HMS occupy pelagic oceanic environments. The HMS FMP describes habitat damage by pelagic longlines as negligible to the pelagic environment. The use of specific hooks and baits, area closures, and bycatch mortality mitigation gear will not have an effect on EFH.

Social and Economic Impacts

The social and economic impacts of alternatives discussed below that deal with the NED are analyzed initially from the vantage point that no pelagic longline fishing is allowed in the NED at the time of this rule making. Social and economic impacts of the NED experiment are not factored into this analysis for purposes of comparison, and are discussed only briefly in the analysis of alternative A1. As such, any future social or economic benefit derived from fishing activities in the NED, even if below historic benefits, are considered positive impacts. Where appropriate, comparisons are drawn with pre-NED closure information to provide a relative sense of impacts from traditional practices and levels.

Under alternative A1 (No Action), NOAA Fisheries does not anticipate a significant change in landings, ex-vessel prices, or economic benefits relative to the "status quo" or any significant social impacts, because this alternative does not change current fishing practices. While the NED experiment occurred outside of the fishery itself, it provided positive economic benefits for pelagic longline vessels participating in that program, as well as shore-side businesses dealing with those vessels, which helped mitigate the adverse economic impacts of the NED closure. With termination of the experiment on December 15, 2003, such economic benefits will no longer be available and the full effect of the NED closure will be felt. As such, relative to the status quo, vessels that participated in the NED experiment and associated shore-side businesses could experience moderate adverse social and economic impacts under the no action alternative. Also, significant, unquantifiable adverse economic impacts could result if no action is taken to address sea turtle interactions in the Atlantic pelagic longline fishery consistent with the ESA.

Alternative A2 would be expected to have moderate positive social and economic impacts for those vessels able to successfully target swordfish outside of the NED and substantial negative economic impacts for those vessels targeting tunas or engaged in mixed trips outside the NED. The species composition of landings for pelagic longline trips conducted in all areas**,** except the NED, can be seen in Table 4.1. As previously noted, this alternative may increase swordfish landings by a range of approximately 9.22 to 30.24 percent (by weight) and decrease tuna landings approximately 81.18 to 87.64 percent (by weight). While data indicate that there may be a link between cooler water temperatures and catches of larger swordfish, it is not entirely clear whether this effect is derived solely from water temperatures or from a combination of factors including the availability of larger fish capable of taking large baits. If so, as the N. Atlantic swordfish stock rebuilds, the availability of larger fish should increase. Nevertheless, for pelagic longline fisheries occurring in warmer waters, these potential increases in swordfish catches and their attendant social and economic benefits, should be considered less certain and may decline to zero or even result in declining catches. As discussed in Section 6.2, average gross revenues of Atlantic pelagic longline vessels are estimated at $178,619. Assuming a steady state in all other aspects including catches of other species and prices, the potential increase in swordfish catches could boost the proportion of total landings attributable to swordfish, by weight, from 36.22 percent to between 39.55 and 47.17 percent, as compared with traditional landings. Assuming that the estimated 9.22 to 30.24 percent increase in the weight of swordfish landed will result in a proportional increase in revenues attributable to swordfish,

vessel revenues may increase by 3.57 to 11.7 percent ($6,384 to 20,941), resulting in overall gross vessel revenues of between $185,003 and $199,560.

For the purposes of this analysis, hook and bait impacts on bigeye tuna catches, as identified during the NED experiment, are used as a proxy for impacts on all tuna catches. Assuming a steady state in all other aspects including catches of other species and prices, the proportion of total landings attributable to tuna by weight may decline from 58.63 percent to between 7.25 and 11.03 percent. Assuming that the estimated 81.18 to 87.64 percent decrease in the weight of tuna landed will result in a proportional decrease in revenues attributable to tunas, vessel revenues could decrease by between 47.93 and 51.74 percent ($85,610 to $92,422), resulting in overall gross vessel revenues of between $93,009 and $86,197. For fishermen unable to target and catch swordfish in numbers sufficient to offset lost tuna revenues, particularly in the Gulf of Mexico where yellowfin tuna dominates catches, this alternative could have adverse economic and social impacts.

As described in the ecological impacts discussion for alternative A2, this alternative could reduce blue shark bycatch. This likely will have little or no economic impact as blue sharks are generally not retained and marketed, but may increase fishing efficiency and reduce economic losses due to damaged or lost fishing gear. The impact of this hook and bait combination on other sharks, dolphin, and wahoo catches is unknown, and is therefore unquantifiable. While NOAA Fisheries cannot directly quantify the impact of this hook and bait combination on landings or vessel revenues attributable to dolphin, this alternative could result in some unquantifiable decrease. During the comment period, commenters raised this as a concern.

In aggregate, under alternative A2, vessels fishing outside the NED could experience a possible change in total revenues ranging from -$92,422 to +$20,941, depending on the frequency with which particular hook and bait combinations are employed, and target species of trips. For mixed trips, the estimated impacts of this alternative may range from -$64,668 to -$86,037 resulting in a decline of gross vessel revenues from $178,619 to between $113,951 and $92,582.

Table 4.1 **The Species Composition of Landings for Pelagic Longline Trips Conducted in All Areas, *Except the NED,* in 2002.** Source: Pelagic Longline Logbook data maintained by the Southeast Fisheries Science Center.

Species	% by weight	% by gross revenues
Swordfish	36.22 %	38.77 %
Yellowfin Tuna	44.41 %	44.49 %
Bigeye Tuna	10.61 %	11.95 %
Bluefin Tuna	1.08 %	1.96 %
Other Tunas	2.53 %	0.64 %

Pelagic Sharks	3.10 %	1.15 %
Large Coastal Sharks	2.04 %	0.97 %

Alternative A2 may cause a significant portion of fishermen to shift effort to target primarily swordfish. There could be substantial changes in the distribution of fleet with an unquantifiable portion possibly exiting the fishery. Changes in fishing patterns may result in fishermen having to travel greater distances to reach more favorable grounds, which would likely result in increased fuel, bait, ice, and crew costs. While there may be a potential increase in travel, this is unlikely to raise significant safety concerns because the fleet is highly mobile. The potential shift in fishing grounds, should it occur, could result in fishermen selecting new ports for offloading. This would likely have negative social and economic consequences for traditional ports of offloading, including processors, dealers, and supply houses, and positive social and economic consequences for any new selected ports of offloading.

An informal internet and telephone survey of hook suppliers provides a range in price of approximately $0.26 to $0.66 ($0.4176 avg) per hook for large 18/0 commercial grade circle hooks and a range of approximately $0.26 to $1.00 (avg. $0.5733) per hook for large commercial grade “J”-hooks. Assuming that an average of 2,500 hooks per vessel are needed initially to equip vessels with enough required hooks for one trip, the compliance cost, on a per vessel basis, may range from $657.25 to $1,650, with an anticipated average cost of approximately $1,044. This cost is estimated to represent a savings to fishermen of approximately 27 percent versus rigging with the same number of “J”-hooks.

Traditionally, bait accounts for 16 to 26 percent of total costs per trip (Larkin *et al.*, 2000; Porter *et al.*, 2001). Future fluctuations in price and availability of mackerel bait may have substantial impact on profitability, either positive or negative, leading to noticeable social impacts. There would also be unquantifiable lost opportunity costs as fishing crews who have not traditionally fished with this hook and bait familiarize themselves with the most efficient techniques.

Alternative A3 could have widely varying impacts from considerable positive to substantial negative impacts. Depending on whether fishermen select the 18/0 non-offset hook with squid or the 18/0 offset hook with whole mackerel, respectively, swordfish catches could range from -32.58 to +30.24 percent (by weight), and tuna catches from -87.64 to +29.22 percent (by weight). See alternative A2 for further details on swordfish catches and potential for decrease in catch in warmer waters. Increases in tuna landings during the NED experiment were substantial, but given limited data were not considered statistically significant. Therefore, estimated increases in landings of tunas and their attendant socio-economic impacts are less certain than estimated losses of tunas. The experiment indicated that, in general, hook and bait combinations that have a positive impact on swordfish catches tend to have a negative impact on tuna catches, and vice versa. Thus, fishermen would have to decide prior to sailing which species to target.

Alternative A3, option i, would have similar socio-economic impacts as those discussed under alternative A2. Alternative A3, option ii, would likely result in considerable negative economic

impacts for fishermen targeting swordfish, minor adverse to positive economic impacts for those undertaking mixed target (tunas and swordfish) trips, and considerable positive economic impacts for those targeting tunas. As discussed in Section 6.2, gross average revenues of Atlantic pelagic longline vessels are estimated at $178,619. Alternative A3, option ii, is expected to reduce that portion of landings historically attributable to swordfish by 28.54 to 32.58 percent from 36.22 percent down to between 24.42 to 25.88 percent, and could result in a decrease in vessel revenues of 11.06 to 12.63 percent ($19,764 to $22,561), resulting in overall gross vessel revenues of between $156,058 and $158,855. With regard to tunas, option ii could potentially increase the portion of landings historically attributable to tunas by a range of 20.24 to 29.22 percent (by weight), from 58.63 percent to between 70.50 and 75.76 percent, and could potentially increase vessel revenues by between 11.95 and 17.25 percent ($21,344 to $30,814), resulting in overall gross vessel revenues of between $199,963 and $209,433. Combining projected changes in swordfish and tuna landings and revenues, the overall impact for vessels fishing outside the NED under option ii could be a change in total revenues ranging between -$22,561 to +$30,814. NOAA Fisheries estimates a change in gross vessel revenues for mixed trips (under alternative A3, option ii) of between -$1,217 to $11,050. This is estimated to result in gross vessels revenues of between $177,402 and $189,669.

Under alternative A3 in aggregate, for vessels able to target swordfish and equip and deploy the most efficient hook and bait combination available, average gross vessel revenues may increase between $6,384 and $20,941. For vessels able to target tunas with the most efficient hook and bait combination available, average gross vessel revenues may increase between $21,344 and $30,814. These potential increases are likely to be over estimates, but provide an estimated range of increased gross vessel revenues of between $185,003 and $209,433. For vessels unable to specifically target swordfish or tunas and which engage in mixed trips, the aggregate impact of alternative A3 may be to change gross vessel revenues by between -$86,037 (18/0 offset circle hook with whole mackerel bait) and +$11,050 (18/0 non-offset circle hook with squid), providing a range of gross vessel revenues of between $92,582 and $189,669. Actual impacts would likely fall between these ranges, depending on the frequency with which particular hook and bait combinations are employed and species targeted. As discussed in alternative A2, results from the NED research experiment indicate a reduction in blue shark catch with 18/0 offset circle hooks and whole mackerel bait. No reduction in blue shark catch is anticipated with the 18/0 non-offset circle hook with squid bait. Potential impacts associated with a reduction in blue shark catch would be similar to those discussed under alternative A2. See alternative A2 for explanation of potential impacts related to catches of other sharks, dolphin, and wahoo. Other potential impacts due to a shift in effort to target certain species, hook and bait costs, and lost opportunity costs would be similar to those discussed under alternative A2.

During the public comment period, numerous commenters expressed concern that this alternative would result in significant economic losses for vessels fishing outside the NED. These vessels frequently engage in mixed target species trips, which were identified in the DSEIS as those most likely to be adversely affected by alternative A3. Other vessel operators and industry representatives stated that the requirement to use 18/0 circle hooks would significantly reduce catches of yellowfin tuna in the GOM and that Atlantic mackerel is either unavailable,

expensive, or ineffective in the GOM. Although the DSEIS presented a range of potential positive to negative impacts (depending upon target species and hook and bait choices), commenters indicated that alternative A3 would render many vessels financially insolvent.

Alternative A4 could have widely varying impacts, ranging from moderately positive to substantially negative, depending on the hook and bait combination selected and target species. Fishermen may experience a change in swordfish landings by weight of between -32.58 and +63.4 percent by weight, depending on whether they choose to equip and deploy the 18/0 non-offset circle hook with squid (range: -28.54 to -32.58 percent), the 18/0 offset circle hook with whole mackerel (range: 9.22 to 30.24 percent), or the 9/0 offset "J"-hook with whole mackerel (+63.4 percent). See alternative A2 for information on potential for decreased swordfish catches in warmer waters. Fishermen could experience changes in tuna catches of -90.24 to +29.22 percent by weight depending on whether they choose to equip and deploy the 9/0 offset "J"-hook with whole mackerel (-90.24 percent), the18/0 offset circle hook with whole mackerel (range: 81.18 to 87.64), or the 18/0 non-offset circle hook with squid (range: +20.24 to 29.22 percent). See alternative A3 for information on limited data for increased tuna catch estimates. Because certain hook and bait combinations work better for swordfish and tuna, under this alternative, fishermen would have to decide prior to sailing which species to target.

