7. 0 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES CONSIDERED

Minimizing bycatch, bycatch mortality, and incidental catch in the Atlantic pelagic longline fishery was identified in the HMS FMP and Amendment One of the Atlantic Billfish FMP as a critical management goal that needed to be addressed pursuant to NS9, which states that:

> *Conservation and management measures shall, to the extent practicable:*
> *(1) Minimize bycatch; and*
> *(2) To the extent bycatch cannot be avoided, minimize the mortality of such bycatch.*

Specifically, an objective of the HMS FMP is to "minimize, to the extent practicable, bycatch of living marine resources and the mortality of such bycatch that cannot be avoided in the fisheries for Atlantic tuna, swordfish, and sharks." Although Amendment One of the Atlantic Billfish FMP defers management of commercial fishing bycatch to the HMS FMP, it also has an objective to "minimize to the extent practicable, bycatch and discard mortality of billfish on gears." These documents provide detailed discussions of bycatch and incidental catch issues associated with the various HMS commercial and recreational fisheries. Further, these plans also note that additional actions beyond those included in the FMPs would be necessary to address these bycatch, bycatch mortality and incidental catch concerns. The following sections describe the evaluation process used by the agency to determine final actions to meet these objectives.

7.1 Use of Time/Area Closures to Reduce Bycatch, Bycatch Mortality, and Incidental Catch from Pelagic Longline Gear in the Atlantic Ocean

The management strategies discussed under this section of the FSEIS examine temporal and spatial restrictions on the use of pelagic longline gear to achieve the overarching goals of this final rule (Section 1.3). Time/area closure management strategies have been used by NMFS to reduce incidental catches for several U.S. marine fisheries, including North Pacific fisheries (herring, crab and groundfish fisheries), the northeast groundfish gillnet fishery (through the Northeast Multispecies FMP), and bluefin tuna discards in the pelagic longline fishery. Several studies have also addressed the potential use of time/area closures to reduce bycatch and bycatch mortality in the Atlantic HMS pelagic longline fishery (see Section 1.6). Utilization of this management strategy would contribute to minimizing bycatch in the Atlantic pelagic longline fishery and should contribute to rebuilding of overfished HMS, to the extent that mortality of juveniles, sub-adults and spawning fish is reduced.

The development of the time/area closure options in the final rule clearly follows a multispecies management approach in considering the four over-arching objectives (Section 1.0) in selection of final agency action. This approach is important because the species composition of the catch from pelagic longline gear is not spatially uniform, as illustrated by the five different sectors of this fishery described in Section 6.3. Further, use of a multispecies approach precludes the setting of specific bycatch target reductions for each species without considering the impact on how effort may be redistributed, both in time and space. For example, if the time/area closures were simply based on reducing swordfish discards by a set percentage, the potential impacts on other species may be negative because closing areas of high swordfish bycatch may push effort into areas or times where sea turtle or billfish bycatch may be disproportionately higher. The challenge of the multispecies approach then becomes defining time/area closures that balance potential decreases in bycatch and target catches of some species with potential increases of other bycatch, incidental catch, or target catch of other species. The benefits that result from closed areas or seasons accrue only if they are not offset by increases in mortality beyond the closures due to changes in fishing patterns. Therefore, the parameters of any closures must include consideration of the fishing effort that is potentially redistributed in both time and space. For the same reason, any closures that are implemented must also be annually reassessed to determine if modifications are necessary to ensure overall closure effectiveness.

NMFS considered many effects of implementing time/area closures. The final action and six rejected time/area closure options have similar effects on many factors. The following discussion covers the similar effects so that they are not repeated for each option. Any additional effects are explained under each option.

Population Effects Due to Changes in the Bycatch of Those Species

While time/area closures may be an effective way to minimize HMS bycatch, bycatch mortality and incidental catch in the U.S. pelagic longline fishery, these wide-ranging species are also targeted by international pelagic longline fleets that do not, for the most part, discard billfish and undersized swordfish. Population effects of any reductions in bycatch, bycatch mortality, and incidental catch must be evaluated in terms of the U.S. catch relative to total stock-wide mortalities, consistent with NS3 directives. International time/area closures may be an option to address stock-wide mortality from incidental catch of billfish and undersized swordfish. The United States negotiated a rebuilding program for North Atlantic swordfish through ICCAT in 1999. The United States will support the development of rebuilding programs for blue and white marlin at the 2000 meetings. The United States is responsible for 29 percent of the north Atlantic swordfish quota (2000 through 2002). One of the time/area closure options could reduce swordfish discards by nearly 42 percent with an associated reduction in swordfish landings of 25 percent under an assumption of no effort redistribution; if effort is redistributed, swordfish discards are reduced by over 31 percent, while landings would decrease by 13 percent. Atlantic billfish are more problematic because billfish mortality levels from all U.S. sources (commercial dead discards and recreational landings) during the 1990s averaged only 5.2 percent for Atlantic blue marlin, 5.8 percent for white marlin, and 6.6 percent of west Atlantic sailfish, relative to the total mortality as reported to ICCAT. The time/area closures will reduce U.S. billfish discards by 6 to nearly 30 percent under the no effort redistribution models; effort redistribution models predict a range of impact of a 14 percent reduction to 11 percent increase in discards. Prohibition of the use of live bait in the Gulf of Mexico would provide a reduction of billfish discards in the Gulf of Mexico of approximately 10 to 45 percent, which translates to an additional 2 to 15 percent reduction, by species, based on Atlantic-wide U.S. discards (see Section 7.2).

To rebuild Atlantic blue marlin within a 10-year time frame, total Atlantic landings will have to be reduced to approximately 1,800 mt for blue marlin and approximately 800 mt for white marlin (see Figure 3.2.4 of Amendment One of the Atlantic Billfish FMP). These target catch levels are much lower than the most recently reported catch levels (1998) of 3,198 mt and 1,118 mt of Atlantic blue marlin and Atlantic white marlin, respectively. If all U.S. billfish-related mortality were eliminated from both recreational and commercial sectors for 1998, the overall contribution by the United States to the additional 1,398 mt (3,198 - 1,800) of Atlantic blue marlin and 310 mt Atlantic white marlin required to allow for Atlantic-wide rebuilding in 10 years would be only 102 mt and 35 mt, respectively (1999 National Report, NMFS 1999c). In 1998, the U.S. reported pelagic longline discards of 52 mt of blue marlin, 32 mt of white marlin, and 27 mt of sailfish. The cumulative impact of the final time/area and gear restriction/modification actions would potentially reduce these discards (under the no effort redistribution model, which provides an estimate of the maximum benefit expected) to 44 mt for blue marlin (15.3% reduction), 29 mt for white marlin (8.4% reduction), and 15 mt for sailfish (44.9% reduction). Therefore, even considering the "best case scenario" for the time/area closures and gear restrictions of the final rule, Atlantic blue marlin and Atlantic white marlin stocks can only be rebuilt through international cooperation. The method of achieving a rebuilding strategy will depend on the outcome of multi-level international negotiations.

Although unilateral actions by the United States will not provide sufficient reductions in mortality to allow rebuilding of these overfished Atlantic billfish stocks, these final actions could be utilized as a framework for international conservation actions through ICCAT. Historically, the United States has been a leader in conservation of Atlantic billfish, and has taken actions (e.g., the 1988 Atlantic Billfish FMP and 1999 Amendment to that FMP) to show its willingness to take the critical steps necessary to conserve billfish stocks. This fact has been a primary negotiation tool at ICCAT, and it is doubtful whether the recent ICCAT actions (i.e., the 1997 and 1998 ICCAT recommendations) would have been possible without the support of the United States. The United States sponsored a recommendation at the 1998 ICCAT meeting that directs the SCRS to develop stock-recovery scenarios, where appropriate, following stock assessments for Atlantic blue and white marlin in the year 2000, and a stock assessment for west Atlantic sailfish in 2001.

<u>Synopsis of Time/Area Analytical Procedures</u>

The following discussion provides a brief overview of the analytical procedures utilized in developing and analyzing the various time/area options. A more complete summary is provided in Appendix C. Pelagic longline logbook data, which are reported to NMFS by commercial fishermen, are used herein to identify times (months) and areas in which most of the bycatch of billfish, undersized swordfish, and other species occurs. For the purposes of this analysis, it is assumed that these data are provided by fishermen to NMFS as required by regulation and are without error, or at least consistent in any pattern of under-reporting. A report prepared by Cramer et. al (1997) provides a summary of some of the issues associated with the accuracy and precision of discard and target catches reported by the logbook system. Pelagic logbook data were used to summarize total monthly U.S. pelagic longline catches throughout the operational range of the U.S. fleet in the Atlantic Ocean for each of calendar years 1995, 1996, 1997 and 1998 (Table 6.2). The geographic distribution of discarded and/or kept swordfish, blue marlin, white marlin, sailfish, spearfish, bluefin tuna, BAYS tunas (bigeye, albacore, yellowfin, and skipjack), pelagic sharks, large coastal sharks, dolphin, wahoo, sea turtles, marine mammals, and sea birds from pelagic longline sets was determined by plotting the average number caught per set by latitude and longitude for each quarter (January - March; April - June; July - September; and October - December). These plots were examined to qualitatively identify areas and times where relatively more bycatch and incidental catches occurred ("hot spots").

Changes in bycatch and incidental catch rates resulting from time/area closures are expressed as a percentage of the total U.S. Atlantic pelagic longline catch, calculated on a monthly basis. The temporal and spatial variations of the ratio of bycatch to target catch, the absolute numbers of bycatch and target catch, and relative fishing effort were also examined to provide further insight into closure effectiveness. For example, an area that has a high discard-to-number kept ratio may be indicative of a "hot spot" area, depending upon the relative volume of fishing effort that is currently or historically conducted in the area. Conversely, an area that has a relatively high absolute number of discards, but a low ratio of discard to number of fish kept, would be evaluated based on the relative fishing effort in the area.

To determine the impact of the various time/area closures on bycatch and incidental catch levels, it is necessary to consider what happens to the fishing effort (pelagic longline sets) within the closed area (i.e., effort redistribution). One extreme is to assume all effort is removed from the system (**no effort redistribution model**). Under this assumption, the results would estimate the maximum possible reduction in incidental and target catch, as well as the maximum economic, social and community impacts. The other extreme is to assume that all effort is randomly redistributed throughout the entire range open to the Atlantic pelagic longline fishery over the period of the closure (**effort redistribution model**). This model assumes that even if the vessel making the original set does not to move to an open area, the opportunity exists for other vessels to make those sets. NMFS recognizes that what really would happen is likely somewhere close to the redistribution of effort model, but within the range of both models. It is also important to note that bycatch rates may be over-estimated by the effort redistribution model if species are concentrated in one area outside the U.S. EEZ, rather than evenly distributed over the entire open area in the Atlantic. In this case, the no effort redistribution model may be more appropriate.

As indicated in the Draft Technical Memorandum issued in November 1999 and in the supplemental information provided with the April 26, 2000, Federal Register notice (65 FR 24440), NMFS analyzed a range of areas for closure within the U.S. EEZ in the Gulf of Mexico and in the South Atlantic Bight area. Those areas ranged from 92° W. longitude to the Texas coast (GulfA) to as far east as 82° W. longitude to the Texas coast (GulfD). These areas encompass the latitudes from the Gulf coast to the U.S. EEZ at 26°N. latitude. The South Atlantic areas ranged from Georgetown, SC to Key West, FL (34° to 24° N. latitude.) and ranged east as far as 74° W. longitude (SAtlB). NMFS analyzed these areas separately to identify whether they met the stated objectives and then analyzed combinations of areas to address cumulative effects on bycatch reduction.

The closed areas would apply to vessels with HMS permits wherever they fish with pelagic longline gear, including state waters. That is, NMFS is closing state waters to pelagic longlining only for federally permitted vessels. If any pelagic longline vessels exist with state fishing permits and without a Federal permit that wish to pelagic longline *only* in state waters within a federal closed area, they may do so if not prohibited by that state. However this is unlikely to occur since little pelagic longline fishing appears to occur in state waters. The State of Florida has prohibited the use of longline gear in state waters.

Impacts of Individual Time/Area Closures from the DSEIS

The 1999 HMS FMP included an annual June closure to pelagic longline gear within the area bound by 39ºN latitude to 40ºN and 68ºW longitude to 74ºW longitude to reduce bluefin tuna discards. The analytical procedures used in the DSEIS included this area in analyzing the impacts of potential time/area closure scenarios. Due to comments received on the DSEIS, the FSEIS separates out the impacts of the bluefin tuna closure to clarify the effects of the individual closures evaluated in the final rule. Evaluation of this closure under the **no effort redistribution model** (Table 7.1) resulted in a 52.9 percent reduction in bluefin tuna discards, with less than a 2 percent reduction in other bycatch or target species. The **effort redistribution model** indicated that closure of this area during the month of June should be effective in reducing bluefin tuna discards by over 50 percent. A minimal increase in target catch of swordfish, dolphin, and large coastal sharks was also predicted, along with an approximately one percent increase in blue and white marlin, and swordfish discards. Small reductions in sea turtle, pelagic sharks discards and landings could be experienced. Because the percent change values are based on the total Atlantic-wide catch of each species, the percentages included in Table 7.1 are additive, within species, for each of the alternatives that follow.

Table 7.1. Impact of the June bluefin tuna closure, by species, for 1995 through 1998.

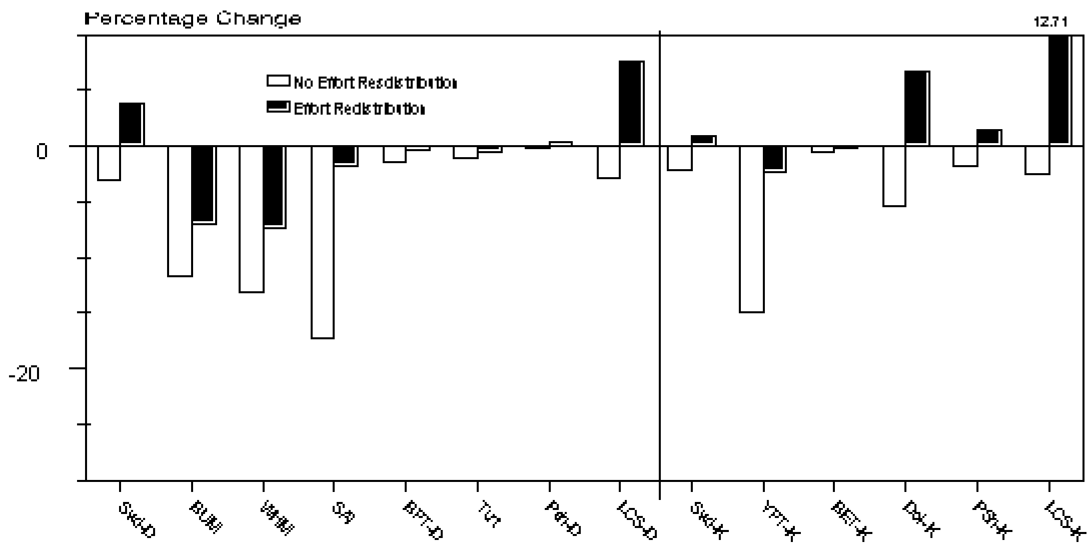
Discards and Target Species	No Effort Redistribution Model (Percent)	Effort Redistribution Model (Percent)
Swordfish Discards	-0.05	0.90
Blue Marlin Discards	-0.06	1.06
White Marlin Discards	-0.58	1.18
Sailfish Discards	0.00	2.27
Bluefin tuna Discards	-52.90	-50.24
Pelagic Shark Discards	-1.90	-0.55
Large Coastal Shark Discards	-0.21	1.74
Turtles	-0.54	-0.09
Swordfish Kept	-0.38	0.74

Discards and Target Species	No Effort Redistribution Model (Percent)	Effort Redistribution Model (Percent)
BAYS Tunas Kept	-1.61	-0.30
Dolphin (Mahi) Kept	-1.46	2.80
Pelagic Sharks Kept	-1.33	-0.20
Large Coastal sharks Kept	-0.01	0.11

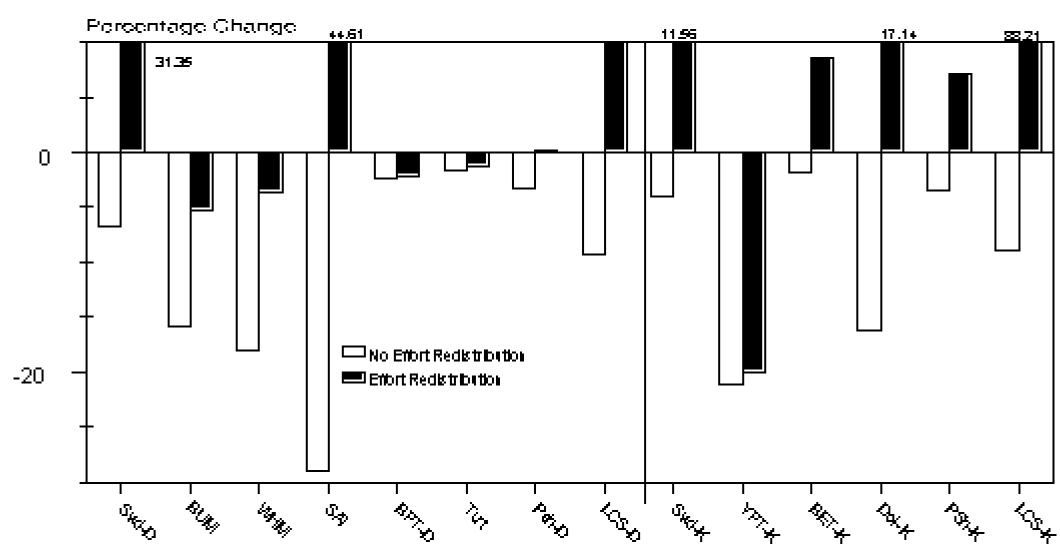
The DSEIS and the supplementary information in a Federal Register Notice published on April 26, 2000, (65 FR 24440) included five time/area closure options that combined effects of closures in the Gulf of Mexico and along the southeastern U.S. Atlantic coast. Comments on the DSEIS indicated that impacts of individual areas in the Gulf of Mexico and southeastern U.S. Atlantic coast should also be provided within this document. Percent change in bycatch, incidental catch and target catch are provided in the following figures for these five areas (Figures 7.1). This figure is included here because it provides a basis for comparison of the final action with rejected options that are presented in the remaining portion of Section 7.1.

Figure 7.1. **Percent change in catch resulting from closures of areas in the Gulf of Mexico and southeastern U.S. Atlantic coast.** Swd-swordfish, BFT-bluefin tuna, BUM-blue marlin, WHM-white marlin, SAI-sailfish, Psh-pelagic sharks, LCS-large coastal sharks, Turt-turtles, YFT-yellowfin tuna, Dol-dolphin, D indicates Discards, K indicates fish kept.

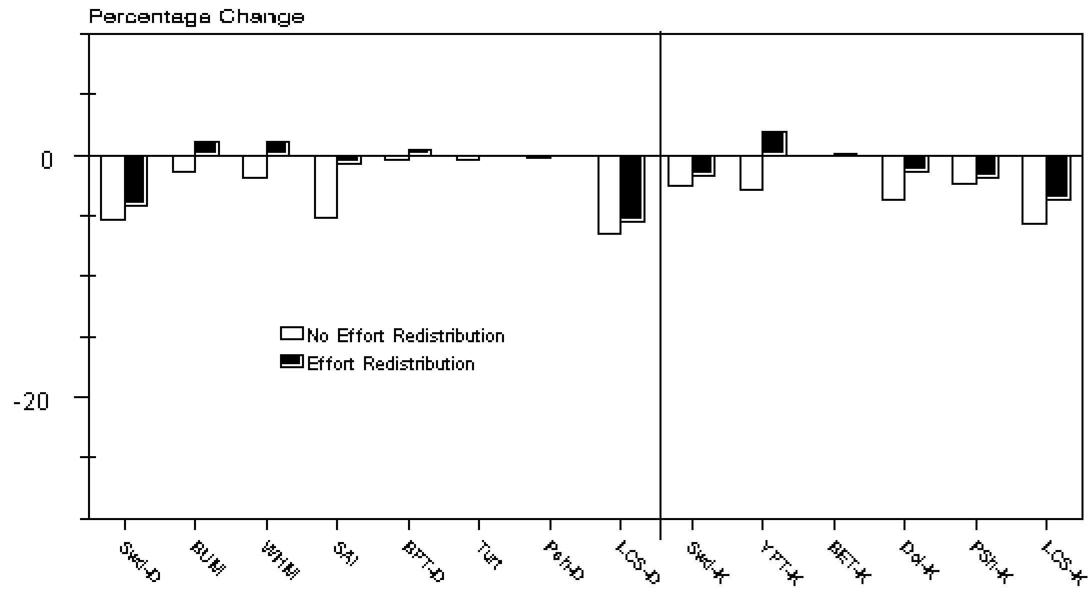
(A). Percent change for closure of GulfB (western Gulf of Mexico. see Figure 7.2), for March through September.