Alternative A4, option i (18/0 offset circle hook with whole mackerel bait) would have socio-economic impacts similar to those discussed under alternative A2. Option ii (18/0 non-offset circle hook and squid bait) would have impacts similar to this discussed under alternative A3, option ii. Option iii (9/0 offset "J"-hook with whole mackerel bait) could have significant positive social and economic impacts for trips targeting swordfish, but substantial negative economic impacts for mixed trips or those targeting tunas.

As discussed in Section 6.2, gross average revenues of Atlantic pelagic longline vessels are estimated at $178,619. Alternative 4, option iii, may increase that portion of landings historically attributable to swordfish by 63.4 percent (by weight) from 36.22 percent to 59.18 percent, and may increase revenues by 24.58 percent ($43,905), resulting in overall gross vessel revenues of $222,524. With regard to tunas, option iii could reduce that portion of landings historically attributable to tunas by 90.24 percent (by weight), from 58.63 percent to 5.72 percent, and could decrease vessel revenues by 53.28 percent ($95,164), resulting in overall gross vessel revenues of $83,455. The average overall impact on vessel revenues of selecting the 9/0 offset "J"-hook and squid bait combination and engaging in a mixed trip would likely result in a loss of gross revenues of approximately $51,259 reducing gross vessel revenues to $127,360.

Under alternative A4, options i and ii in aggregate, for vessels able to target swordfish and use the most efficient hook and bait combination available, average gross vessel revenues may increase between $6,384 and $43,904. For vessels able to target tunas and use the most efficient hook and bait combination available, average gross vessel revenues may increase by between $21,344 and $30,814. These potential increases are likely to be over estimates, but provide an estimated range of increased gross vessel revenues of between $185,003 and $222,523. For

vessels unable to specifically target swordfish or tunas and which engage in mixed trips, gross vessel revenues could change by between -$86,037 (18/0 offset circle hook with whole mackerel bait) and +$11,050 (18/0 non-offset circle hook with squid), providing a range of gross vessel revenues of between $92,582 and $189,669. Actual impacts would likely fall between these ranges, depending on the frequency with which particular hook and bait combinations are employed and species targeted. Alternative A4, options i and ii, would have similar socio-economic impacts on blue sharks, other sharks, dolphin, and wahoo as alternative A2. Other potential impacts due to a shift in effort to target certain species, hook and bait costs, and lost opportunity costs would be similar to those discussed under alternative A2.

Alternative A5 (a) could have minimal to moderate adverse economic impacts depending on the target species. As per the ecological discussion of this alternative, the use of 16/0 circle hooks is expected to result in little or no change in catches of tunas, and a 10 to 20 percent decrease in catches of swordfish. As discussed in Section 6.2 gross revenues of Atlantic pelagic longline vessel are estimated at $178,619. Under this alternative, the proportion of total landings attributable to tuna would likely remain at approximately 58.6 percent by weight, and average vessel revenues attributable to tunas would likely remain at approximately $104,670. With regard to swordfish, the proportion of landings historically attributable to swordfish may decrease from 36.22 percent to between 28.98 and 32.6 percent by weight, and vessel revenues may decrease by 3.88 ($6,925) to 7.75 ($13,850) percent, resulting in overall gross vessel revenues of between $171,694 and $164,769. This reduction in swordfish catch is not anticipated as fishermen would have the flexibility to utilize hook and bait combinations which have been shown to be effective at catching swordfish. Fishermen using 18/0 or larger circle hooks to target large swordfish may experience economic impacts similar to those discussed under alternative A3, *supra*. The impact of the 16/0 hook on catches of shark, dolphin, wahoo, and other marketable species is unknown.

An informal internet and telephone survey of hook suppliers provides a range in price of approximately $0.28 to $0.50 ($0.3539 avg) per hook for large 16/0 commercial grade circle hooks. Assuming that an average of 2500 hooks per vessel are needed to initially comply with proposed hook requirements (equip vessels with enough hooks for one trip), the compliance cost, on a per vessel basis, may range from $697.50 to $1,241.75, with an anticipated average cost of approximately $884.75. The cost of 16/0 circle hooks is estimated to result in a savings of approximately 35 percent versus rigging with the same number of “J”-hooks.

Alternative A5 (a), by itself, would not be expected to cause significant changes in fishing practices or the level of fishing effort, but may result in some limited shift in fishing patterns with fishermen possibly seeking more favorable tuna fishing grounds. Potential impacts due to a shift in effort to target certain species and lost opportunity costs would be similar to those discussed under alternative A2.

Alternative A5 (b), a preferred alternative, may have minimal to moderate adverse economic impacts depending on the target species. This alternative would allow fishermen to target both tunas and swordfish with 16/0 or larger non-offset circle hooks and 18/0 or larger circle hooks

with an offset not to exceed 10 degrees, while employing locally available baits traditionally used in different segments of the fishery. This flexibility will allow fishermen to target different species and adjust to changing market conditions while at sea and may help prevent potential bait supply problems and decrease initial compliance costs by allowing the use of hooks that some fishermen may already possess. This alternative addresses concerns raised during public comment that DSEIS preferred alternative A3 provided inadequate flexibility in hook sizes or bait types, while providing reductions in leatherback sea turtle interactions and mortalities and loggerhead sea turtle mortalities. See ecological discussion for alternative A5 for details.

Based on public comment received, NOAA Fisheries expects that the vast majority of fishermen will regularly employ the 16/0 circle hook, which has been employed by vessels in the Gulf of Mexico in the past. As such, the socio-economic impacts of alternative A5 (b) are expected to be similar to those discussed under alternative A5 (a), above.

The measures analyzed in alternative A5 (a) received much support from the U.S. pelagic longline fishing industry, because they provide an opportunity to fish for a wider variety of species, commonly targeted outside the NED, by allowing a choice of baits and a smaller hook size. The measures in alternative A5 (b) also provide flexibility, thus they also are expected to allow vessels outside the NED to fish for a wider variety of species, including yellowfin tuna, and remain financially solvent while doing so.

Alternatives A7 - A10 (b) could have, as described in detail below, varying ranges of economic and social impacts for the estimated 12 vessels that may fish in the NED. Actual impacts for these alternative are expected to fall between the ranges provided. While some of the alternatives may indicate potential decreases in tuna catches, it is important to note that tuna catches in the NED are currently zero given the closure, and as noted in Table 4.2, have traditionally represented only a limited portion of total gross revenues for vessels fishing in the NED. Moreover, given that no pelagic longline vessels can currently fish in the NED, any income derived from future NED trips would result in positive social and economic impacts, regardless of hook and bait restrictions that vessels may have to operate under in this area. For purposes of these analyses, impacts on bigeye tuna catches, as identified during the NED experiment, are used as a proxy for impacts on all tuna catches. Per Section 6.2, average gross revenues of Atlantic pelagic longline vessels are estimated at $178,619.

Alternative A7 may have substantial positive to minor negative impacts for vessels that may fish in the NED. Swordfish catches may increase by approximately 9.22 to 30.24 percent (by weight) over traditional NED catches, while tuna catches may fall by 81.18 to 87.64 percent (by weight). Given that the gross revenues of vessels fishing in the NED have traditionally been primarily derived from swordfish landings (Table 4.2), this alternative would likely have substantial positive economic and social benefits for swordfish vessels over the status quo as well as historically. See alternative A2 for more information on potential decreased swordfish catches in warmer waters.

This alternative could increase the proportion of total landings historically attributable to swordfish from 88.54 percent to the equivalent of between 96.7 to 115.31 percent. Assuming that the projected 9.22 to 30.24 percent increase in the weight of swordfish landed would result in a proportional increase in revenues attributable to swordfish, vessel revenues may increase by between 8.13 percent ($14,515) and 26.65 ($47,608), providing new gross vessel revenues of between $193,134 and $226,227. The portion of total historical landings attributable to tuna may decline from 9.85 percent (by weight) to between 1.22 and 1.85 percent. Assuming that the projected 81.18 to 87.64 percent decrease in the weight of tuna landed would result in a proportional decrease in revenues attributable to tuna, vessel revenues may decrease by between 9.15 ($16,342) and 9.88 percent ($17,642), providing new gross vessel revenues of between $162,277 and $160,977. In aggregate, combining increased swordfish revenues with decreased tuna revenues, vessels fishing in the NED under this hook and bait combination and engaging on a mixed target trip could see changes in vessel revenues ranging from -$3,127 to +$31,266 providing new gross vessel revenue totals ranging from $175,492 to $209,885.

Alternative A7 is not expected to cause noticeable changes on the practices or behavior of fishermen or raise safety at sea concerns. However, there will be a minor unquantifiable lost opportunity, as compared to pre-NED closure trips, as fishing crews who have not traditionally fished with this hook and bait combination familiarize themselves with the most efficient techniques. Changes in hook and bait costs would be expected to be similar to those analyzed under alternative A2. This alternative would be expected to have substantial positive social and economic impacts for fish processors and dealers in the Northeast by providing them additional business. From 1998 to 2000, NED area vessels landed 21 percent of all swordfish landed by the U.S. Atlantic pelagic longline fishery (Cramer, 2001). See alternative A2 for explanation of potential impacts related to catches of blue sharks, other sharks, dolphin, and wahoo.

Table 4.2 **The Species Composition of Landings for Pelagic Longline Trips Conducted in the NED Area in 2000.** Source: Logbook and weigh-out data maintained by the Southeast Fisheries Science Center.

Species	% by number	% by weight	% by gross revenues
Swordfish	87.79	88.54	88.14
Yellowfin tuna	0.39	0.27	0.19
Bigeye tuna	9.57	8.23	8.72
Bluefin tuna	0.12	0.99	2.27
Other tunas	1.00	0.36	0.09
Pelagic sharks	1.14	1.60	0.59

Species	% by number	% by weight	% by gross revenues
Large coastal sharks	0.00	0.00	0.00

* Calculations involving gross revenues of vessels fishing in the NED were executed using weight and revenue values from 2000 to avoid problems with bias stemming from mandated fishing gears and techniques tested in the NED experiment.

Alternative A8 would be expected to have moderate positive social and economic impacts for vessels that may return to the NED to target swordfish, substantial adverse economic impacts for vessels targeting tunas, and moderate adverse economic impacts for vessels embarking on mixed trips. The analysis of this alternative is based on data from year three (2003) of the NED experiment as this hook and bait treatment was only tested during that year. An informal internet and telephone survey of hook suppliers provides a range in price of approximately $0.92 to $1.00 ($0.96 avg) per hook for large 20/0 commercial grade circle hooks. Assuming that an average of 2,500 hooks per vessel are needed to initially comply with proposed hook requirements (equip vessels with enough hooks for one trip), the compliance cost, on a per vessel basis, may range from $2,300 to $2,500, with an anticipated average cost of $2,400.

This alternative may increase swordfish landings by an estimated 5.8 percent (by weight) and decrease in tuna landings 92.9 percent (by weight). However, the increase in swordfish landings for this alternative is less certain, as it was not determined to be statistically significant. See also alternative A2 for discussion of potential decreased swordfish catches in warmer waters. This alternative could increase the proportion of total landings historically attributable to swordfish from 88.54 percent to the equivalent of 93.68 percent (by weight), and increase vessel revenues by 5.11 percent ($9,131), resulting in overall gross vessel revenues of $187,750. The portion of total historical landings attributable to tuna may decline from 9.85 percent (by weight) to less than one percent. Assuming that the projected 92.9 percent decrease in the weight of tuna landed would result in a proportional decrease in revenues attributable to tuna, vessel revenues may decrease by 10.47 percent (-$18,701), resulting in overall gross vessel revenues of $159,918. In aggregate, combining increased swordfish revenues with decreased tuna revenues, vessels fishing in the NED under this hook and bait combination and engaging on a mixed target trip could see a decline in gross vessel revenues of $9,570, providing new estimated gross vessel revenues of $169,049.

Alternative A8 is expected to have similar impacts as alternative A7 on fishing behavior, safety at sea, opportunity costs, other marketable species, and fish processors and dealers in the Northeast. See alternative A2 for explanation of potential impacts related to catches of blue sharks, other sharks, dolphin, and wahoo.

Alternative A9 may have substantial positive to minor negative impacts for vessels that may fish in the NED. Under this alternative, swordfish catches could increase by between 9.22 and 63.4 percent (by weight) over traditional NED landings, depending on whether fishermen chose to equip and deploy the 18/0 offset circle hook with whole mackerel or the 9/0 “J”-hook with whole

mackerel, respectively. See alternative A2 for information on potential decreased swordfish catches in warmer waters. This alternative could result in significant decreases in tuna catches of between 81.18 and 90.2 percent by weight (respectively). However, as previously stated, the gross revenues of vessels fishing in the NED have traditionally been derived primarily from swordfish landings. Increased swordfish catches over "traditional" or "pre-NED closure" catches, would likely substantially improve vessel profitability and crew income over the status quo or historical social and economic impacts.

Socio-economic impacts of alternative A9, option ii (18/0 circle hook with whole mackerel bait), would be similar to the impacts discussed under alternative A7. Alternative A9, option i (9/0 "J"-hook with whole mackerel bait), would likely have more positive social and economic impacts. This alternative could increase total landings historically attributable to swordfish from 88.54 percent (by weight) to the equivalent of 144.67 percent. Assuming that the projected 63.4 percent increase in the weight of swordfish landed would result in a proportional increase in revenues attributable to swordfish, vessel revenues may increase by as much as 55.88 percent ($99,814), providing new estimated gross vessel revenues of $278,433. The portion of landings historically attributable to tuna by weight may decline from 9.85 percent of historical landings to less than one percent of historical tuna landings, by weight. Assuming that the projected 90.24 percent decrease in the weight of tuna landed would result in a proportional decrease in revenues attributable to tuna, vessel revenues may decrease by 10.17 percent ($18,166), providing new estimated gross vessel revenues of $160,453.

Combining projected increases in swordfish revenues with projected lost tuna revenues for option i, gross vessel revenues for vessels engaging on a mixed trip may increase by approximately $81,648 providing a new estimated total of $260,267. As such, changes in vessel revenues under alternative A9 (both options i and ii) could range from between -$3,127 and +$81,648, providing for a possible range of total gross vessel revenues of between $175,492 and $260,267. These figures likely represent over estimates in both directions. The actual impact would likely fall between these two, depending on the frequency with which particular hook and bait combinations are employed and species targeted.

Alternative A9 is expected to have similar impacts as alternative A7 on fishing behavior, safety at sea, opportunity costs, other marketable species, and fish processors and dealers in the Northeast. Alternative 9, option ii, would have similar socio-economic impact relating to blue sharks , other sharks, dolphin, and wahoo, as would alternative A2.

Alternative A10 (a) may have substantial positive to substantial negative for vessels that may fish in the NED. Depending on whether fishermen select the 18/0 offset circle hook with whole mackerel or the 18/0 non-offset circle hook with squid, respectively, swordfish catches could change by +30.24 to -32.58 percent (by weight), and tuna catches by -87.64 to possibly as much as +29.22 percent (by weight). See alternative A2 for more information on potential decreased swordfish catches in warmer waters. Increases in tuna landings during the NED research experiment were substantial, but given limited data were determined not to be statistically

significant. Because different hook and bait combinations impact swordfish and tuna catches differently, fishermen would have to decide prior to sailing which species to target.

Alternative A10 (a), option i, would have socio-economic impacts similar to those discussed under alternative A7. Alternative A10 (a), option ii, would likely have a small positive impact relative to the status quo, but negative economic impacts from a historical perspective for fishermen targeting swordfish or embarking on a truly mixed target trip in the NED. Further, fishermen would likely experience minor positive increases in revenues associated with tuna catches from a historical perspective; however, these revenues would not likely be able to offset overall historical revenue losses stemming from decreased swordfish catches.

Alternative 10 (a), option ii, would likely reduce the portion of landings historically attributable to swordfish from 88.54 percent (by weight) to between 59.69 and 63.27 percent. Assuming that the projected 28.54 to 32.58 percent decrease in the weight of swordfish landed would result in a proportional decrease in revenues attributable to swordfish, vessel revenues may decrease by between 25.16 percent ($44,932) and 28.72 percent ($51,292), resulting in overall gross vessel revenues of between $127,327 and $133,687. The portion of vessel landings historically attributable to tuna by weight may increase from 9.85 percent to between 11.84 and 12.73 percent. Assuming that the potential 20.24 to 29.22 percent increase the weight of tuna landed would result in a proportional increase in revenues attributable to tuna, vessel revenues may increase by 2.23 percent ($4,074) to 3.29 percent ($5,882), resulting in overall gross vessel revenues of between $182,693 and $184,501. The overall impact on vessel revenues of selecting the 18/0 non-offset circle hook and squid bait combination and engaging in a mixed trip in the NED would likely result in a decline in revenues of between $39,050 and $47,218, providing new estimated gross vessel revenues of between $131,401 and $139,569. As such, for vessels engaging in mixed trips, alternative A10 (a) (both options i and ii) is expected to result in aggregate changes vessel revenues of between -$47,218 and +$31,266, resulting in overall gross vessel revenues of between $131,401 and $209,885. These figures likely represent over estimates. The actual impact would likely fall between these two, depending on the frequency with which particular hook and bait combinations are employed and species targeted. Most fishermen would likely select option i as the preponderance of effort in the NED has historically targeted swordfish, but this alternative also includes a hook and bait type that is effective at catching tunas, should fishermen opt to engage on a tuna directed trip in the NED. While there is a choice between two options, during the comment period, several commenters stated that this alternative would result in significant economic losses to U.S. vessels fishing in the NED. Specifically, commenters stated that requiring the use of only either whole mackerel or squid baits, depending upon whether the hook is offset or not, would not allow vessels to adapt to changing conditions on longer fishing trips. See Appendix C1 for summary of comments and responses.

Alternative A10 (a) is expected to have similar impacts on fishing behavior, safety at sea, opportunity costs, other marketable species, and fish processors and dealers in the Northeast, as alternative A7, discussed above. This alternative would likely have similar socio-economic

impacts as alternative A3 with regard to blue shark bycatch. See alternative A2 for an explanation of potential impacts related to catches of other sharks, dolphin, and wahoo.

Alternative A10 (b) may have substantial positive to substantial negative impacts for vessels that may fish in the NED. In response to public comment, noted above, this alternative modifies DSEIS alternative A10 to allow for more efficient opportunistic targeting of swordfish and tunas and the ability to adjust to changing market conditions on longer trips, while ensuring significant reductions in leatherback and loggerhead sea turtle interactions and mortalities.

Given the increased flexibility in terms of the hook and bait combinations that may be selected, the potential range of estimated economic impacts is very broad and, thus, likely exceeds the actual impacts that would result from this alternative. Depending on whether fishermen select the 18/0 offset circle hook with whole mackerel or the 18/0 non-offset circle hook with squid, respectively, when viewed against historical landings, there may be a change in swordfish catches of +30.24 to -32.58 percent (by weight). Results of the experiment also indicate that fishermen could experience changes in tuna catches of -87.64 to possibly as much as +29.22 percent (by weight) depending on whether they choose to equip and deploy the 18/0 offset circle hook with whole mackerel or the 18/0 non-offset hook with squid, respectively, when viewed against historical landings. Increases in tuna landings during the NED research experiment were substantial, but given limited data were determined not to be statistically significant. The experiment results indicate that when the tested hook and bait combinations have a positive impact on swordfish catches they tend to have a negative impact on tuna catches, and visa versa.

The portion of landings historically attributable to swordfish may vary by -32.58 to +30.24 percent, shifting swordfish landings from 88.54 percent (by weight) of landings to between 59.69 and 115 percent. Assuming that the projected changes in the weight of swordfish landed would result in a proportional change in revenues attributable to swordfish, vessel revenues may vary by between -28.72 percent (-$51,292) and +26.65 percent ($47,608), providing new estimated gross vessel revenues of between $127,327 and $226,227. The portion of vessel landings historically attributable to tuna by weight may shift by between -87.64 and +29.22 from 9.85 percent of landings to between 1.22 and 12.73 percent. Assuming that the projected changes in the weight of tuna landed would result in a proportional change in revenues attributable to tuna, vessel revenues may vary by -9.88 percent (-$17,642) to +3.29 percent ($5,882), resulting in a range of overall gross vessel revenues of between $160,977 and $184,501. For vessels engaging on mixed trips, alternative A10 (b) is expected to have an overall impact on vessel revenues of between -$68,934 and +$53,490, resulting in a range of overall gross vessel revenues of between $109,685 and $232,109.

The above estimates represent the outer bounds of the range of impacts. For example, the estimated loss of $68,934 is based upon fishermen choosing to equip and employ the 18/0 non-offset circle hook with squid bait to target swordfish while operating in the NED. This scenario is unlikely to occur as fishermen seek to maximize revenues and this hook and bait combination has been shown to be highly inefficient at catching swordfish. Nevertheless, it represents the maximum potential loss under the available options and, as such, has been included in the range.

Based on public comment, hook and bait efficiencies, and traditional target species, the majority of fishermen are expected to employ the 18/0 offset circle hook with whole mackerel while pursuing swordfish in the NED, and opportunistically switch to the 18/0 non-offset circle hook with squid while at sea for sets targeting bigeye tunas. As such, landings of target species are expected to increase over historical levels.

Alternative A10 (b) is expected to have similar impacts on fishing behavior, safety at sea, opportunity costs, other marketable species, and fish processors and dealers in the Northeast, as alternative A7, discussed above. This alternative would likely have similar socio-economic impacts as alternative A3 with regard to blue shark bycatch. See alternative A2 for an explanation of potential impacts related to catches of other sharks, dolphin, and wahoo.

Alternatives A13, A14, and A15 will all likely have some substantial negative social and economic impacts on commercial fishermen, their communities, buyers, and dealers. Alternative A13, the closure in the central portion of the Gulf of Mexico year-round, is the smallest area geographically of the three alternatives and would likely have the least social and economic impact, whereas alternative A14, the time/area closure of the central Gulf of Mexico and the NEC area year-round would likely result in the greatest social and economic impact. Alternative A15 encompasses the same geographic area as alternative A14, but is targeted at specific months (May through October) with the highest sea turtle interactions.

The year-round closure in the central Gulf of Mexico encompasses 25,489 nm^2 and the combined GOM and NEC closure encompasses over twice the area at approximately 56,471 nm^2. Since both of these areas (central GOM and NEC) have experienced high levels of fishing effort in the past, a substantial number of fishing vessels would have to adjust their fishing practices accordingly. For all fishing areas, this could mean that fishermen may travel greater distances to reach favorable fishing grounds, and spend longer periods at sea which could result in increased fuel, bait, ice, crew costs, and may also raise some safety concerns. The greater distances traveled might also cause a shift in ports selected for offloading. Fishermen may choose to offload in ports closer to their new fishing grounds and not at their homeports or traditional offloading ports. This could have a negative economic impact on buyers and dealers in traditional offloading ports, and potentially adverse social impacts on families and communities. However, a shift in offloading ports could create positive economic impacts in newly utilized offloading ports, and potential positive social and economic impacts for these communities.

In addition to the aforementioned potential impacts, analyses pertaining to alternative A13 indicate that with redistribution of effort, swordfish and bigeye tuna catches may increase by as much as 17 and 32 percent, respectively, in terms of numbers of fish. Analyses for alternative A14, indicate that with redistribution of effort, swordfish catches may increase by as much as 18 and 33 percent, respectively, in terms of numbers of fish. Analyses for alternative A15 indicate that with redistribution of effort swordfish, yellowfin tuna, and bigeye tuna catches would likely increase by 5, 3, and 17 percent, respectively, in terms of numbers of fish. As the size of fish caught within and outside these closures were not known at the time of this rule making, it is unclear if the changes in swordfish and tuna catches would result in positive or negative

economic impacts. As such, while the impacts are not quantifiable at this time, NOAA Fisheries anticipates that the overall impacts of closures of these sizes would likely be adverse in nature.