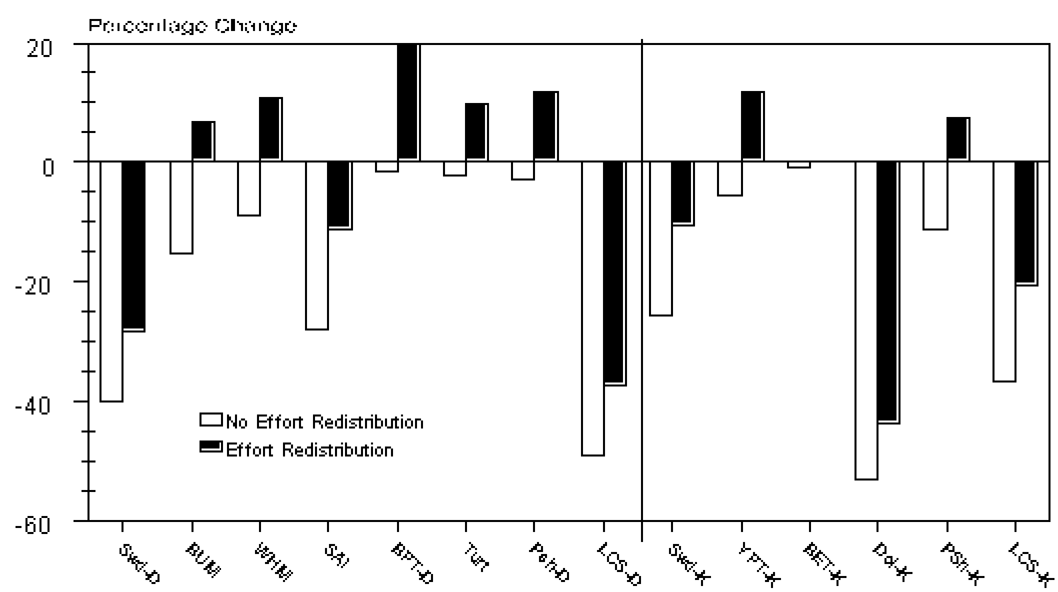
(B) Percent change for closure of GulfC (central and western Gulf of Mexico, see Figure 7.4), for March through September.



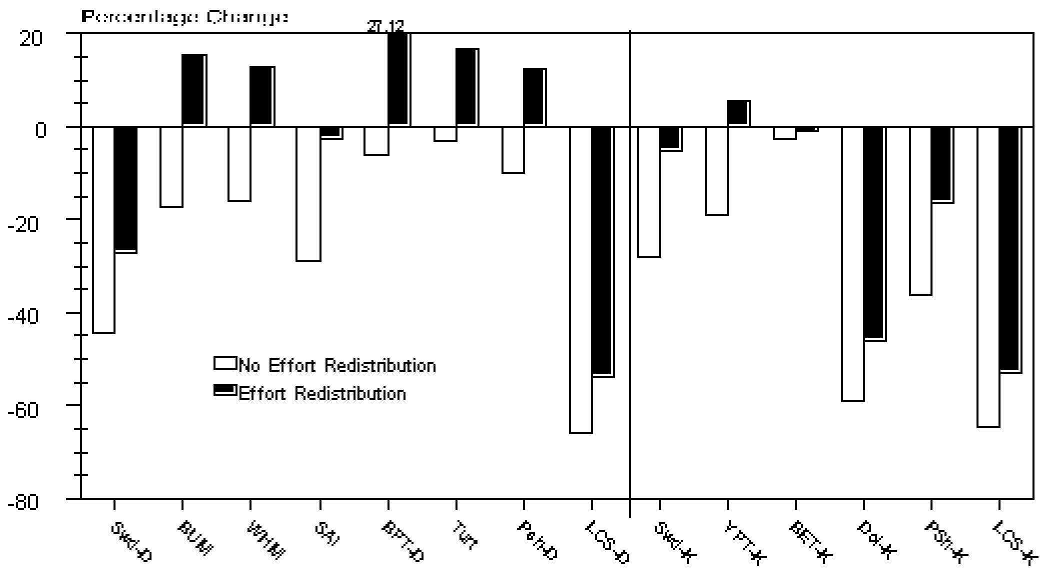
(C) Percent change for closure of DeSoto Canyon (northeastern Gulf of Mexico, see Figure 7.10), year-round.



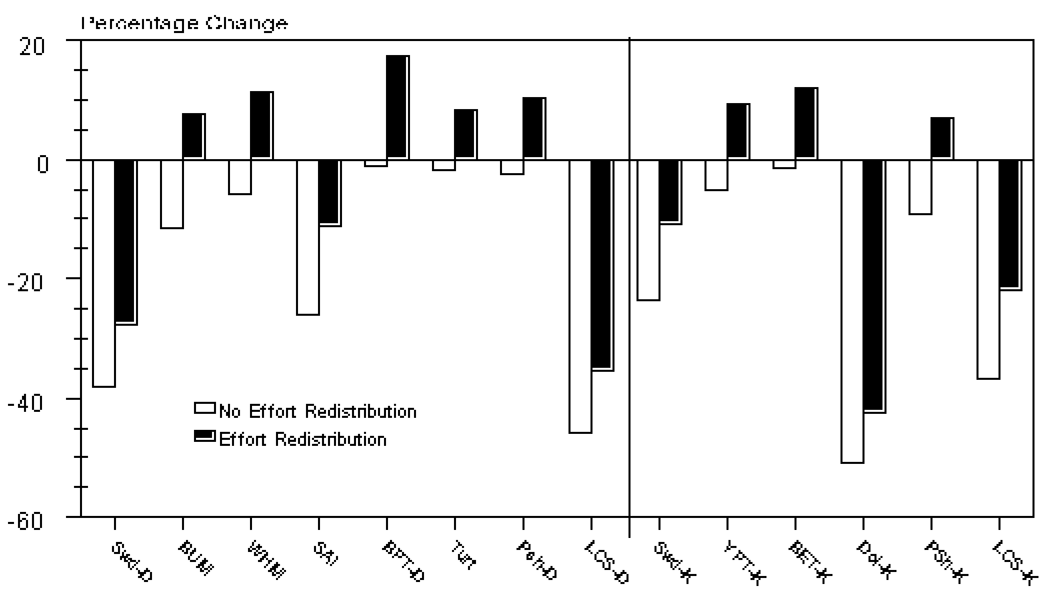
(D) Percent change for closure of SAtlC (see map Figure 7.4), year-round.



(E) Percent change for closure of SAtlB (see map, Figure 7.6), year-round.



(F) Percent change for closure of SAtlE (see map, Figure 7.2), year-round.



Ecological Effects Due to Changes in Bycatch of Those Species

Little is known about the effects of HMS population dynamics on the Atlantic and Gulf of Mexico ecosystems. While it is clear that because many HMS are apex predators, they are dependent on abundant prey sources, it is not clear how an increase or decrease in HMS stock levels can affect other species. For example, some species of adult sharks are known to prey on juvenile sharks. One could imagine that healthy stocks could then "feed" themselves to some extent. However, the ecological effects of taking marine mammals or sea turtles from the system are not known. In this document, NMFS provides general information about trends in pelagic longline catches that result from each combination of time/area closures.

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

In the analysis of the following options using the effort distribution model, the change in turtle interactions must be carefully considered due to the fact that the Atlantic pelagic longline fleet exceeded its incidental take levels for 1999, as summarized in Section 5.8. The ESA Section 7 consultation resulted in a draft Biological Opinion (BO) indicating that continued operation of the pelagic longline fishery is likely to jeopardize the continued existence of loggerhead sea turtles. A final BO is expected by late June 2000. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. NMFS has initiated efforts to address the BO, including possible regulatory and non-regulatory actions. It should be noted, however, that turtle bycatch rates may be over-estimated by the effort redistribution model because the model assumed catch-per-unit-effort in the remaining open areas was constant. Thus, if species are concentrated in one area (e.g. sea turtles in the Grand Banks), rather than evenly distributed over the entire open area, the results could be skewed. Nevertheless, the finding in the early June 2000 draft BO is based on take that occurred before these final actions.

Effects on Marine Mammals and Sea Birds

Given existing observer data, any of these closures might increase takes of marine mammals if fishing effort concentrates in the Mid-Atlantic Bight area, where most takes of mammals are observed. Figure A1 in Appendix A indicates locations of observed marine mammal takes in 1995-1997 in relation to the final time/area closures identified in this document. Many marine mammals are encountered in the Mid-Atlantic Bight area. If fishermen who currently fish in closed areas redistribute their effort north of the closed South Atlantic Bight area, marine mammal takes are likely to increase because effort might be concentrated in the Mid-Atlantic Bight (i.e., the closest area to their traditional fishing grounds). However, if those fishermen's sets are replaced with sets in the Northeast Coastal or Northeast Distant areas (Appendix A), marine mammal takes could remain constant. NMFS cannot estimate the actual distribution of sets that will result from these alternatives but it is likely that some sets will take place in the Mid-Atlantic Bight, some sets will be made in high seas areas, and some sets will be redistributed farther north along the coast.

Effort redistribution is an important factor because NMFS is currently developing serious injury guidelines in order to estimate post-release mortality associated with marine mammal interactions. NMFS intends to re-convene the Atlantic Offshore Cetacean Take Reduction Team in the future and they might be faced with an added challenge of further reducing takes of strategic stocks.

The net effect of the various time/area options on sea birds is unknown, given the limited number of interactions provided in the existing observer data for the Atlantic pelagic longline fishery. In 1997-1998, pelagic longline fishermen were observed taking 41 sea birds, in areas that ranged from the Northeast Coastal area (see Appendix A) to the South Atlantic Bight. None were observed taken in the Gulf of Mexico. By re-distributing effort out of the Gulf of Mexico, there might be more sea birds taken than with the status quo management scheme. Closing the South Atlantic Bight area would likely result in redistributed effort farther north along the Atlantic Coast where bird takes are about equal (19 birds taken in South Atlantic Bight vs. 22 birds taken in Mid-Atlantic Bight and Northeast Coastal-Appendix B, Table 4). However, in observer data collected from July 1990-June 1997, more birds were taken in the Mid-Atlantic Bight and Northeast Coastal areas (25 birds), than in the South Atlantic Bight area (8 birds- Appendix A, Table 5).

Effects on Essential Fish Habitat

The HMS FMP and Amendment One to the Atlantic Billfish FMP state that Atlantic HMS occupy pelagic oceanic environments, which is the general operational range of the U.S. Atlantic pelagic longline fishery. The HMS FMP describes habitat damage by pelagic longlines as negligible to the pelagic environment. Time/area closures are not anticipated to have a negative effect on the EFH for Atlantic HMS and might be beneficial to the ecosystem in the closed area because pelagic longline bycatch would be reduced, enhancing survival rates of juveniles, sub-adults and reproductive fish.

Changes in Fishing, Processing, Disposal, and Marketing Costs

A time/area closure would result in changes in fishing, processing, and marketing practices and costs because effort is redistributed and fishermen might need to sell their catch to previously unknown dealers. Time/area closures will affect fishing costs of vessels, as they must travel to further sites (either for each trip or for the season). Thus, fuel and moorage costs could possibly increase. Because some fishermen currently have strong financial and loyalty links to their dealers, time/area closures could affect both dealers and fishermen from both economic and social aspects. The long-standing relationships between certain vessel operators and dealers at specific locations can provide financial benefits to both parties. Time/area closures, therefore, afford reduced certainty to dealers (supply of raw product) and a lack of a credit source (or other services) for vessel operators. Some fishermen might continue to sell to their original buyer; however, transport costs for the catch might increase.