The redistribution of effort analysis indicates that the catch of targeted species such as swordfish and yellowfin tuna could potentially increase as a result of the time/area closures. This may be the result of catch per unit effort (CPUE) which is as high or higher outside the time/area closure as it is inside the time/area closure. This is not the case for bigeye tuna, however, for which the catch decreases in alternative A13 and A14 with redistribution of effort. Only alternative A15 showed an increase in the catch of all three targeted species with redistribution of effort (Appendix 1, Table 1). The economic impact of increased or decreased catches by number is not quantifiable at this time as potential change in the overall weight of landings remains unknown. A shift in fishing effort could result in greater conflicts between fishermen if the space for setting gear becomes constricted.

Alternative A16, a preferred alternative, would likely have only minor initial adverse social and economic impacts, as there are currently similar requirements in the pelagic longline fishery, with minor positive long-term impacts resulting from reduced hook replacement costs. The purchase of the release and disentanglement gear would likely be a relatively minor expense to most fishermen. A full suite of release gear is estimated to cost between $485.00 and $1056.50. Some of this cost could be reduced if fishermen were able to construct some pieces themselves, subject to NOAA Fisheries approval, instead of purchasing pre-assemble gear from commercial suppliers. NOAA Fisheries has received comment in the past that the use of dehooking devices and other disentanglement gear may not only reduce costs for fishermen by retrieving hooks, but may also increase the efficiency of fishing operations by reducing the time and effort spent re-rigging gear and removing hooks and line from target and non-target species. However, if the use of these additional gears requires more time during haulback, corresponding increases in fishing costs could be expected.

With regard to administrative and enforcement impacts, the no action alternative (A1) is not expected to have any impacts, as it does not change current fishing practices. The gear modification alternatives (A2 - A5 (b), A7 - A10 (b)) and release gear/handling alternative (A16) raise administrative and enforcement considerations, because they would establish new limitations, throughout the fishery, on the type of hooks and baits that vessels could use, thus changing current fishing practices. Additional costs could include outreach, development of brochures or other materials, and/or training or workshops to educate fishermen and enforcement personnel on the new requirements. In the gear alternatives, NOAA Fisheries has tried to mitigate such impacts to the extent practicable by providing that vessels, at all times, are limited to having only specific hooks and baits on board and/or in use. In addition, as discussed in Section 1.1, NOAA Fisheries is exploring operational and implementation considerations of educational workshops and a certification process. Alternatives A13 - A15 would require enforcement to monitor new time and area closures. However, the existing requirement for all pelagic longline vessels to have and use vessel monitoring systems on board would help to facilitate monitoring of the closures.

Conclusion

As discussed in greater detail in Sections 1.2 and 1.3, the objectives of this rule making are multifaceted and include, *inter alia*,: 1) addressing sea turtle interactions and mortalities to avoid jeopardy for Atlantic leatherback and loggerhead sea turtles; 2) reconsidering the NED and other time and area closures in light of possible gear modifications; and 3) minimizing, to the extent practicable, the economic impacts of sea turtle bycatch mitigation measures. Preferred alternatives A5(b), A10(b), and A16 strike an appropriate balance between protecting and conserving living marine resources and maintaining a viable domestic pelagic longline fleet, in compliance with legal mandates. To achieve this balance, NOAA Fisheries examined and re-examined the best available scientific and socio-economic data and public comment on the DSEIS and proposed rule. Where appropriate, the Agency incorporated refinements to data and modified the preferred measures in the FSEIS based on these examinations and comments.

Alternatives A5 (b), A10 (b), and A16 are the preferred alternatives because in combination they are expected to provide significant conservation benefits to sea turtles in the Atlantic pelagic longline fishery, while allowing the fishery to continue operating, consistent with the 2004 BiOp, the ESA, the MSA, and other applicable law. The preferred hook and bait alternatives (A5 (b) and A10 (b)) are expected to result in interactions with 588 leatherback sea turtles and 635 loggerhead sea turtles. The numbers of interactions were calculated in a precautionary manner by applying the lowest estimated sea turtle interaction reduction rates for the allowable hook and bait types. As such, actual sea turtle interaction rates could be lower than the estimates provided above. These alternatives may also have important bycatch mitigation benefits for other species known to interact with pelagic longline gear, such as sea birds, marine mammals, sharks, marlin, and other finfish. In addition, alternatives A5 (b) and A10 (b) mitigate potential adverse economic impacts by providing flexibility in the selection of hooks and baits. Alternative A16 is a preferred alternative because it is expected to further reduce post-hooking mortality of incidentally captured sea turtles and other species.

The suite of preferred alternatives best meets the purpose and scope of this rulemaking by providing comprehensive and meaningful protection to Atlantic sea turtles, maintaining the viability of the domestic pelagic longline fishery, and achieving legal and policy obligations. Importantly, by providing a successful roadmap for sea turtle bycatch and bycatch mortality reduction, NOAA Fisheries may provide the impetus for other nations to adopt similar sea turtle conservation measures, thereby bringing truly meaningful protection to sea turtles throughout their entire range.

4.2 IMPACTS ON ESSENTIAL FISH HABITAT

The Magnuson-Stevens Act requires that NOAA Fisheries evaluate the potential adverse effects of fishing activities on EFH and must include management measures that minimize adverse effects to the extent practicable. At this time, there is no evidence that physical effects caused by pelagic longline fishing under this FMP are adversely affecting EFH to the extent that

detrimental effects can be identified on habitat or fisheries. The preferred alternatives will have no direct impact on EFH. Further discussion of EFH is provided in Chapter 10.

4.3 IMPACTS ON PROTECTED SPECIES

The preferred alternatives are expected to reduce sea turtle interaction and mortality levels. Background information on threatened and endangered sea turtles and ESA consultation history for this fishery are provided in Chapters 1 and 3. On June 1, 2004, a new BiOp was completed for the Atlantic PLL fishery. The 2004 BiOp is summarized below. A copy of the BiOp is available on request or on the internet at http://sero.nmfs.noaa.gov/pr/rulings/hmsbo060104.pdf

4.3.1 Findings of the June 1, 2004, Biological Opinion

NOAA Fisheries has analyzed the best available scientific and commercial data, the current status of the species, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of any sea turtle species. In doing so, the analysis focused on the impacts and population response of sea turtles in the Atlantic Ocean. However, as discussed in the June 1, 2004, BiOp (NOAA Fisheries, 2004), the impact of the effects of the proposed action on the Atlantic populations is directly linked to the global populations of the species, and the final jeopardy analysis is for the global populations as listed in the ESA.

Based upon the analyses described above, the June 2004 BiOp concluded that long-term continued operation of the Atlantic pelagic longline fishery, authorized under the Atlantic Highly Migratory Species FMP:

- **is not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp's ridley, or olive ridley sea turtles**; and

- **is likely to jeopardize the continued existence of leatherback sea turtles**.

Critical habitat has not been designated for these species in the action area; therefore, the destruction or adverse modification of critical habitat will not occur.

4.3.2 Reasonable and Prudent Alternative (RPA) Contained in the June 1, 2004, Biological Opinion

The 2004 BiOp indicates that the continued operation of the Atlantic HMS pelagic longline fishery, as proposed, is likely to jeopardize the continued existence of leatherback sea turtles. The clause "jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR §402.02).

Regulations implementing Section 7 of the ESA (50 CFR §402.02) define RPAs as alternative actions, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and, (4) would, NOAA Fisheries believes, avoid the likelihood of jeopardizing the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

The BiOp recognized that threatened and endangered sea turtles face a risk of global extinction because of a wide array of human activities and natural phenomena. The BiOp recognized, for example, that the number of turtles killed by foreign longline fleets poses a much larger and more serious threat to the survival and recovery of sea turtles than U.S. HMS fisheries in the Atlantic Ocean. Further, the BiOp recognized that sea turtles will not recover without addressing the full range of human activities and natural phenomena that could cause these animals to become extinct in the foreseeable future. The existence of these other threats, however, does not affect NOAA Fisheries' responsibility to ensure that the action is not likely to jeopardize the continued existence of leatherback turtles. An RPA that ensures that the HMS pelagic longline fishery is not likely to jeopardize the continued existence of listed species may not necessarily ensure that the species will recover in the wild and may not prevent other human activities from causing their ultimate extinction.

4.3.2.1 Specific Elements of the Reasonable and Prudent Alternative

The BiOp stated that NOAA Fisheries must undertake management and conservation measures to address and reduce the adverse effects to leatherback populations expected to result from this action. Specifically, the BiOp requires: (1) reduce post-release mortality of leatherback sea turtles; (2) improve monitoring of the effects of the fishery and take management action to avoid long-term elevations in leatherback takes; (3) confirm the effectiveness of the hook and bait combinations that are required as part of the action; and, (4) take management action to avoid long-term elevations in leatherback takes and mortality. These measures are necessary to avoid the likelihood of jeopardy and to authorize the continued prosecution of the HMS pelagic longline fishery. The RPA is designed to reduce the effects of the HMS pelagic longline fishery to such a degree that the effects are not likely to appreciably reduce these sea turtles' likelihood of surviving and recovering in the wild (NOAA Fisheries, 2004). What follows is a summary of the RPA.

Maximize Gear Removal to Maximize Post-release Survival

Sea turtle post-release survival is not only dependent on the type of interaction (i.e., where hooked, entangled or not), but also on the amount of gear left following the release. Removal of some or all of the gear – except deeply-ingested hooks – is likely to improve the probability of a sea turtle surviving an interaction event. The January 2004 draft post-release mortality criteria account for the probable improvement in survivorship resulting from removal of gear, where

appropriate, for each injury. Maximizing gear removal therefore is critical for lowering mortality ratios.

Based on results from the NED research experiment, substantial reductions in mortality can be achieved by maximizing the amount of gear removed from hooked sea turtles. The post-release mortality ratio for leatherback sea turtles using the NED gear removal proportions and circle hook data was only 13.1%. The NED research experiments had 100% observer coverage and captains and crew that were well trained, well equipped, and experienced in gear removal from sea turtles. That post-release mortality ratio, therefore, represents the level of mortality NOAA Fisheries expects if the fishery is required to use circle hooks and to have all required gear-removal equipment on board, and has the training, experience, and willingness to use the equipment.

It is critical that the same level of gear removal achieved in the NED research experiment be attained throughout the fishery. Improving the post-release mortality ratio in the entire HMS pelagic longline fishery to levels associated with circle hook use in the NED research experiment would decrease total leatherback sea turtle mortality caused by the fishery by 58%. The NED experience shows that extensive training, experience, and high motivation is needed to achieve these high rates of success. Therefore, NOAA Fisheries will provide outreach and training to maximize gear removal, and will monitor the effectiveness of these efforts.

As part of the outreach and training strategy discussed in the document, the June 2004 BiOp requires development and distribution of training materials on the safe handling of sea turtles and gear removal techniques to all HMS pelagic longline permitted vessels. In addition, it requires that a fishery outreach point of contact (POC) be established. The POC will have a critical role in ensuring that fishermen learn the requirements, the techniques, and the reasons for maximum gear removal. In addition to simply answering fishermen's questions, the POC will actively reach out to fishermen to learn about their experiences, troubleshoot problems, and share solutions and successful experiences with other fishermen and NOAA Fisheries' scientists and managers. (In response to this requirement, NOAA Fisheries has already designated the following POC,

Charles Bergman
3209 Frederic Street
P.O. Drawer 1207
Pascagoula, MS 39568-1207

E-mail: charles.bergman@noaa.gov
Telephone: 228-762-4591 (ext. 259)
Cellular phone: 228-623-0748)

The BiOp requires voluntary training workshops to explain the final sea turtle conservation requirements to fishermen. In addition, pelagic longline observers must provide additional outreach and training to captains and crews on sea turtle safe handling and gear removal

techniques, as well as provide constructive feedback to captains and crew. Before disembarking, the observers will inspect the onboard sea turtle release and disentanglement gear and determine whether it meets the requirements. This information is to be recorded for management purposes to assess the implementation of this RPA; this information is not intended to be used for enforcement purposes.

The BiOp requires implementation of a training and certification program to ensure that the captain on board each permitted HMS vessel authorized to fish with pelagic longline gear has successfully completed training on sea turtle safe handling and gear removal by December 31, 2005. Training must include demonstrations of sea turtle release equipment and protocols and pelagic longline equipment modifications required under HMS regulations. The training content must be developed in consultation with the SEFSC. The certification process must reasonably ensure that the certified individual has actually completed and understood the training material. The certification process must also include documentation requirements so that law enforcement officers can readily verify a vessel's compliance with the requirement for a certified captain and one crew member. After 2005, training and certification opportunities must be available so new captains can receive training.

The outreach, training, and certification requirements, described above, are expected to bring the whole fleet up to the high level of gear removal performance that was seen in the NED research experiment. The fleet will receive initial outreach in 2004, mandatory training and certification in 2005, and will gain experience after that training throughout 2006. By the beginning of 2007, then, it is anticipated that the fleet will have reached the maximum performance level seen in the NED research experiment.

The BiOp requires monitoring of the overall expected mortality of sea turtles caught in the pelagic longline fishery, based on their release condition and the January 2004 draft post-release mortality criteria. Net mortality ratio targets are intended ensure that the fleet's progress in improved sea turtle handling and gear removal reach the net mortality ratios of 13.1% for leatherback sea turtles and 17.0% for loggerhead sea turtles by the beginning of 2007 (the long-term targets). These long-term mortality targets are based on consistent, annual progress in 2004, 2005, and 2006. The targets are presented in Table 4.3.

Table 4.3 Net Mortality Rate Performance Standards. Source: NOAA Fisheries, 2004

	Assumed 3rd & 4th Quarters, 2004	Target for 1st Quarter, 2005	Target for 1st Quarter, 2006	Target for 1st Quarter, 2007 and onward
Leatherbacks	32.8%	26.2%	19.6%	13.1%
Loggerheads	21.8%	20.2%	18.6%	17.0%

Improve the Accuracy and Timeliness of Reporting and Analysis, and Take Corrective Action to Prevent Long-Term Elevated Mortality

The sea turtle take estimates used in the jeopardy analysis are produced from observed bycatch rates and logbook effort data. Bycatch rates (currently catch per hook) are quantified based on observer data by geographic area and quarter. The estimated bycatch rate is then multiplied by the total fishing effort (currently number of hooks) reported in the mandatory logbook to obtain estimates of the total interactions for sea turtles. Both the accuracy of the data and the timeliness of its reporting are critical to monitoring the effects of the fishery and assessing whether the RPA avoids jeopardy for leatherback sea turtles. Observer coverage must be sufficient to produce a statistically reliable sample of the HMS pelagic longline fishery that accurately represents the entire fishery. These data must also be available in a timely fashion to monitor the fishery and take corrective action to avoid long-term elevation of turtle takes beyond those authorized in this opinion. Levels of observer coverage and timeliness of reporting have been insufficient in the past. Improvement in the level of observer coverage and within-year and annual reporting are needed.

The jeopardy analysis concluded that the incidental mortality of 198 leatherback turtles annually, based on the estimated annual capture of 588 animals, was expected to reduce the likelihood of leatherback turtles' survival and recovery in the wild. The first element of the RPA will, over the next two-and-a-half years, reduce the net post-release mortality for leatherback turtles by 60%, and NOAA Fisheries has specified requirements to monitor this reduction. No measures are specified, however, in the RPA that further reduce the estimated annual bycatch levels of leatherbacks beyond the level predicted for the action. Because the basis of the jeopardy determination – total estimated mortality – is the product of the post-release mortality ratio and the estimated take levels, NOAA Fisheries must also ensure that take levels do not become elevated.

The jeopardy analysis stressed that one-time or short-term mortality on leatherback sea turtles, on the scale of the action's annual impacts, is not likely to produce any noticeable effect on the population. Similarly, minor, short-term exceedance of estimated take and mortality levels is not expected to have noticeably worse population effects, as long as take and mortality do not also increase on average over the long term. High degrees of variability in natural and anthropogenic mortality, nesting levels, recruitment success, and the inherent ability of long-lived animals to withstand short-term impacts require focus on long-term, rather than short-term effects, because of both the biological significance of long-term effects the likely inability to detect a population response from short-term impacts.

NOAA Fisheries has issued incidental take statements for the fishery on an annual basis in the past. Annual take estimates have high variability, however, because of natural and anthropogenic variation. For example, leatherback sea turtle takes over the history of the observer program have ranged from as low as 308 in 1997 to the all time high of 1,208 in 2001. This high variability and the absence of within-year take monitoring of estimates have precluded early detection of possible take exceedances.

To ensure that the long-term operation of the fishery does not jeopardize the continued existence of leatherback sea turtles, the BiOp requires improved monitoring of takes in the fishery and the ability to take timely corrective action. However, corrective action within any one single year will likely never be practicable, and minor or short-term exceedance of annual predicted take levels is not believed to be sufficient to jeopardize leatherback sea turtles. Therefore, the RPA and the associated ITS establishes a three-year authorized take level for sea turtles. The BiOp requires the provision of timely take information during the course of each three-year period to allow ample time to detect significant problems in remaining within the authorized take levels and to take corrective action (e.g., closure of sea turtle interaction hot spots, additional gear restrictions). The BiOp states that a three-year period is the shortest practicable time period to detect and avoid potential long-term take exceedance. Three years is expected to be sufficiently protective of leatherback sea turtles: within a reporting period, highly elevated takes could only theoretically continue for two consecutive years before corrective action would be taken in the third year to maintain the total take at the authorized annual average level. Maintaining long-term takes at the average 3-year level considered in the BiOp, even though higher take levels may occur in certain years, will ensure that the effects of elevated takes do not reduce appreciably the likelihood of leatherback sea turtles' survival and recovery in the wild.

Improve Observer Coverage

The BiOp requires at least 8% observer coverage in the HMS pelagic longline fishery, based on total annual reported sets. The BiOp requires adjustment of the observer program's internal target number of observed sets to achieve the 8% minimum coverage level, taking into account the program's average success rate of observing only 81% percent of the planned sets, and improved communication between vessel operators and the observer program in an effort to increase the success rate in placing observers on longline trips. The BiOp further requires increased efforts to achieve observer coverage in areas and quarters where sampling has historically been low. By December 31, 2006, there should be no quarter-area stratum with an assumed sea turtle take of zero because of lack of current or historic observer coverage and current year reported effort over 30 sets.

Improve Observer Data Collection

To be able to use observer data to analyze the potential effects of the newly required hooks and baits, the BiOp requires more detailed hook and bait information be collected by the observer program. The BiOp stipulated that the Agency train and require observers to record not only hook size and brand, but also amount of hook offset and whether different sizes, brands, and/or offset hooks are used on a given set. In the case of sets with multiple hook or bait styles, observers must record the proportion of each hook and bait style used, and if any sea turtles are captured, the exact hook and bait involved. It is also recommended that exact hook and bait details be recorded for catches of the primary target species.

Improve Within-Year Monitoring

The BiOp requires improved within-year monitoring to detect high take levels as soon as possible by improving the existing quarterly reports:

a) Sea turtle take estimates must be prepared using observer data and preliminary effort data for that quarter. If preliminary effort data are not available, quarterly take estimates must be prepared based on effort data from previous years.
b) Quarterly reports must be submitted to SERO, HMS Management Division, the Northeast Regional Office Protected Resources Division, and the Office of Protected Resources no later than 45 days into the subsequent quarter. In addition to the information previously provided in the quarterly reports, they must include the quarterly take estimates specified here, the number of unique vessels observed, the cumulative number of unique vessels observed since the effective date of the sea turtle conservation regulations, and the percent of observed vessels that had the required turtle handling and gear removal results.
c) Observed takes by statistical area and quarter over the history of the observer program must be reviewed for any notable trends or patterns that can be used to further interpret the significance of the number of observed takes reported during each quarter. A summary of that review should be completed by March 31, 2005. Any take prediction hypotheses stemming from that review must be tested retrospectively using the 2004 quarterly and annual take estimates. Results should be included in the 2004 annual take report.

Improve Timeliness of Reporting Yearly Take Estimates

The BiOp requires improved timeliness of reporting yearly sea turtle take estimates by:

a) Compiling logbook effort data in computer databases and conducting quality control as logbooks are submitted throughout the year, so that effort data are available for analysis as soon as possible after the end of the year;
b) Completing annual take estimates based on observer and effort data by March 15 of each year;
c) Subsequently revising the annual estimates by May 31, if quality control of the effort data for ICCAT purposes results in changes in the effort data; and
d) Immediately providing these take estimates to SERO, HMS Management Division, the Northeast Regional Office Protected Resources Division, and the Office of Protected Resources.

Confirm Effectiveness of Hook and Bait Combinations

Additional research on the effect of offsetting hooks is needed to determine how significant a factor hook offsets are in turtle catch rates.

The biop requires that the long-term implementation of the action reduce leatherback sea turtle interactions by at least 50% as compared to current U.S. longline industry-standard practices. In addition, while the opinion focuses on the effects of the U.S. Atlantic longline fleet, the sea turtle population impacts from the longline fleets of other nations, both in the Atlantic and globally, are much more severe than the effects of the U.S. fleet. Convincing other nations to adopt comparable gear and/or bait modifications to reduce their impacts is essential for the conservation of leatherback and loggerhead sea turtles globally. As long as uncertainty remains

about the economic effects of the use of the 16/0 or the 18/0 circle hook, there is little hope that the international longline fleets will adopt alternate fishing gear and therefore little hope of achieving significant threat reduction for sea turtles from international longline gear. The BiOp requires a research project, with an expected completion date of December 31, 2006, to address the following:

Evaluation of Leatherback Sea Turtle Bycatch
The BiOp requires experiments and/or monitoring of the longline fishery to confirm whether the assumed bycatch reduction rate of leatherback sea turtles with the use of the 16/0 circle hook is equivalent to the 18/0 circle hook by:

a) comparison of the effects of the 16/0 and 18/0 hooks in controlled fishing experiments, or
b) comparison of the effects of the 16/0 hook to the former status quo hooks in controlled fishing experiments, or
c) comparison of fishery dependent data.

Evaluation of Effect of Offset Circle Hooks
The BiOp requires experiments and/or monitoring of the longline fishery to determine more precisely the effect of offsets up to 10˚ on rates of sea turtle bycatch, hooking location, and post-release mortality by:

a) comparison of the effects of the 16/0, non-offset and 16/0, 10˚ offset circle hooks in controlled fishing experiments, or
b) comparison of the effects of the 18/0, non-offset and 18/0, 10˚ offset circle hooks in controlled fishing experiments.

Evaluation of Economic Impacts
The BiOp requires experiments and/or monitoring of the longline fishery to verify the target species catch effects of the 18/0 circle hook in tuna-directed fishing by either:

a) comparison of the effects of the 16/0 and 18/0 hooks in controlled fishing experiments, or
b) comparison of the effects of the 16/0 hook to the former status quo hooks in controlled fishing experiments.

Principles for Conducting Evaluations
The BiOp requires the continuation of the successful practice of working cooperatively with government and academic researchers, the U.S. pelagic longline industry, and foreign partners to accomplish the required research effectively, efficiently, and with broad buy-in. Separate evaluations may be combined in individual projects for efficiency. In particular, sea turtle and target species evaluations may be particularly amenable to combined study.

In selecting among the various alternatives and designing actual experiments, some catch rate effects will be difficult to detect because of the low rates of catch and bycatch in the pelagic longline fishery, and the high variability in those rates. Experiments looking at negative effects

(i.e., intended to support a conclusion that two rates are *not* different), in particular, should be statistically designed with an understanding of the power of the test and an understanding that decisions involving conservation of endangered and threatened species are to be risk-averse. That is, statistical analysis of sea turtle catch effects shall err on the side of assuming an adverse effect does exist or a beneficial effect does not exist, rather than the converse.

Research funded or implemented by NOAA Fisheries may be subject to permit requirements under the ESA or the MSA. NOAA Fisheries conducts Section 7 analyses on the issuance of any such permits. Some of the research may not require additional authorizations, however, if it would involve fishing with allowed gear (under the requirements of the action) and interventions with any bycaught sea turtles would be consistent with the action and the currently authorized operation of the pelagic observer program, or any other properly authorized research program.

Application of Evaluation Results

The BiOp requires analysis of the results of the previous years' scientific experiment (or require reporting from government-funded researchers) for the effects of all the tested parameters on sea turtle and target species catch rates, within 3 months of the completion of each fishing season (*i.e.*, before April 2005, April 2006, and April 2007). The BiOp requires that the research results must be communicated and coordinated with research partners and other interested parties in a timely manner, so that continuing research might be adapted or modified appropriately.

The BiOp requires evaluation of the interim and final research results against the requirements of the action. The BiOp further requires consideration of the possible application of the results through rulemaking to modify the action, if necessary to reduce sea turtle interactions or improve fishery economic performance.