The secondary processing firms are not likely to be affected as much by any of the closure alternatives if they currently depend on imported swordfish, tunas, or sharks throughout the year when the domestic fishery cannot provide a steady supply. If they do not currently work with these imported species, it is possible they would be able to replace their domestic fish supply with imports or with fish caught in open areas. Most of these firms handle species caught in other fisheries as well, which also provides them some flexibility.

Closure of any of the areas considered in the South Atlantic Bight will likely have a significant effect on what appears to be a high-quality niche market that Florida longline boats have enjoyed in the past five or more years. These boats take relatively short fishing trips and sell high-quality swordfish to dealers. Any of the alternatives are likely to cause dealers to shift their geographic location and their marketing strategies to accommodate for catches farther north. In addition, NMFS expects that dealers may encourage vessels that have previously taken longline trips of longer duration to take shorter trips in order to reap the higher prices in this niche market.

Changes in Fishing Practices and Behavior of Fishermen

As a result of time/area closures, pelagic longline fishermen might: 1) quit fishing for HMS and sell their limited access permits for shark, swordfish, and tunas, 2) relocate their homeport in order to fish for HMS in an open area, or 3) travel farther from their current homeport to fish. Because of the size of some of the vessels that currently fish in the South Atlantic Bight swordfish longline sector, it is unlikely that many of these vessels would move to fish farther offshore in an open area. The east coast of Florida is a unique area in that the Gulf Stream flows close to shore and the fishery is available to smaller longline vessels.

In the short-term, the vessels that have fished in any closed area during that time of year may cease longline fishing for that time period or rely on other forms of income, including other commercial fishing operations or shoreside industries. However, at a recent HMS AP meeting, industry representatives advised NMFS that fishermen should be expected to redistribute fishing effort as a result of a time/area closure. The analyses provided herein provide an estimate of the net effects. However, exact prediction of fishing effort redistribution in response to regulatory actions is difficult (Cramer and Scott, 1998, Curtis, 1999).

Changes in Research, Administration, and Management Effectiveness

A time/area closure will increase research, administration, and enforcement costs, due largely to evaluating and monitoring the final action closure. The primary mechanism for monitoring pelagic longline activity will be through implementation of a Vessel Monitoring System (VMS) program for the entire pelagic longline fleet, developed as part of the HMS FMP. All pelagic longline vessels will be required to be equipped with an operational VMS unit by September 1, 2000. Those costs associated with enforcement are already considered under the HMS FMP and its implementing regulations. The evaluation and monitoring program would require increased efforts to provide spatial analysis of the pelagic longline catch and discard database.

Implementing a fleet-wide VMS program has substantial initial administration and enforcement costs; however, once the program is established, its capabilities will allow for more effective use of limited assets to enforce the closed areas.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

All time/area closure alternatives (except *Status Quo*) would likely have significant economic impacts on the South Atlantic swordfish longline sector and the Gulf of Mexico tuna longline sector (see Section 6.0 for details of these fleets, and Sections 8.0 and 9. 0 for additional information on economic and social impacts). Specific impacts for each time/area alternative are discussed below.

Under a 1999 ICCAT recommendation, U.S. fishermen have a dead discard allowance for North Atlantic swordfish of 320 mt in 2000, 240 mt in 2001 and 160 mt in 2002. If fishing activity results in an amount of dead discards in excess of the allowance, then the country must deduct the amount of excess from its allocation of catch that can be retained in the following year. During the 1998 calendar year, a total of 443 mt of swordfish were reported discarded by U.S. fishermen in the North Atlantic. Under the time/area strategy of the final action, for example, the no redistribution model indicates swordfish bycatch reduction of 42% and with effort redistribution, swordfish discards may decrease by 31%. In the first year of the closures, it is expected that the dead discard allowance would not be exceeded (assuming some proportion of the swordfish bycatch is released alive) as a result of implementation of the final time/area closure. Therefore, time/area closures reduce swordfish bycatch and may help mitigate the effects of counting dead discards against the quota, in 2000 and future years.

Although the objectives of the final rule for developing time/area closures for pelagic longline fishing did not address the recreational fishing component of HMS management, the closures may provide localized increases in recreational opportunities for Atlantic billfish or other HMS, which may lead to an increase in economic benefits and greater angler satisfaction. In the United States, Atlantic blue marlin, Atlantic white marlin, west Atlantic sailfish and longbill spearfish can be landed only by recreational fishermen fishing from either private vessels or charterboats. Recreational angling for Atlantic billfish can be further sub-divided into tournament and non-tournament trips. The total population of billfish anglers has not been quantified; available estimates are based on expansion techniques of recreational fishing databases. Fisher and Ditton (1992) estimated that there were 7,915 U.S. tournament billfish anglers in the west Atlantic Ocean during 1989, making a total of 102,895 billfish fishing trips (90 percent confidence interval = 6,512), including tournament and non-tournament participation. More recently, Ditton and Stoll (1998) reported in summarizing an analysis by the American Sportfishing Association of the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, that 230,000 anglers in the United States spent 2,136,899 days fishing for various billfish species. They noted that the ten states with the highest number of billfish anglers were: 1. Florida (159,575); 2. California (31,162); 3. North Carolina (30,071); 4. Hawaii (26,588); 5. Texas

(23,714); 6. New Jersey (17,687); 7. New York (12,671); 8. South Carolina (numbers not available); 9. Maryland (9,959); and 10. Delaware (8,666).

Fisher and Ditton (1992) completed an inventory of 359 billfish tournaments held in 1989 along the U.S. Atlantic coast, including the Gulf of Mexico, as well as Puerto Rico and the U.S. Virgin Islands. A total of 1,984 billfish anglers were surveyed, with 1,171 anglers responding. Respondents reported spending an average of $1,601 (excluding tournament fees) for a billfish fishing trip that lasted an average of 2.59 days, with an average of 13 trips taken each year. The average amount spent annually on billfish tournament fees was $1,856, or $546 per tournament, giving a $2,147 total expenditure per angler per trip. The total annual expenditure estimates generated from the Fisher and Ditton study indicated that in 1989, billfish tournament anglers spent an estimated $180 million in attempting to catch billfish (tournament and non-tournament trips), giving an average equivalent expenditure of $4,242 for each fish caught or $32,381 for each billfish landed. Ditton (1996) reported that the annual net economic benefits for the group surveyed was over $2 million. Fisher and Ditton estimated that there were 7,915 U.S. tournament billfish anglers, which translates to a $262 annual consumers surplus per billfish angler.

Ditton and Clark (1994) provided a description of the economics associated with recreational billfish anglers participating in at least one of 14 billfish tournaments held between August 1991 and October 1992 in Puerto Rico. A total of 885 residents (of an estimated 1,475 resident billfish participants) and 154 non-resident anglers (82 were from the mainland United States or U.S. Virgin Islands; 72 were from other countries) were surveyed. Trip expenditures per resident averaged $711 per trip (average of 21 trips/year) and $3,945 for non-resident anglers fishing in Puerto Rico (average 7 billfish trips/year in Puerto Rico). Resident angler expenditures averaged $1,963 per billfish caught, while expenditures for non-residents averaged $2,132 per billfish caught. Ditton and Clark (1994) estimated the net economic benefits per trip at $549, yielding total annual net economic benefits of $18 million. Total resident and non-resident (U.S. citizens and foreign countries) angling expenditures were over $21 million and $4 million, respectively.

Social Effects

Time/area closures might have adverse social impacts on the Gulf of Mexico tuna longline sector as well as the South Atlantic swordfish sector. In particular, the pelagic longline communities in Florida are likely to disintegrate if fishermen choose to quit commercial fishing or pursue fishing with other gears and/or other areas. In effect, a year-round closure of this fishery may eliminate the local pelagic longline fishery, but could relocate it elsewhere. Therefore, social impacts from this alternative might be mitigated by the transfer of pelagic longline families to existing pelagic longline communities farther north along the coast. Further, the alternative might have indirect adverse social impacts on the Mid-Atlantic tuna/swordfish sector if fishing grounds are crowded or there is increased competition for the swordfish or tuna market locally. Many fishermen would suffer economic and social impacts of large closure areas. Communities along the Gulf of Mexico and Southeast U.S. Atlantic coasts are dependent on fishing, and fishermen might not want to move out of these communities as a result of the closure to pelagic longline fishing. For many of these fishermen, their boats are probably not large enough to fish longer trips farther from shore. Instead, these fishermen may pursue other commercial fisheries in which they hold permits or other non-fishing activities. Fishermen who exit the fishery may receive some compensation from the sale of their limited access swordfish, shark, and tuna permits, currently estimated to be worth $10,000 for a directed fishing permit.

Time/area closures might reduce user-group conflicts between recreational and commercial fisheries, particularly for Atlantic billfish fishermen in the Gulf of Mexico. The issue of user-conflicts was one of the major problems identified in the 1988 Atlantic Billfish FMP. The recreational billfish fishery has grown in size and value over the past decade, although many anglers have increased their efforts outside the United States to locations with greater fishing success. Any management measure leading to a reduction in bycatch of billfish from commercial fishing gear may lead to localized increased angler success (Pepperell, 1999), satisfaction, and resultant social and economic benefits to associated U.S. recreational industries, as discussed above.

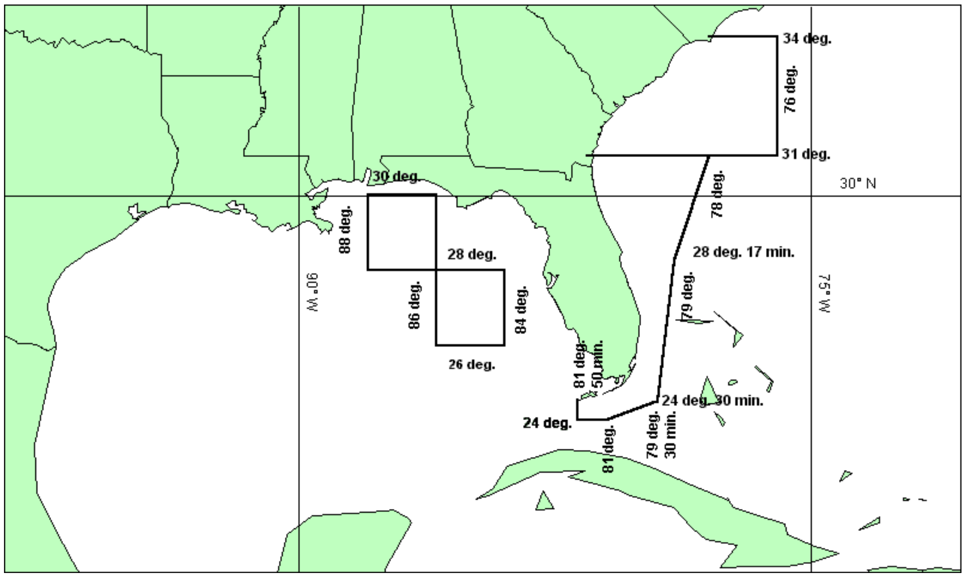
Environmental Justice Issues

Executive Order 12898 requires that federal actions address environmental justice in the decision making process. In particular, the environmental effects of the proposed action should not have a disproportionate effect on minority and low-income communities. Time/area closures would not have any significant effects on human health. The economic and social effects would be most significant in certain communities in coastal areas adjacent to the closures. While some vessel operators and fish dealers may face significant reductions in revenues and may be forced to cease operations if alternative sources of fishing gross revenues are not available or feasible, the economic effects would not fall disproportionately on minority or low income communities.