Take Corrective Action to Prevent Long-Term Elevated Take and Mortality

Implement Adaptive Management Strategy to Prevent Exceedance of Three-Year ITS

The ITS accompanying the opinion specifies authorized incidental take levels for sea turtles, over three-year periods, beginning with 2004. The final annual reports of take estimates will be the basis for assessing actual vs. authorized takes. During the course of each three-year period, the BiOp requires review of each quarterly and annual report as soon as it becomes available. If these reports indicate that the fishery is not likely to stay within the authorized three-year take levels, the BiOp requires protective/corrective action to be taken to avoid long-term elevations in sea turtle takes and ensure that take levels in the ITS are not exceeded. Such actions may include time-area closures, additional gear modifications or restrictions, or any other action deemed appropriate. In addition to the above possible actions, NOAA Fisheries should consider establishing a rule that would allow implementation of corrective measures through framework action. Such a rule would provide industry with greater certainty on the types of management responses that may occur and would allow for more timely action, reducing the need for later, more drastic action.

Reduce Near-Term (2004-2006) Mortality of Leatherbacks by Reducing Fishery Interactions, If Necessary

The conservation measures in the first and third elements of the RPA will be carried out over the next two-and-a-half years. The post-release mortality reduction is not expected to be fully effective until 2007. Likewise, completion of testing that can confirm the effectiveness of the required hook and bait combinations is not required or likely to be completed before 2007. When those elements are successfully implemented, after 2006, long-term average annual capture and mortality of leatherback sea turtles are expected to be 588 interactions and 84 mortalities, and the three-year authorized incidental take for leatherback turtles would be 1,764 interactions, with a corresponding 252 mortalities. In the meantime, however, mortality will likely be higher as gear removal and post-release survival incrementally improve. Estimated three-year capture and mortality of leatherback sea turtles for 2004 - 2006 would be 1,981 interactions and 548 mortalities. The 548 mortalities in 2004 - 2006 would be more than double the level expected in 2007 - 2009 and beyond, and represent only a 17% reduction in mortalities, compared to the action without the first element of the RPA. Also, the risk to leatherback sea turtles from the action during this initial three-year period will be higher, as the effectiveness of the required hook and bait combinations will not have been confirmed. Therefore, it is particularly important that mortality rates associated with the fishery not be allowed to exceed the targets laid out in the first element of the RPA.

The RPA requirements will ensure that total leatherback sea turtle *takes* do not exceed long-term average take rates, over three year periods. NOAA Fisheries may need to take additional management action to reduce leatherback *mortality* in the near-term (2004 - 2006), while the other elements of this RPA are being implemented and reaching full effectiveness. Because the impacts to leatherback sea turtles during the near-term are already expected to be greater than the future impacts, the BiOp requires careful monitoring of post-hooking survival, particularly during the next two-and-a-half years. If fleet-wide gear removal rates are not sufficient to meet the performance targets, the BiOp requires immediate action to offset the increased mortality rates and bring overall anticipated mortality back down to the level specified in the first element of the RPA.

Closure of the Gulf of Mexico to Pelagic Longline Fishing

The Gulf of Mexico fishing area in the second and third quarters (April-September) accounted for fully half of the estimated leatherback sea turtle bycatch in the longline fishery, based on 2002 observer data. The BiOp states that a large-scale closure of the Gulf of Mexico during that time will significantly reduce fishing effort – and thus sea turtle interactions – and likely not simply result in effort displacement. The effect of such a closure would be a 41% reduction in leatherback sea turtle interactions, annually, if there is no effort redistribution. Some redistribution of longline effort would likely occur, but the BiOp states that redistribution will likely be minimized under the large-area closure scenario. Many Gulf of Mexico-based vessels may convert to other fisheries or stay idle for a six-month closure.

If fleet-wide gear removal rates are not sufficient to meet the performance targets in Table 4.3, the BiOp requires immediate implementation of a closure for the entire Gulf of Mexico. The

timing and duration of the closure must be sufficient to offset, through reduced interactions, the effects of the higher post-release mortality associated with the poor gear removal levels, and may be longer or shorter than the six-month closure discussed above.

The BiOp allows substitution of an alternative closure or closures to the required Gulf of Mexico closure, if analyses show that the alternative closure(s) would be equally effective at reducing leatherback sea turtle bycatch, after accounting for redistribution of fishing effort. NOAA Fisheries may consider whether alternative closure formulations would be more desirable because of reduced socioeconomic impacts, increased bycatch reduction of other species (e.g. loggerhead turtles, billfish, bluefin tuna, undersize target species), or other relevant factors.

Removal of Closure Requirement

The time-area closure(s) may be removed when data collected on gear removal and post-release survival show that fleet-wide interaction types and gear removal rates have met the post-release mortality targets. With successful implementation of the other elements of the RPA, those criteria should be met by early 2007. If they are not met, the closure(s) must remain in effect until they are.

Corrective Action to Achieve Post-Release Survival Targets

If the 2005 and 2006 targets (Table 4.3) are not achieved, in addition to the closure discussed above, the BiOp requires NOAA Fisheries to determine whether there are identifiable problems in training, compliance in the fishery, effectiveness of the circle hooks, or effectiveness of the gear removal tools and techniques. NOAA Fisheries must then take corrective action, as appropriate, to ensure that the long-term targets are successfully achieved.

4.3.3 Effect of the Reasonable and Prudent Alternative

As noted earlier, the RPA is designed to reduce the effects of the HMS pelagic longline fishery to a level where they are not likely to appreciably reduce the leatherback sea turtle's likelihood of surviving and recovering in the wild. The measures in the RPA will also necessarily affect the impacts of the action on loggerhead and other hardshell sea turtles, which were not found likely to be jeopardized by the action. This section briefly summarizes the effects of the action, as modified by the RPA, on all affected species of sea turtles.

The first element of the RPA provides measures to minimize post-release mortality over a two-and-a-half year period. The second element of the RPA requires improvements in the monitoring of the fishery's effects. The third element of the RPA requires further research on the required hook and bait types. The fourth element of the RPA requires that the long-term average take rates are not exceeded. The fourth element also requires careful monitoring of the progress the fishery makes towards maximum gear removal and conditionally requires the closure of the Gulf of Mexico area (or an equivalent alternative) for a period necessary to offset the mortality effects if the fishery does not meet the post-release mortality reduction targets. Table 4.4 summarizes the anticipated take levels and associated mortality based on

implementation of the RPA and contrasts it with the mortality associated with the action without the RPA (shown in parentheses). Because the Gulf of Mexico closure is conditional, Table 4.4 does not reflect the effect of a closure in the take levels.

Table 4.4 **Anticipated Triennial Incidental Takes and Mortality of Listed Species in the Pelagic Longline Fishery with Implementation of the RPA**. Note: Total estimated mortality without the RPA is shown in parentheses. Source: NOAA Fisheries, 2004

Species	Time Period	Total Captures	Post-Release Mortality	Total Estimated Mortality
Leatherback	2004-2006	1981	32.8% in 2004, declining to 26.2% in 2005, declining to 19.6% in 2006	548 (662)
	2007-2009, 2010-2012...	1764	13.1%	252 (594)
Loggerhead	2004-2006	1869	40.3% in 1st & 2nd Qtrs 2004, declining to 20.2% in 2005, declining to 18.6% in 2006	438 (468)
	2007-2009, 2010-2012...	1905	17.0%	339 (429)
Other hardshell sea turtles	2004-2006	105	40.3% in 1st & 2nd Qtrs 2004, declining to 20.2% in 2005, declining to 18.6% in 2006	25 (25)
	2007-2009, 2010-2012...	105	17.0%	18 (21)

Leatherback sea turtles receive the greatest benefits from the RPA in reduced total mortality, both over time and compared to the proposed action. Over the long-term, the RPA reduces total estimated mortality by 58% for leatherback sea turtles. Long-term mortality is reduced by 21% for loggerhead sea turtles and by 15% for the other hardshell species. Because NOAA Fisheries determined that the mortality of slightly higher numbers of loggerhead, green, Kemp's ridley, hawksbill, and Olive ridley sea turtles is not likely to jeopardize the continued existence of those species, the same conclusion for the action under the RPA was reached.

The jeopardy analysis for leatherback sea turtles focused on the action's effects on females. The BiOp indicates that the effects on males would be the same as on females, with an assumed 50:50 sex ratio and no reason to believe that there is a sex-selectivity in pelagic longline captures of leatherback sea turtles. Female sea turtles were critical to the analysis, however, as their numbers are most measurable as nesters and their survival more directly affects the species' reproduction. The BiOp highlighted a number of concerns resulting from aspects of the species'

biology, the impacted segments of the population, and the scientific uncertainty about the species' status, the species' life history, and the effectiveness of the hook and bait combinations in the proposed action.

With implementation of the first element of the RPA, continued prosecution of the longline fishery is expected to result in mortality of only 21 adult and 21 subadult females annually. This reduced level of mortality represents only 0.5% of the total leatherback sea turtle mortality from pelagic longline fleets in the Atlantic and the Mediterranean and less than 0.1% of the estimated adult female leatherback sea turtle population in the Atlantic. In addition, the second element of the RPA will ensure that the fishery's effects will not exceed the predicted take levels for three-year periods. The third element of the RPA further reduces the risk to leatherback sea turtle populations associated with the action by more definitively confirming the effects of hook and bait combinations and the implications of the sea turtle conservation rulemaking. The third element is also expected to have important conservation implications for sea turtles, beyond just the RPA, by improving the scientific and management arguments available to convince other nations – whose sea turtle impacts are much larger than the U.S. Atlantic HMS pelagic longline fleet's – to adopt hook and bait requirements for sea turtle conservation. The fourth element also provides an important check on the effectiveness of the first element by requiring that closures be implemented if the post-release survival gains are not achieved in a timely manner. The jeopardy analysis stated that one-year or short-term mortality – at the level of the action – would not have a noticeable population effect, but the Agency is aware that it would be part of a continuing action. Therefore, during the near-term period when mortality will be higher than the long-term target for the RPA, but below the level of the action without the RPA, the fourth element assures that mortality will be tightly controlled and not allowed to exceed the near-term targets. With the near-term risks controlled and long-term annual leatherback sea turtle mortality reduced to exceedingly low levels, compared to the overall mortality (half-a-percent of longline mortality in the basin) and the population's size (less than a tenth of a percent), the BiOp indicates that the anticipated effects of these losses will be below the threshold where they would produce a detectable change in Atlantic leatherback sea turtle populations. Taken together, the elements of the RPA are expected to reduce the threat posed by the U.S. Atlantic HMS pelagic longline fishery to leatherback sea turtles to a level where it is unlikely that the action would appreciably reduce the likelihood of the species' survival and recovery. Therefore, the BiOp concludes that – if all of the elements of this RPA are fully implemented – the long-term continued operation of the U.S. Atlantic pelagic longline fishery is not likely to jeopardize the continued existence of leatherback sea turtles.

4.3.4 Incidental Take Statement

Section 9 of the ESA and protective regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is

not considered to be prohibited taking under the ESA provided that such taking is in compliance with the reasonable and prudent measures and terms and conditions of the ITS.

Section 7(b)(4)c) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of endangered whales is provided and no take is authorized. Nevertheless, the HMS Division must immediately (within 24 hours, if communication is possible) notify the NOAA Fisheries' Office of Protected Resources should a take of an endangered whale occur.

4.3.4.1 Amount or Extent of Take

The BiOp indicates that the levels of incidental take shown in Table 4.5 may be expected to occur as a result of the action and the implementation of the RPA. These numbers represent the total takes over three-year periods, beginning with 2004. Total annual takes in the fishery are estimated by the SEFSC based on their pelagic observer program, the NED research experiment results, and reported fishing effort. The reasonable and prudent measures specified in this ITS, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The BiOp requires immediate reinitiation of formal consultation, an explanation of the causes of the take exceedance, and review of the need for possible modification of the reasonable and prudent measures (50 CFR 402.16). The RPA contains specific requirements to prevent the incidental take levels from being exceeded, so take exceedance should only occur under exceptional circumstances.