The following time/area options examine the varying ecological, economic, and social impacts of closures of Gulf of Mexico and southeastern U.S. Atlantic coastal waters.

Final Action: Closure of the DeSoto Canyon area and the East Florida Coast area year-round; Closure of the Charleston Bump area February 1-April 30.

Figure 7.2. Geographic boundaries for DeSoto Canyon, East Florida Coast and Charleston Bump.



Background and Summary of Additional Analytical Procedures

During the comment period for the proposed HMS bycatch rule, NMFS received many comments indicating that the DeSoto Canyon area located in the eastern Gulf of Mexico should be closed to pelagic longline effort due to the historically high occurrence of undersized swordfish in that location. Although NMFS had analyzed closures in the Gulf of Mexico in the November 1999 Draft Technical Memorandum which encompassed the DeSoto Canyon sub-region, NMFS responded to this comment by preparing an April 26, 2000, federal register notice (65 FR 24440), including a summary of biological, economic, and social impacts associated with closure of this area. Briefly, procedural methods involved examining logbook information dating back to 1993 (1995 was used in the previous analysis) through 1998 (which was unavailable at the time the proposed rule was prepared) for the area bounded by 84°W to 90°W longitude and 26°N to 30°N latitude. This large area in the northeastern Gulf of Mexico was then subset into 2° X 2° (latitude X longitude) blocks, noting inter-annual and intra-annual changes of target and discard catch-per-unit-effort and ratios of target catch to discards, where appropriate (e.g., swordfish kept vs. swordfish discarded). Following this procedure, two blocks were identified for potential year-round closure: 86°W to 88°W longitude and 28°N to 30°N latitude; and 84°W to 86°W longitude and 26°N to 28°N latitude. A summary of pelagic longline catch and discards of swordfish in these areas between 1993 and 1998 is provided in Table 7.2. The northwest block of the DeSoto Canyon area falls within the GulfC closure. The lower, southeastern block of the DeSoto Canyon is located within the GulfD area, which was examined in the Draft

Technical Memorandum, which was made available to the general public in November 1999, and was included as an attachment to the DSEIS.

Table 7.2. Summary of the annual (1993 through 1998) number of swordfish kept and discarded, number of hooks used, and annual ratio of swordfish kept to swordfish discarded from the two blocks identified for closure in the northeastern Gulf of Mexico (DeSoto Canyon).

Year	Swordfish Kept	Swordfish Discarded	Ratio Kept/Discarded	Number of Hooks
1993	1,685	2,370	0.71	482,881
1994	1,630	3,816	0.43	464,803
1995	1,125	1,195	0.94	312,172
1996	2,769	1,983	1.40	354,307
1997	182	1,188	1.50	272,737
1998	968	476	2.03	233,495
Total	9,959	11,028	0.90	211,395

Comments on the proposed rule and DSEIS also indicated that the proposed closures along the U.S. southeast Atlantic coast would have a significant economic and social impact on pelagic longline vessels and on shore-side businesses that operate in the area. There was also concern voiced regarding the biological, social and economic impacts of vessels that displace effort into areas open to fishing. The level of turtle takes by the pelagic longline fishery, particularly from the Northeast Distant area also provided further rationale for examining strategies that would reduce the level of effort redistribution, particularly in the fall months. To respond to these concerns, an evaluation was made of the catch patterns within the SAtlE to determine if changes could be made to the temporal and/or spatial components of this closure that would address the four over-arching objectives of the FSEIS, *but at the same time*, minimize economic and social impacts related to effort redistribution.

After a qualitative review of the logbook information from pelagic longline sets made in SAtlE over the four year period between 1995 through 1998, the area was sub-divided into two smaller areas separated at the 31ºN latitude line (slightly north of the Florida/Georgia border). The U.S. coastline remains as the western border of the closures; the eastern boundaries of SAtlE also remain unchanged. For ease in reference, the northern area of SAtlE between 31ºN and 34ºN will be designated as the "Charleston Bump" area and the area south of 31ºN will be referred to as the "East Florida Coast" closure. Monthly patterns of effort (number of hooks), swordfish kept, swordfish discarded, catch-per-unit-effort, ratio of swordfish kept to swordfish discarded, and monthly total discards as a percent of the total annual discards were summarized for the two areas to assist in the process of identifying any patterns that could be used to reduce the time an area is closed, while still achieving the objectives of the agency action (Table 7.3 and Table 7.4).

Table 7.3. Summary of monthly catch and discards of swordfish between 1995 through 1998 in the Charleston Bump area.

Month	Number of Hooks	Swd Kept	Swd Discarded	Swd Kept CPUE x 1000 hooks	Swd Discard CPUE x 1000 hooks	Ratio Kept/Discard	Percent of Area Annual Discards
Jan	226,459	566	329	2.50	1.45	1.72	5.1
Feb	293,918	1842	1079	6.27	3.67	1.71	16.7
Mar	471,423	3850	2634	8.17	5.59	1.46	40.7
Apr	325,295	1532	989	4.71	3.04	1.55	15.3
May	345,522	1384	506	4.00	1.46	2.73	7.8
June	233,423	1160	312	5.00	1.34	3.72	4.8
July	60,043	316	124	5.26	2.06	2.55	1.9
Aug	20,712	185	44	8.93	2.12	4.20	0.7
Sept	16,603	145	15	8.73	0.90	9.67	0.2
Oct	28,464	289	205	10.15	7.20	1.41	3.2
Nov	15,340	164	116	10.69	7.56	1.41	1.8
Dec	20,335	156	113	7.67	5.56	1.38	1.7
Total	2,057,537	11,589	6466	5.63	3.14	1.79	

Table 7.4. Summary of monthly catch and discards of swordfish between 1995 through 1998 in the East Florida Coast area.

Month	Hooks x 1000	Swd Kept	Swd Discarded	Swd Kept CPUE x 1000 hooks	Swd Discard CPUE x 1000 hooks	Ratio Kept/Discard	Percent of Area Annual Discards
Jan	215,874	2859	2337	13.24	10.83	1.22	7.8
Feb	201,966	1805	1485	8.94	7.35	1.22	4.9
Mar	243,922	3266	2441	13.39	10.01	1.34	8.1
Apr	366,192	4183	2232	11.42	6.09	1.87	7.4
May	452,945	4115	2070	9.08	4.57	1.99	6.9
June	355,864	5518	2410	15.51	6.77	2.29	8.0
July	315,727	4923	2148	15.59	6.80	2.29	7.1
Aug	297,399	5296	3060	17.81	10.30	1.73	10.2
Sept	258,314	6490	3104	26.87	12.02	2.24	10.3
Oct	337,472	8063	4057	23.89	12.02	1.99	13.5
Nov	203,898	4097	2284	20.09	11.20	1.79	7.6
Dec	229,280	4124	2421	18.00	10.56	1.70	8.0
Total	3,478,853	55,189	30,049	15.87	8.64	1.84	

The information provided in Tables 7.3 and 7.4 was examined to determine the number of swordfish landed and discarded, both in terms of numerical dominance and in catch-per-unit-effort. Temporal variations in the ratio of swordfish kept to swordfish discarded were also evaluated to identify times of the year when more swordfish are discarded relative to the number kept. A total of six temporal and spatial alternatives to the SAtlE closure were identified from this evaluation process (Table 7.5).

Table 7.5. Closure alternatives for the Charleston Bump and East Florida Coast sub-areas of SAtlE. Months open to fishing are shaded and designated with a "O"; months closed to pelagic longline fishing are designated with a "C."

Closure Options		J	F	M	A	M	J	J	A	S	O	N	D
Alternative 1: SAtlE Jan to Dec *Closed 12 months*		C	C	C	C	C	C	C	C	C	C	C	C
Alternative 2: SAtlE Nov to April *Closed 6 months*		C	C	C	C							C	C
Alternative 3: N of 31 N: Open	N	O	O	O	O	O	O	O	O	O	O	O	O
S: of 31 N: Closed *Some area open all year*	S	C	C	C	C	C	C	C	C	C	C	C	C
Alternative 4: N of 31 N: Feb-May	N	O	C	C	C	C	O	O	O	O	O	O	O
S: of 31 N: Nov - Apr *Closed 3 months*	S	C	C	C	C	O	O	O	O	O	O	C	C
Alternative 5: N of 31 N: Feb-July	N	O	C	C	C	C	C	C	O	O	O	O	O
S: of 31 N: Aug-Jan *Some area open all year*	S	C	O	O	O	O	O	O	C	C	C	C	C
Alternative 6: N of 31 N: Feb-Apr	N	O	C	C	C	O	O	O	O	O	O	O	O
S: of 31 N: All year *Closed 3 months*	S	C	C	C	C	C	C	C	C	C	C	C	C

The next step in identifying a subset alternative to the SAtlE area was to apply the no effort redistribution and effort redistribution models to each of the five alternatives to determine if any of the subsets provided similar bycatch and incidental catch reductions (Objective 1), minimally impacted target catch (Objective 2), and altered incidental catches of other species (Objective 3). The results of the two models are presented in Table 7.6. For each species, the "best" alternative to the SAtlE closure, in terms of meeting the objectives of the FSEIS, is shaded.

Following this iterative process, Alternative 6 (Closure of Charleston Bump during February through April, and East Florida Coast year-round) provided results most similar to SAtlE in terms of reducing swordfish discards and maintaining catch of target species of swordfish and

BAYS tunas. Under the effort redistribution model, the final action was better than the preferred southeastern Atlantic closure identified in the DSEIS (SAtlE) in reducing sailfish discards, and did not increase bycatch of blue marlin, white marlin, and turtles to the degree expected under the preferred alternative of the proposed rule. Target catch of dolphin and large coastal sharks were also less impacted by final action than by the preferred alternative in the DSEIS.

Table 7.6. Comparison of time-area options under no effort redistribution and effort redistribution models.