Table 4.5 **Anticipated Incidental Takes of Listed Species in the Pelagic Longline Fishery.** Source: NOAA Fisheries, 2004

Species	Number Captured from 2004-2006	Number Captured each Subsequent 3-Year Period
Leatherback turtle	1981	1764
Loggerhead turtle	1869	1905
Green, Hawksbill, Kemp's ridley, and Olive Ridley turtle, in combination	105	105

4.3.4.2 Effect of the Take

The BiOp determined that the level of anticipated take specified in Table 4.5 is not likely to result in jeopardy to the green, hawksbill, Kemp's ridley, olive ridley, or loggerhead sea turtle. This level of take is also not likely to result in jeopardy to leatherback sea turtles when the RPA specified in Section 8 of the BiOp is enacted, and the following reasonable and prudent measures are fully implemented. The RPA reduces the level of mortality affecting captured sea turtles, improves monitoring and reporting, requires management action to avoid long-term elevations in sea turtle takes, and confirms the effectiveness of hook and bait combinations.

4.3.5 Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires that, when an agency action is found to comply with Section 7(a)(2) of the ESA and the action may incidentally take individuals of listed species, NOAA Fisheries will issue a statement specifying the impact of any incidental taking. It also states that reasonable and prudent measures necessary to minimize impacts, and terms and conditions to implement those measures be provided and must be followed to minimize those impacts. Only incidental taking by the Federal agency or applicant that complies with the specified terms and conditions is authorized.

The reasonable and prudent measures and terms and conditions are specified as required by 50 CFR § 402.14 (i)(1)(ii) and (iv) to document the incidental take by the HMS pelagic longline fishery and to minimize the impact of that take on sea turtles. These measures and terms and conditions are non-discretionary, and must be implemented in order for the protection of Section 7(o)(2) to apply. There is a continuing duty to regulate the activity covered by this incidental take statement. If there is a failure to adhere to the terms and conditions of the incidental take statement through enforceable terms, and/or a failure to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of the incidental take, the BiOp requires reporting on the progress of the action and its impact on the species as specified in the incidental take statement [50 CFR 402.14(i)(3)].

NOAA Fisheries notes that the HMS pelagic longline fishery has been the subject of several previous biological opinions which have specified their own reasonable and prudent measures to monitor and minimize the impacts of incidental take. Most of those reasonable and prudent measures have been permanently implemented through regulations or as standard operating procedures. In addition, the purpose of the HMS Management Division's February 11, 2004, proposed rule is to reduce the bycatch rates and bycatch mortality of sea turtles in the pelagic longline fishery. Thus, the action already includes many measures to monitor and minimize the impact of the longline fishery's incidental take of sea turtles. Further, the RPA in this opinion contains additional sea turtle conservation measures, necessary to remove jeopardy to leatherback sea turtles, that also monitor and minimize the impact of the action's incidental take of sea turtles. The BiOp indicates that the following reasonable and prudent measures are

necessary and appropriate to monitor and minimize the effect of take of listed species considered in this opinion:

a) Improve the understanding of leatherback sea turtle life history and population status and provide updated information to be used in management decisions.

b) Continue efforts to better understand sea turtle post-release mortality rates and the factors affecting these rates.

c) Take action to ensure improved compliance with safe handling and release gear required on board.

d) Improve the HMS pelagic longline fishery's compliance with vessel safety requirements to reduce the number of inadequate or unsafe vessels for purposes of carrying an observer and for allowing operation of normal observer function vessels in the fleet.

4.3.6 Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the BiOp stipulates the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

a) *Convene an expert working group on leatherback sea turtles.* By December 31, 2004, NOAA Fisheries must select and assemble a group of population biologists, sea turtle scientists, life history specialists, and natural resource managers who are known experts on sea turtle conservation issues, especially for leatherback sea turtles. These experts may come from academic, government, industry, and/or non-profit organization backgrounds. This group will be charged with compiling the best, most up-to-date information on leatherback sea turtle life history, ecology, population status, and threats. The information is then to be synthesized and presented in a NOAA technical memorandum to be used as a reference on the ecology and status of leatherback sea turtles in the Atlantic and to provide information to be used in making sound management and conservation decisions.

b) *Leatherback research plan*. NOAA Fisheries must develop and implement a research plan to obtain the necessary demographic data to conduct stock assessment analysis and determine the status of the Atlantic leatherback sea turtle. These include, but are not limited to survivorship in each life history stage, age and growth, age and size at stage, age and size at maturity, fecundity and the associated variability of each, and recruitment and dispersal.

c) *Finalize post-release mortality criteria.* OPR must issue final post-release mortality criteria by December 31, 2004.

d) *Post-release mortality studies.* NOAA Fisheries must initiate a full study of post-hooking mortality of loggerheads based on the results of the pilot study conducted in the NED and begin a pilot study for leatherbacks. NOAA Fisheries has demonstrated the ability to capture control (fishery independent) and treatment (fishery dependent) loggerheads, and should now implement a full study in order to attain an appropriate sample size to compare survival between the two groups. A similar study should be initiated for leatherbacks as well. Results of these studies would refine post-hooking mortality estimates currently used by the OPR.

e) *Compliance with Safe Handling and Release Equipment On Board.* NOAA Fisheries must ensure NOAA Fisheries' Office of Law Enforcement (OLE), in cooperation with the U.S. Coast Guard and state law enforcement partners, receive training on the new safe handling and release equipment requirements and conduct dock-side and at-sea boardings that ensure that the gear is on board.

f) *Compliance with vessel safety requirements for observer coverage.* NOAA Fisheries must establish procedures to notify OLE of any vessel authorized to fish with pelagic longline gear and selected for observer coverage that is found to be inadequate or unsafe for purposes of carrying an observer and for allowing operation of normal observer function. Such vessels are prohibited from fishing without observer coverage. NOAA Fisheries must establish procedures for those vessels and issue regulations requiring vessels authorized to fish with HMS pelagic longline gear to notify the OLE and POP when safety problems have been corrected, before the vessel conducts another fishing trip.

4.4 ENVIRONMENTAL JUSTICE CONCERNS

Executive Order 12898 requires agencies to identify and address disproportionately high and adverse environmental effects of its regulations on the activities of minority and low-income populations. In particular, the environmental effects of the regulations should not have a disproportionate effect on minority and low-income communities. The communities of Dulac, LA, and Fort Pierce, FL, have significant populations of Native Americans and Black-Americans respectively. These two communities also have significant populations of low-income residents. Additionally, there is a diffuse Vietnamese-American population in LA who actively participate in the pelagic longline fishery, and who commute to fishing ports, but do not live in "fishing communities" as defined by the MSA and identified in Chapter 9 of this document. None of the preferred alternatives are expected to have a disproportionate impact on these minority populations and low-income populations. See Chapter 9, infra, for further description of communities.

4.5 COASTAL ZONE MANAGEMENT CONCERNS

The Coastal Zone Management Act (CZMA, 1972, reauthorized 1996) requires that Federal actions be consistent to the extent practicable, with the enforceable policies of all state coastal zone management programs. NOAA Fisheries has determined that the preferred alternatives which seek to minimize protected species interactions with pelagic longline fishing gear and associated mortality will be implemented in a manner consistent to the maximum extent practicable with the enforceable policies of the coastal states in the Atlantic, Gulf of Mexico, and Caribbean that have federally approved coastal zone management programs. During the proposed rule stage, NOAA Fisheries asked for states' concurrence with this determination. As of June 2004, seven states had replied affirmatively regarding the consistency determination. NOAA Fisheries presumes that the remaining states also concur with the determination. NOAA Fisheries has worked closely with states in the past and will continue to work with the states to ensure consistency between state and Federal regulations.

4.6 CUMULATIVE IMPACTS

Cumulative impact is the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7). A cumulative impact includes the total effect on a natural resource, ecosystem, or human community due to past, present, and future activities or actions of Federal, non-Federal, public, and private entities. Cumulative impacts may also include the effects of natural processes and events, depending on the specific resource in question. Cumulative impacts include the total of all impacts to a particular resource that have occurred, are occurring, and will likely occur as a result of any action or influence, including the direct and reasonably foreseeable indirect impacts of a Federal activity. The goal of this section is to describe the cumulative ecological, economic and social impacts of past, present and reasonably foreseeable future actions with regard to the pelagic longline fishery.

Past, Present, and Reasonably Foreseeable Actions

In addition to this current rulemaking, which is intended to address the bycatch and bycatch mortality of threatened and endangered sea turtles in the Atlantic pelagic longline fishery, NOAA Fisheries has implemented rules in the past and expects to implement more in the future to address the management and conservation of target and non-target species in the HMS fisheries.

One of the primary goals of the 1985 Atlantic Swordfish FMP and the 1999 HMS FMP was to establish management measures intended to reduce overfishing and rebuild north Atlantic swordfish populations. Measures implemented to rebuild and manage the north Atlantic swordfish fisheries included, among other things, quotas, gear restrictions, retention and size limits, overharvest and underharvest adjustment authority, and permitting and reporting

requirements, including a limited access system. The limited access system was intended to prevent overcapitalization and reduce latent effort in the fishery.

Since the HMS FMP, NOAA Fisheries has issued two FSEIS for final actions designed to reduce impacts on both target and non-target species. The first one, published in June 2000, analyzed time/area closures and gear restrictions, including live bait prohibitions and corrodible hook requirements, to reduce bycatch, bycatch mortality, and incidental catch in the pelagic longline fishery. The final actions were expected to have negative direct, indirect, and cumulative economic and social impacts for pelagic longline fishermen and were expected to have positive ecological impacts.

The second FSEIS, published in July 2002, implemented measures contained in the June 14, 2001, BiOp that addressed sea turtle bycatch and bycatch mortality in HMS fisheries. The final actions were expected to have positive ecological impacts. Certain measures, such as the NED closure, were expected to have negative direct, indirect, and cumulative economic and social impacts on pelagic longline fishermen. These effects, however, were mitigated in the short-term for vessels that were able participate in in the NED experiment. The rulemaking also implemented measures in the shark gillnet fishery. Although the management measures for the shark gillnet fishery (required net checks for sea turtles and other marine mammals at least every two hours and ceasing of fishing and notification to NOAA Fisheries if a whale is taken) were not anticipated to have any impacts on pelagic longline fishermen, they are expected to have some positive impact in regard to reductions in sea turtle mortality.

Other subsequent actions include the implementation of VMS requirements for pelagic longline vessels and mandatory cost earnings reporting. Reasonably foreseeable future actions include the development of final rules for proposed rules related to: an international trade permit and additional trade tracking requirements for swordfish, bigeye tuna, and bluefin tuna (69 Fed. Reg. 19147 (April 12, 2004)); chartering permits and import prohibitions (69 Fed. Reg. 25357 (May 6, 2004)); and implementation of ICCAT swordfish quotas (68 Fed. Reg. 36967 (June 20, 2003)). In addition, NOAA Fisheries is currently developing Amendment 2 to the HMS FMP and Amendment 2 to the Billfish FMP and may, in these amendments or in future rulemakings, consider additional bycatch reduction measures, quota allocations between directed, incidental, and recreational permit holders, changes to season openings and closings, permit streamlining, and additional species specific quotas.

Cumulative Ecological Impacts

The HMS FMP concluded that the cumulative long-term impacts of management measures implemented in the FMP would be to rebuild overfished fisheries; minimize bycatch and bycatch mortality, to the extent practicable; identify and protect essential fish habitat; and minimize adverse impacts of fisheries regulations on fishing communities, to the extent practicable. Subsequent to the HMS FMP, NOAA Fisheries has taken other actions, including those described above to promote the long-term sustainability of the HMS fisheries, in compliance with the MSA, ESA, ATCA, and other applicable law.

The HMS FMP and subsequent regulatory actions provide for domestic management and conservation measures for Atlantic swordfish, bigeye tuna, yellowfin tuna, albacore, and other HMS species. However, international efforts are necessary in order to rebuild these stocks. The United States has participated and will continue to participate at ICCAT to further international management of these species throughout their range. Currently, North Atlantic swordfish, although still overfished, are recovering, and are estimated to be at 94% of the biomass needed to produce MSY (Table 3.1). Atlantic bigeye tuna is overfished and overfishing is occurring. Recent stock assessment results indicate that the current biomass of Atlantic bigeye tuna is about 10 - 20 percent below the biomass corresponding to MSY and that current fishing mortality is about 15 percent higher than the rate that would achieve MSY. Atlantic yellowfin tuna are not overfished but overfishing may be occurring. The reported yellowfin tuna landings appear to be close to the MSY level and fishing effort and fishing mortality may be in excess of levels associated with MSY. North Atlantic albacore tuna are overfished and overfishing is occurring (Table 3.1). Recent analyses indicate that the current spawning stock biomass is about 30 percent below that associated with MSY. However, the United States is a minor harvesting nation with regard to Atlantic bigeye, yellowfin, and albacore tunas. For example, U.S. fishermen caught relatively small amounts of albacore from the North Atlantic stock/management unit (322 mt in 2001) and minor catches of South Atlantic albacore (2 mt in 2001) (NOAA Fisheries, 2003a).