Area/ Alternatives	Portion of Catch Attempting to Reduce								Minimize Impacts on this Portion of Catch				
	Swd discard	BUM discard	WHM discard	SAI discard	BFT discard	Turtle caught	P.sharks discard	LCS discard	Swd kept	BAYS kept	Dolphin kept	P. sharks kept	LCS kept
No Displacement Model: 1995 through 1998													
1) SAtlE closed all year	-38.03	-11.36	-5.94	-25.82	-0.93	-1.86	-2.29	-45.81	-23.67	-4.00	-50.86	-9.03	-36.61
2) SAtlE closed Nov - April	-19.23	-3.15	-2.03	-5.22	-0.41	-0.72	-1.65	-22.71	-10.08	-2.33	-7.24	-5.44	-26.98
3) N: open all year S: Closed all year	-31.30	-10.20	-3.80	-23.94	-0.67	-1.46	-1.13	-29.96	-19.56	-1.36	-23.56	-5.24	-19.56
4)N: closed Feb-May S: closed Nov-Apr	-19.17	-3.39	-2.59	-5.59	-0.27	-0.68	-1.43	-20.00	-7.40	-2.54	-22.39	-4.93	-21.76
5)N: closed Feb-July S: closed Aug to Jan	-14.70	-6.01	-3.10	-11.36	-0.37	-0.82	-1.34	-23.25	-14.70	-3.13	-28.56	-4.51	-12.59
6) N: closed Feb-Apr S: Closed all year	-36.20	-10.56	-4.54	-24.38	-0.70	-1.65	-1.83	-36.55	-22.02	-3.21	-26.60	-7.10	-26.50
Displacement Model 1995 through 1998													
1) SAtlE closed all year	-27.69	7.74	11.40	-11.30	17.31	8.41	10.18	-35.53	-10.76	10.42	-42.56	7.00	-22.05

Area/ Alternatives	Portion of Catch Attempting to Reduce								Minimize Impacts on this Portion of Catch				
	Swd discard	BUM discard	WHM discard	SAI discard	BFT discard	Turtle caught	P.sharks discard	LCS discard	Swd kept	BAYS kept	Dolphin kept	P. sharks kept	LCS kept
2) SAtlE closed Nov - April	-13.21	8.67	6.75	1.11	2.16	1.12	2.47	-18.04	-2.44	3.46	-5.33	2.46	-17.91
3) N: open all year S: Closed all year	-24.69	-0.64	5.85	-16.08	9.56	6.49	8.17	-22.56	-12.02	8.31	-15.01	4.23	-11.73
4)N: closed Feb-May S: closed Nov-Apr	-13.04	9.12	6.95	2.24	2.73	1.09	2.60	-14.18	-2.73	3.56	-18.57	3.66	-12.02
5)N: closed Feb-July S: closed Aug to Jan	-16.36	3.63	5.70	-3.70	6.71	5.24	6.92	-15.82	-6.61	5.36	-22.79	4.12	-3.97
6) N: closed Feb-Apr S: Closed all year	-27.32	5.36	9.71	-13.20	10.75	7.13	8.45	-27.86	-11.29	8.33	-16.44	5.89	-14.74

Population Effects on Bycatch Species

The DeSoto Canyon area would eliminate approximately 32,860 nm^2 miles of ocean to the use of pelagic longline gear by U.S. commercial fishermen (Figure 7.2). The DeSoto Canyon portion of this final action would result in the following changes in bycatch under the **no effort redistribution** model: swordfish discards reduced by 5%, blue and white marlin discards reduced by 1 and 2% , respectively, and sailfish discards reduced by 5%. This closed area has virtually no effect, positive or negative on sea turtle populations if fishing effort is not redistributed. Target catch of swordfish, BAYS tunas, and pelagic sharks would all be reduced by approximately 2%. Under the **effort redistribution** model, the DeSoto Canyon portion of this final action would have the following results: swordfish discards reduced by 4%, blue and white marlin increased by 1% each, and sailfish discards reduced by 1%. This closed area would not have any population effects on sea turtles if it is assumed that fishing effort is redistributed throughout the Gulf of Mexico. Target catch of swordfish, dolphin and pelagic sharks would all be reduced by less than 2%, while catches of yellowfin tuna would increase by nearly 2%.

The DeSoto Canyon closure will be implemented on November 1, 2000, or approximately 90 days after the target date for publication of the final rule on August 1, 2000. The three month delay in implementing the year-round closure in this area to allow affected businesses to move their base of operation will potentially result in additional discards of approximately 140 swordfish, 10 blue marlin, 8 sailfish, and 15 white marlin, based on average annual discards of these species for August through October. Delay of the closure will also allow additional retention of target catches of swordfish (260 fish) and yellowfin tuna (550 fish), again based on average landings for this three month period.

The Charleston Bump area is approximately 49,090 nm^2 of ocean and the East Florida Coast area is approximately 50,720 nm^2 of ocean (Figure 7.2). Collectively, the year-round closure of the East Florida Coast and the February through April closure of the Charleston Bump areas of this final action would result in the following changes in bycatch under the **no effort redistribution** model: swordfish discards reduced by 36%, blue and white marlin discards reduced by 11 and 5%, respectively, and sailfish discards reduced by 24%. This closed area could decrease turtle interactions by 2% if we assume that fishing effort is not redistributed. Under the **effort redistribution model**, the combined Charleston Bump and East Florida Coast closures, the following results would be predicted: swordfish discards *reduced* by 27%, blue and white marlin *increased* by 5 and 10%, respectively, and sailfish discards *reduced* by 13%. This closed area could *increase* sea turtle interactions by 7% if we assume that fishing effort is redistributed throughout the Gulf of Mexico or the Atlantic Ocean, including the Caribbean Sea. Target catch would be *reduced* for swordfish (11%) and dolphin (16%), while catches of yellowfin tuna (8%), bigeye tuna (10%) and pelagic sharks (5%) would *increase*.

The Charleston Bump and East Florida Coast closures will be implemented on February 1, 2001, or approximately 180 days after the target date for publication of the final rule on August 1, 2000. The six month delay in implementing the year-round closure in this area to allow affected businesses to move their base of operation will have no impact on the Charleston Bump area, which will be closed only during February through April of each year. However, the 180-day delay in closing the East Florida Coast area could potentially result in additional discards of approximately 4300 swordfish, 125 blue marlin, 122 sailfish, and 26 white marlin, based on average annual discards of these species for the period between August through January. Delay of the closure will also allow additional retention of target catches of swordfish (7800 fish) and yellowfin tuna (300 fish), again based on average landings for this six month period.

Combined, the areas of this final action encompass approximately 132,670 nm^2 of ocean which would be closed to Atlantic pelagic longline fishermen on a seasonal basis. For the combined Gulf of Mexico (DeSoto Canyon) and southeast Atlantic coast (Charleston Bump and East Florida Coast) areas, the **no effort redistribution** model from the 1995 through 1998 pelagic logbook database resulted in the following percent reductions of incidental catch and bycatch (Figure 7.3): swordfish discards, 42%; blue marlin discards, 12%; white marlin discards, 6%; sailfish discards, 30%; bluefin tuna discards, 1% (when combined with the June closure, the net effect on bluefin tuna discards is a 54% reduction)[1]; and sea turtles, 2%. Under the no effort redistribution model, target and incidental landings are also reduced, including: swordfish, 25%; BAYS tunas, 5% (yellowfin tuna, 6%; bigeye tuna, 1%); dolphin, 30%, pelagic sharks (kept and discarded), 9% and 2%, respectively; and large coastal sharks (kept and discarded), 32% and 43%, respectively.

Under the **redistribution of effort** model for the combined Gulf of Mexico and southeast U.S. Atlantic coast areas, the final action *reduced* swordfish discards by 31% and sailfish discards by 14%. The discards of blue marlin and white marlin *increased* by 7% and 11%, respectively, when effort was redistributed from the closed areas. Bluefin tuna discards also increased by 11% when pelagic longline effort was randomly redistributed throughout the operational range of the U.S. Atlantic pelagic longline fishery; however when combined with the June closure, the *net effect* on bluefin tuna is a 39% *reduction* in discards. Target landings of swordfish were *reduced* under this closure alternative (13%), as were dolphin (18%), but landings of several target species *increased* when pelagic longline effort was redistributed, including BAYS tunas (10%) , and pelagic sharks (4%). The incidental catch of sea turtles also increased (7%) with pelagic longline effort redistribution. However, the effort redistribution model will tend to over-estimate changes in catch for species with non-random distributions (e.g., turtles in the Grand Banks area) as previously explained. Comments received on the proposed rule concur with NMFS that many of the displaced vessels are too small to fish with pelagic longline gear in areas of high turtle concentrations (e.g., the Grand Banks). Therefore, a 7% increase in turtle takes is expected to be the *maximum* increase.

Blue marlin, white marlin and sailfish discard rates generally increase when effort is redistributed from the closed areas along the SE U.S. Atlantic coast to the remaining open areas of the Atlantic and Gulf of Mexico, including locations of relatively high CPUE for billfish. Blue marlin bycatch

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[1]In the draft SEIS, the reduction in bluefin tuna discards was inflated because the analysis included the existing time/area closure off the Mid-Atlantic coast, as discussed above. This analysis separates out that closed area in order for the reader to differentiate the results of each closed area/combination.

rates may be over-estimated by the effort redistribution model because calculation of CPUE in the remaining open areas assumes the species distribution is constant. If the species is concentrated in one area, rather than evenly distributed over the entire open area, results could be skewed. Pelagic longline effort in the Caribbean (fishing areas below 22ºN latitude) represents approximately 14.7 percent of the total U.S. Atlantic-wide fishing effort, but accounts for 50% of the total blue marlin discards. These areas were not considered for closure since they are generally located outside U.S. EEZ waters. Closures were limited to the U.S. EEZ to maximize the impact of the closure on all sources of fishing mortality (i.e., both domestic and foreign). Therefore, it is likely that the no effort redistribution model would be more applicable for blue marlin (12 percent reduction in discards). Although white marlin discards were less concentrated in the Caribbean (32% of total Atlantic-wide levels), it is likely that the effort redistribution model also overestimated the impact of shifting pelagic longline effort, particularly in consideration of the size of vessel affected. Pelagic longline vessels fishing from the east coast of Florida to North Carolina are generally smaller than in other areas along the eastern seaboard, with vessel lengths generally 50 feet or smaller (Figure 6.4). Due to the distance of these areas from the continental United States and the size of many of the vessels operating off Florida, Georgia and South Carolina, it seems unlikely that much effort from the SE U.S. would be redistributed into the open Caribbean or southwest Atlantic Ocean. Therefore, the impact of effort redistribution on Atlantic billfish discards may be lower than that predicted by the effort redistribution model. Table 7.7 shows the estimated change in total weight (lbs) of target catch estimated by the model from reported levels for 1995 through 1998 through the pelagic logbook system.

Figure 7.3 **Percent change in catch resulting from DeSoto Canyon, Charleston Bump and East Florida Coast closures, 1995 through 1998.** Swd-swordfish, BFT-bluefin tuna, BUM-blue marlin, WHM-white marlin, SAI-sailfish, Psh-Pelagic sharks, LCS-large coastal sharks, Turt-turtles, YFT-yellowfin tuna, BET-bigeye tuna, Dol-dolphin, D indicates discards, K indicates fish kept.

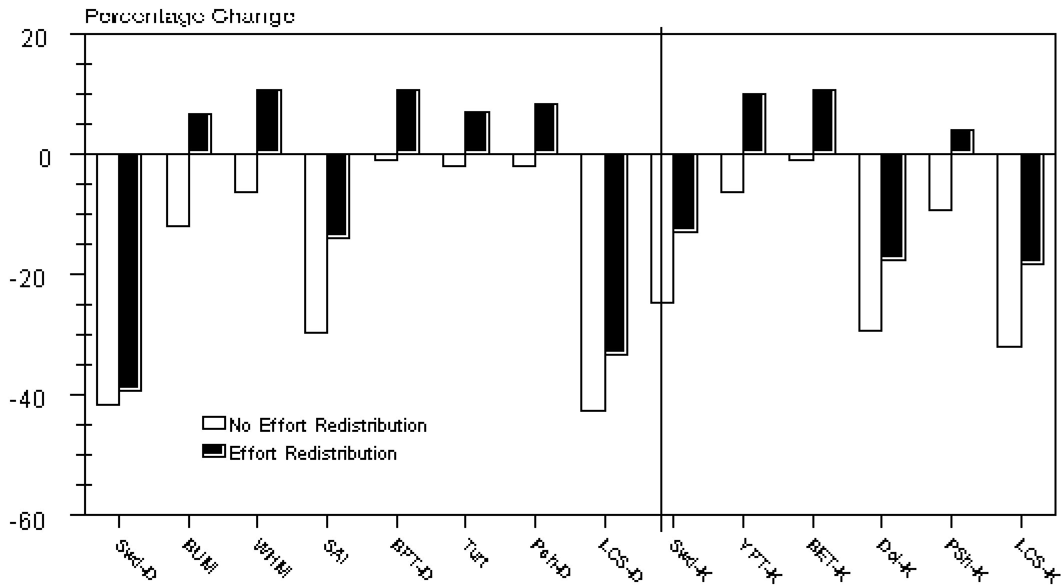


Table 7.7. **Impact of the DeSoto Canyon, Charleston Bump and East Florida Coast closures, 1995 through 1998, on the estimated weight of target catch (x 100,000 lbs) "with" and "without" redistribution of effort.**

Species	1995		1996		1997		1998	
	Without	With	Without	With	Without	With	Without	With
Swordfish	-9.65	-3.28	-14.38	-6.31	-12.77	-6.73	-16.03	-11.34
BAYS tunas	-13.08	17.10	-13.55	21.11	-9.49	22.62	-7.52	16.97
Bluefin tuna	-0.02	0.07	-0.02	0.07	-0.01	0.04	-0.01	0.05
Pelagic sharks	-1.44	0.63	-1.44	0.62	-1.19	0.62	-0.75	0.32
LCS	-11.92	-5.91	-10.56	-7.07	-3.45	-1.49	-3.48	-2.77
Dolphin	-3.08	-2.19	-1.53	-0.92	-2.38	-1.36	-0.56	-0.19
Wahoo	-0.29	0.10	-0.18	0.11	-0.21	0.15	-0.24	0.17

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

Under the no effort redistribution model, discards of swordfish would be reduced similar to levels noted for the preferred alternative identified in the DSEIS (SAtlE+GulfB). The final action closure is about half as effective in reducing the discards of blue and white marlin. However, analysis on the impact of use of live bait in the Gulf of Mexico (see final action under Section 7.2) indicates that the relatively higher incidence of billfish discards in GulfB may be a function of fishing practice (i.e., using live bait), rather than an actual reflection of higher frequency of occurrence. Prohibiting live bait may equalize much of the benefits between the GulfB and DeSoto Canyon closures, particularly for sailfish. The reduction in discards of pelagic sharks and large coastal sharks are similar between the proposed and final action closures. When effort redistribution is modeled, the DeSoto Canyon-Charleston Bump/East Florida Coast closures are more effective in reducing the discards of swordfish than the SAtlE+GulfB closure, and slightly more effective in reducing discards of sailfish. Discards of pelagic sharks and large coastal sharks will be lower under the final action that noted in the preferred alternative in the proposed rule.

The Charleston Bump/East Florida Coast closure will increase sea turtle interaction with redistribution of effort, but to a lesser degree than the year-round closure of SAtlE selected as a preferred alternative in the DSEIS. As noted in Section 5.8, NMFS reinitiated consultation under Section 7 of the ESA due to exceeding sea turtle take levels for the pelagic longline fishery in 1999. The June 2000 draft BO indicated that the continued operation of the Atlantic pelagic longline fleet is likely to jeopardize the continued existence of loggerhead turtles. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. Therefore, any increase in turtle takes as a result of effort redistribution must be carefully considered. NMFS has initiated efforts to address the BO, including possible regulatory and non-regulatory actions.

The "turtles caught" component analyzed under both the no effort redistribution and effort redistribution models, is a combination of all species of turtles reported by pelagic longline fishermen in the logbooks and identified as either released uninjured, injured or killed. To further refine the effects of the final action, the two effort models were applied to logbook information for 1995 through 1998 for loggerhead and leatherback sea turtles reported as either release uninjured, injured or killed (Table 7.8 A and B). Of the 2792 turtles interacting with pelagic longline gear between 1995 through 1998, 2504 were either leatherbacks (n=719) or loggerheads (n=1785) turtles that were reported caught but not injured. The 7.13% increase in turtle interactions predicted by the effort redistribution model (Figure 7.3) would result in an increase of 190 leatherbacks and loggerhead released unharmed, with the remainder of the impact resulting in an increase of 4 turtles injured and only 1 turtle killed, at least based on logbook reports.

Table 7.8. Impact of final time/area closures on the number of loggerhead and leatherback turtles caught and release unharmed, injured or killed on pelagic longline sets made during 1995 through 1998.

A. Charleston Bump (February through April) and East Florida Coast (year-round)

		Turtles Caught But NOT Injured		Turtles Injured		Turtles Killed	
	Turtles Caught[2]	Leather-backs	Logger-heads	Leather-backs	Logger-heads	Leather-backs	Logger-heads
Total Atlantic	2792	719	1785	3	35	10	3
No Effort Redistribution	-1.64%	-1.67%	-0.78%	0.0%	0.0%	0.0%	0.0%
Expected Change[1]	2746	707	1771	3	35	10	3
Effort Redistribution	7.13%	8.09%	7.43%	7.01%	10.78%	8.07%	17.15%
Expected Change	2991	777.2	1917.7	3.2	38.8	10.8	3.5

[1]Expected Change means the predicted change in catch (takes) based on the no effort redistribution model or effort redistribution model. Positive values for the models indicate a predicted INCREASE in catch, while negative values are indicative of a predicted DECREASE in catch. All changes are based on Atlantic-wide levels.
[2]Turtles Caught correspond to values provided Figure 7.3.

B. De Soto Canyon, closed all year.

		Turtles Caught But NOT Injured		Turtles Injured		Turtles Killed	
	Turtles Caught[2]	Leather-backs	Logger-heads	Leather-backs	Logger-heads	Leather-backs	Logger-heads
Total Atlantic	2792	719	1785	3	35	10	3
Total Gulf of Mexico	66	27	9	0	1	1	0
No Effort Redistribution	-0.29%	-0.56%	-0.06%	0.0%	-2.9%	0.0%	0.0%
Expected Change[1]	2784	715	1784	3	34	10	3
Effort Redistribution	0.0%	-0.1%	0.0%	0.0%	-2.8%	0.5%	0.0%
Expected Change	2784	718.3	1785	3	34	10	3

[1]Expected Change means the predicted change in catch (takes) based on the no effort redistribution model or effort redistribution model. Positive values for the models indicate a predicted INCREASE in catch, while negative values are indicative of a predicted DECREASE in catch. All changes are based on Atlantic-wide levels.
[2]Turtles Caught correspond to values provided Figure 7.3.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

The ex-vessel gross revenues of the pelagic longline fishery as a whole might decrease by over $7.5 million if all the effort is not redistributed (Table 7.9), which is about half the effect anticipated under similar conditions for the preferred DSEIS alternative closure of areas GulfB+SAtlE. However, if the redistribution does occur, the ex-vessel gross revenues of the fishery might increase by nearly $3 million. The actual impact of this closure is probably somewhere between these two values. In general, businesses and communities in the center of any closed area are likely to suffer the greatest loss in gross revenues while those businesses and communities along the edges of the closed area might not notice any differences. Businesses and communities outside the closed area might notice increased benefits as effort is moved to the open areas. A more complete evaluation of the economic and social impacts of the final action is provided in Sections 8.0 and 9.0, respectively, of this document based on the most conservative assumption, from an economic standpoint, of no effort redistribution.

Table 7.9. Impact on fishermen that results from the projected change in ex-vessel gross revenue based on change in number of target species caught in 1997 (in millions of dollars) for closing the Charleston Bump and East Florida Coast areas.

Species	Change in Ex-Vessel Gross Revenues (millions of $)	
	No Redistribution Model	Redistributed Effort Model
Swordfish	-4.64	-2.44
BAYS tunas	-2.35	5.61
Bluefin tuna	-0.01	0.02
Pelagic sharks	-0.09	0.05
Large Coastal Sharks	-0.19	-0.08
Dolphin	-0.35	-0.20
Wahoo	-0.04	0.03
Total	**-7.67**	**2.97**

Changes in the Distribution of Benefits and Costs

The economic impact of the final action closure on pelagic longline target species was estimated by multiplying the percent change in target catch predicted by the no redistribution and redistribution models by the total Atlantic annual catch of each species. The resultant values are summarized in Table 7.7. Negative numbers indicate fewer fish would be caught under this closure scenario, while positive numbers indicate more fish caught. Dealers outside closed areas are likely to benefit due to increased effort close to their locations. In contrast, dealers in close proximity to closed areas may be directly negatively impacted.

The dollar values in Table 7.9 represent the change in gross revenue only to fishermen. Under the redistribution model, it is likely that fishing costs would increase as well, thereby exacerbating any decrease in gross revenues. Localized increases in recreational success for billfish, tunas and swordfish are likely following reduction of pelagic longline effort in the closed areas. The analytical approach used in the FSEIS does not quantify the possible increase in recreational opportunities; therefore any potential increase in angler consumer surplus and net economic benefit cannot accurately be estimated. However, it is possible that concomitant increases in vessel manufacture and purchase, dock and fuel services, tackle and gear supplies, charters, as well as other businesses in support of the recreational fishing industry, could be experienced.