In 2002, total estimated swordfish catch of U.S. vessels, including U.S. vessel landings and dead discards was 2,708.7 mt (NOAA Fisheries, 2003b). This represents a modest increase of 55.4 mt from 2001, but a 22.5 percent decrease from 2000. U.S. swordfish landings are monitored in-season from reports submitted by dealers, vessel owners and vessel operators, NOAA Fisheries port agents, and mandatory daily logbook reports submitted by U.S. vessels permitted to fish for swordfish. The U.S. pelagic longline fleet has historically accounted for a small percentage of total Atlantic HMS landings. Even when including U.S. discards for bluefin tuna, swordfish, blue marlin, white marlin, and sailfish, the U.S. accounts for approximately five to six percent of all pelagic longline landings reported to ICCAT.

For non-target species, which include a variety of finfish species and protected species such as sea turtles, NOAA Fisheries has undertaken rulemakings to implement bycatch reduction measures and reductions in overall fishing effort, including: a limited access permit regime, closed areas, gear restrictions, minimum size restrictions, and requirements to post handling and release guidelines for incidentally captured sea turtles and marine mammals. In addition, the VMS requirement for pelagic longline vessels will further assist NOAA Fisheries in enforcing time/area closures, and protecting vulnerable HMS life stages. Several time/area closures have been implemented as part of HMS fisheries to reduce discards, protect juvenile HMS, and to reduce bycatch of protected species. Currently, approximately 3 million square miles of ocean are closed to HMS fishing at various times of the year. In addition, NOAA Fisheries has undertaken the NED research experiment and engaged in other domestic and international efforts to address sea turtle bycatch as discussed in Section 11.2.

The suite of preferred alternatives in this action (A5 (b), A10 (b), and A16) are expected to have significant conservation benefits for protected sea turtles and other bycatch species consistent with the ESA, MSA, and other applicable law. Additional positive ecological impacts are anticipated from actions to be taken pursuant to the 2004 BiOp. See Section 4.1 for further information on the impacts of the preferred alternatives, and Section 4.3 for a summary of the 2004 BiOp. In addition, the successful implementation of bycatch and mortality reduction gears and techniques in the U.S. will facilitate the promotion and use of such gears and techniques by foreign vessels. Other alternatives analyzed also could have positive ecological impacts. As described in Section 4.1, implementing different hook and bait treatments could result in varying degrees of reductions in interactions and mortalities of sea turtles and other non-target species as well reductions or increases in target catches. Certain hook and bait requirements outside the NED (alternatives A2 - A5 (a)), when applied with certain NED requirements (alternatives A7 - A10 (a)) and/or time and area closures (alternatives A13 - A15), could result in significant positive ecological impacts for sea turtles, including interaction levels that may be lower than the suite of preferred alternatives.

Reasonably foreseeable future actions, noted above, would implement ICCAT recommendations. The international trade permit and trade tracking requirements, if finalized, would facilitate monitoring of swordfish, bigeye tuna, and bluefin tuna and help combat illegal, unreported, and unregulated fishing (IUU). The chartering permit final rule would allow for monitoring of fishing activities of U.S. vessels engaged in arrangements to fish in foreign waters, and also implement import sanctions for certain countries and species. ICCAT quotas for swordfish and other HMS species are negotiated as part of international rebuilding efforts. None of these actions are expected to have significant ecological impacts.

In summary, all of the above past, present, and reasonably foreseeable future actions are expected to have positive cumulative ecological impacts by allowing stocks to rebuild and reducing bycatch and bycatch mortality of protected and other non-target species.

Cumulative Economic and Social Impacts

The cumulative economic and social impact of actions taken since the 1985 Atlantic Swordfish FMP, and the 1999 HMS FMP has been to reduce the number of participants and overall latent effort in the pelagic longline fishery. By reducing the number of permitted vessels in the fishery, implementing bycatch reduction measures, expanding the list of prohibited shark species, and a variety of other commercial measures, the fishery has had to deal with regulatory impacts and adapt to economic changes.

In June 1984, vessels targeting swordfish by methods other than rod and reel were required to obtain permits from the Southeast Regional Office. In January 1985, 340 permit requests had been received. This number was presumed to be the total number of commercial swordfishing vessels operating in the management area. This number was believed to represent a decline since 1980. Despite the decrease in the number of vessels operating in the management area, it was believed that effort may have increased (SAFMC, 1985). With the implementation of the

HMS FMP in 1999, both the number of vessels and fishing effort were reduced. The limited access permit system reduced the number of swordfish permits to 303 (203 directed and 100 incidental) as of November, 2003. Because pelagic longline vessels must possess a tuna longline permit, a swordfish permit (directed or incidental), and a shark permit (directed or incidental), the maximum number of vessels currently eligible to participate in this fishery is 303. Recent analysis indicates that of these 303 vessels, only 148 reported landings in 2002 (See Chapter 6).

As a result of management actions, vessels that used to participate in the pelagic longline fishery may have moved to other fisheries, gone out of business, or experienced other adverse economic impacts. Average ex-vessel prices for swordfish, tunas, and sharks have remained fairly constant, and have not increased enough to offset potential declines in landings. The reasonably foreseeable future actions, noted above, would not likely have significant social or economic impacts. If finalized, the international trade and chartering permit final rules would impose additional reporting requirements and some potential costs associated with applying for permits. The final rule implementing ICCAT quotas for swordfish could have some positive economic benefit; however, current quotas have not been reached and effort is not expected to increase. None of these actions are expected to have significant adverse socio-economic impacts.

The preferred alternatives in this action (A5 (b), A10 (b), and A16), while they would not directly reduce the number of fishery participants, may have negative socio-economic impacts by altering traditional fishing practices and imposing additional costs associated with new gear requirements. However, this action is expected to have significant positive economic impacts for the portion of the fleet that may fish in the current NED closed area, and may have positive economic impacts elsewhere depending on the hooks and baits utilized and target species. As discussed in Section 4.1, in response to public comment, this action modifies the preferred alternatives from the DSEIS to mitigate for adverse economic impacts. The preferred alternatives, individually, and in aggregate, may reduce gear related costs over the long-term. Other alternatives for hook and bait requirements outside the NED (A2 - A5 (a)) and within the NED (A7 - A10 (a)) and for time/area closure alternatives (A13 - A15) could have significant negative socio-economic impacts if they alter fishing practices to the extent that vessels cannot effectively target species. All of the alternatives analyzed, including the preferred alternatives, would raise some administrative and enforcement costs, as discussed in Section 4.1, but no significant safety at sea concerns.

The overriding goal of HMS management has been to provide sustainable harvests that will provide the greatest economic benefits to the largest number of individuals. Some of the economic impacts experienced by the fishery are not solely the result of Federal actions. The year-round availability of imported HMS (See Section 3.2), fluctuating fuel prices, and consumer boycotts have likely contributed to economic impacts experienced by pelagic longline fishermen. In summary, while certain actions have resulted in negative socio-economic impacts, all of the above past, present, and reasonably foreseeable future actions are expected to ensure the long-term sustainability and continued economic viability of the pelagic longline fishery consistent with applicable law. Management and conservation measures promote the recovery and rebuilding of target species and protected resources, which provide for the continued

operation of the fishery. As noted above, for this action, the preferred alternatives mitigate for potential socio-economic impacts to the extent practicable, consistent with the ESA, MSA, and other applicable law.

4.7 COMPARISON OF THE ALTERNATIVES

The ecological, social, and economic impacts compared in Table 4.6 are for the foreseeable short-term future. However, many of the potential short-term, adverse social and economic impacts associated with the alternatives could translate into positive long-term social and economic impacts as operating efficiency increases over time. This table presents a rough summary of impacts associated with each of the alternatives analyzed; however, there are competing impacts associated with many of the alternatives listed. As such, please reference the individual alternatives as analyzed in Chapters 4, 6, 7, and 8.

Table 4.6 **Impacts of Alternatives Considered**. The symbols +, -, and 0 refer to positive, negative, and zero impacts respectively. A combination of symbols (e.g. + +/- -) indicate variable impacts for different segments of the fishery. See preceding sections for details of impacts of each alternative.

ALTERNATIVE		ECOLOGICAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
Bycatch and Bycatch Mortality Reduction Measures				
Alternative A1	Maintain existing hook and bait restrictions in the Atlantic pelagic longline fishery; maintain existing time/area closures in the Atlantic pelagic longline fishery; maintain existing possession and use requirements for bycatch mitigation gear (dipnets and line clippers), as well as sea turtle handling and release guidelines as currently specified by NOAA Fisheries. (No Action)	- - -	0	0
Alternative A2	Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait.	+ + +	+ +/- - -	+ +/- - -

ALTERNATIVE		ECOLOGICAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
Alternative A3	Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only one of the following hook and bait combinations: i) 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait; **OR** ii) 18/0 or larger non-offset (flat) circle hooks and squid bait.	+ + +	+ +/- - -	+ +/- - -
Alternative A4	Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only one of the following hook and bait combinations: i)18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait; **OR** ii) 18/0 or larger non-offset circle hooks and squid bait; **OR** iii) 9/0 "J"-hooks with an offset not to exceed 25 degrees and whole mackerel bait.	+ +	+ +/- - -	+ +/- - -

ALTERNATIVE		ECOLOGICAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
Alternative A5 (a)	Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger circle hooks with an offset not to exceed 10 degrees.	+ +	- -	- -
Alternative A5 (b)	*Limit vessels with pelagic longline gear onboard, at all times, in all areas open to pelagic longline fishing, excluding the NED, to possessing onboard and/or using only 16/0 or larger non-offset circle hooks and/or 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole finfish and squid baits may be possessed and/or utilized with allowable hooks.* (*Preferred Alternative)*	+ +	+ +/- -	+ +/- -
Alternative A7	Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait.	- -	+ + +/-	+ + +/-

ALTERNATIVE		ECOLOGICAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
Alternative A8	Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 20/0 or larger circle hooks with an offset not to exceed 10 degrees and whole mackerel bait.	- -	+ +/- - -	+ +/- - -
Alternative A9	Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only one of the following hook and bait combinations: i) 9/0 "J"-hook with an offset not to exceed 25 degrees and whole mackerel bait; **OR** ii) 18/0 or larger circle hook with an offset not to exceed 10 degrees with whole mackerel bait.	- -	+ + +/-	+ + +/-

ALTERNATIVE		ECOLOGICAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
Alternative A10 (a)	Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing and/or using only one of the following hook and bait combinations: i) 18/0 or larger circle hook with an offset not to exceed 10 degrees with whole mackerel bait; **OR** ii) 18/0 or larger non-offset (flat) circle hook with squid bait.	- -	+ + +/- - -	+ + +/- - -
Alternative A10 (b)	*Open the NED to pelagic longline fishing and limit vessels with pelagic longline gear onboard in that area, at all times, to possessing onboard and/or using only 18/0 or larger circle hooks with an offset not to exceed 10 degrees. Only whole mackerel and squid baits may be possessed and/or utilized with allowable hooks. (Preferred Alternative)*	- -	+ + +/ - - -	+ + +/- - -
Alternative A13	Prohibit the use of pelagic longline gear in HMS Fisheries in an area of the central Gulf of Mexico year-round (12 months).	- -	- -	- -

ALTERNATIVE		ECOLOGICAL IMPACTS	SOCIAL IMPACTS	ECONOMIC IMPACTS
Alternative A14	Prohibit the use of pelagic longline gear in HMS fisheries in portions of the central Gulf of Mexico and the Northeast Coastal Statistical Reporting Area year-round (12 months).	+ + +	- - -	- - -
Alternative A15	Prohibit the use of pelagic longline gear in HMS fisheries in portions of the central Gulf of Mexico and the Northeast Coastal Statistical Reporting Area from May through October (6 months).	+ + +	- - -	- - -
Alternative A16	*Require vessels with pelagic longline gear onboard to possess or use dipnets and line clippers that meet newly revised design and performance standards, plus require these vessels to possess, maintain, and utilize additional sea turtle handling and release gear and comply with handling and release guidelines as specified by NOAA Fisheries. (Preferred Alternative)*	+	-	-

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