Summary

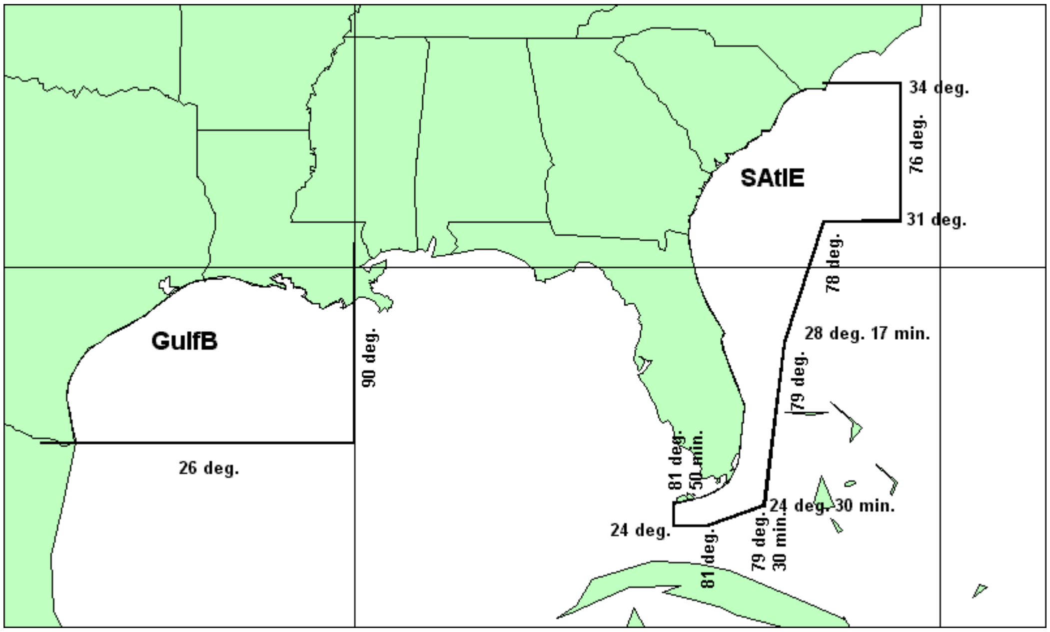
This alternative is the final action because it is effective at reducing undersized swordfish and sailfish bycatch while minimizing economic, social and community impacts, particularly on Gulf of Mexico fishermen, but also for fishermen and businesses located along the southeast U.S. Atlantic coast (because the Charleston Bump area will be open for nine months of the year). NMFS' objective is to optimize target catch while reducing bycatch and incidental catch. Under the effort redistribution model, the proposed rule would decrease discards of swordfish by 24% and sailfish by 13 %, while potentially increasing blue marlin discards by 1% and white marlin discards by 4%. The final time/area closures, in conjunction with the live bait prohibition (Section 7.2) would reduce swordfish discards by 31% and sailfish discards by 29%; blue marlin and white marlin discards could increase by 3% and 7% respectively. Target catches under the proposed agency action would reduce the number of swordfish kept by 10% and dolphin kept by 36%; landings of BAYS tunas would increase by 9%. The final action time/area closures in the DeSoto Canyon, East Florida Coast and Charleston Bump could reduce number of swordfish kept by 13% and dolphin kept by 18%, while BAYS tunas landings would increase by nearly 10%.

During the comment period for the proposed agency action, many comments were received regarding environmental justice issues, particularly for the Vietnamese American community in the Gulf of Mexico and the impact on the yellowfin tuna fishery with closure of the western Gulf. Comments from residents of SC noted a similar issue with minority workers in commercial industries that support the pelagic longline fishery in that area. NMFS has minimized the economic effects of the proposed western Gulf of Mexico closure that was specifically established to reduce billfish bycatch, by prohibiting use of live bait by pelagic longline vessels instead. Application of this gear restriction appears to be as effective in reducing sailfish discards as the western Gulf closure, and is approximately half as effective in reducing marlin discards. In consideration of the magnitude of U.S. billfish discards relative to Atlantic-wide levels and the extent of the economic impacts associated with the proposed Gulf closure, modifying fishing practices is a viable alternative that effectively addresses the objectives of the agency actions by reducing billfish bycatch, to the extent practicable, while allowing fishing to continue in the western Gulf of Mexico (see Section 7.2).

The final action also resulted in the smallest predicted increase in sea turtle interactions (7 percent) when effort is redistributed, of all the time/area alternatives considered. It should be noted, however, that turtle bycatch rates may be over-estimated by the effort redistribution model because estimation of catch-per-unit-effort assumes species are randomly distributed in the remaining open areas. The results could be skewed if species are concentrated in one area such sea turtles in the Grand Banks, rather than randomly distributed over the entire open area. Further, nearly 90 percent of all sea turtle interactions with pelagic longline gear result in release of the animal with no damage, based on information provided in the pelagic logbooks.

Rejected Option: Closure of Gulf B (March through September) and SAtlE (year-round).

Figure 7.4. Geographic boundaries for GulfB and SAtlE.



Population Effects on Bycatch Species

Closure of GulfB during March through September and SAtlE year round was identified as the preferred alternative the DSEIS and proposed rule. This alternative would close approximately 99,800 nm^2 of Atlantic Ocean and 96,500 nm^2 of Gulf of Mexico waters to the use of pelagic longline gear by U.S. commercial fishermen (Figure 7.4). The **no effort redistribution model** from the 1995 through 1998 pelagic logbook database resulted in the following percent reductions of incidental catch and bycatch (Figure 7.5): swordfish discards, 41%; blue marlin discards, 23%; white marlin discards, 19%; sailfish discards, 43%; and sea turtles, 3%. Under this model, target and incidental landings are also reduced, including: swordfish, 26%; BAYS tunas, 14% (yellowfin tuna 20% and bigeye tuna 2%); dolphin, 56%, pelagic sharks (kept and discarded), 11% and 2%, respectively; large coastal sharks (kept and discarded), 39% and 49%, respectively.

When **effort is redistributed**, the SAtlE+GulfB closure provided the following percent *reductions* in bycatch and incidental catches: swordfish discards, 24%; sailfish discards, 13%; and large coastal shark discards, 28%. The discards of blue marlin and white marlin *increased* by 1% and 4%, respectively, when effort was redistributed from the SAtlE+GulfB closure. Relative to the status quo, target landings of swordfish were *reduced* under this closure alternative (10%), as were dolphin (36%) and large coastal sharks (9%), but landings of several target species *increased* when pelagic longline effort was redistributed, including an 9% increase in BAYS tunas (yellowfin tuna 7% and bigeye tuna 12%), and a 8% increase in pelagic sharks. Under the effort redistribution model, pelagic longline encounters with sea turtles would increase by 8 %. Table 7.10 shows the estimated change in total weight (lbs) of target catch estimated by the model from levels for 1995 through 1998 in the pelagic logbooks, relative to observed levels.

Figure 7.5. Percent change in catch resulting from closure of area GulfB (March to September), SAtlE (year-round), 1995 through 1998. Swd-swordfish, BFT-bluefin tuna, BUM-blue marlin, WHM-white marlin, SAI-sailfish, Psh-Pelagic sharks, LCS-large coastal sharks, Turt-turtles, Dol-dolphin, YFT- yellowfin tuna, BET-bigeye tuna, D indicates discards, K indicates fish kept.

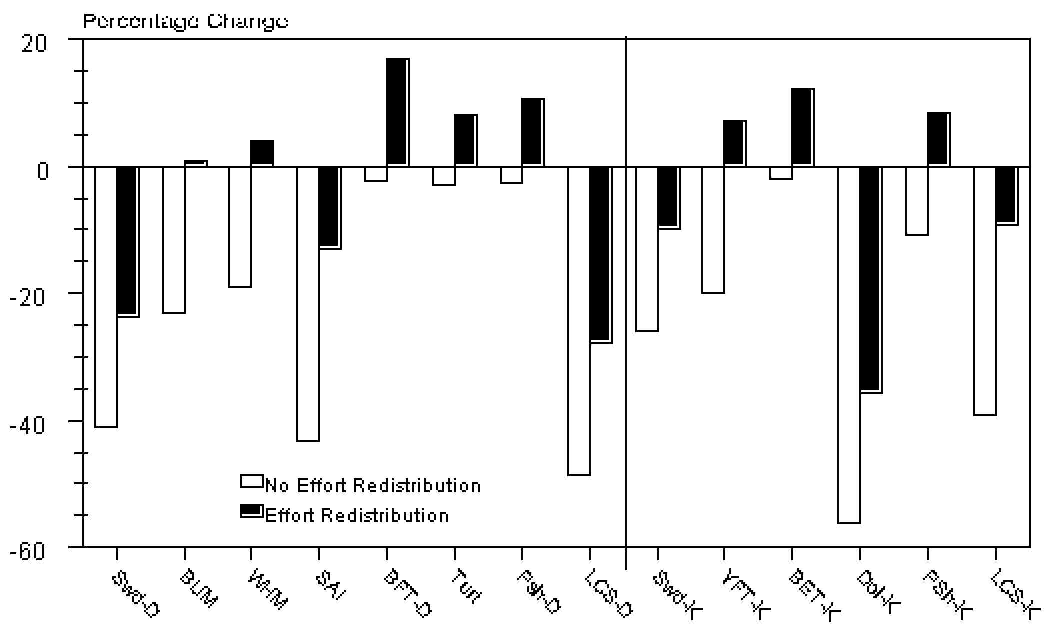


Table 7.10. Impact of the GulfB + SAtlE closure on the estimated weight of target catch (x 100,000 lbs) "with" and "without" redistribution of effort.

Species	1995		1996		1997		1998	
	Without	With	Without	With	Without	With	Without	With
Swordfish	-11.10	-1.77	-14.33	-1.94	-13.14	-4.44	-17.21	-11.12
BAYS tunas	-39.97	5.59	-37.81	19.06	-33.12	22.20	-19.11	22.19
Bluefin tuna	-0.13	0.04	-0.14	0.01	-0.06	0.02	-0.05	0.03
Pelagic sharks	-1.54	1.46	-1.81	1.06	-1.43	1.24	-1.03	0.26

Species	1995		1996		1997		1998	
Large Coastal Sharks	-14.10	-1.47	-10.99	-5.41	-5.31	-3.34	-4.31	-3.54
Dolphin	-5.81	-3.67	-2.47	-0.66	-5.19	-3.19	-1.26	-0.68
Wahoo	-1.14	-0.39	-0.65	-0.05	-0.87	-0.14	-0.84	0.03

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

Under the no effort redistribution model, the bycatch and incidental catch of all species would be reduced. However, when effort redistribution is modeled, the bycatch, incidental catch or catch of turtles, blue marlin, white marlin, and pelagic sharks would be expected to increase for the GulfB+SAtlE closure, while catch of large coastal sharks and swordfish decreases (relative to the status quo). A similar observation is noted for sea turtles, with reductions of 3% with no effort redistribution, while bycatch of sea turtles could increase by 8% under the redistribution of effort model. As noted in Section 5.8, NMFS reinitiated consultation under Section 7 of the ESA due to sea turtle take levels for the pelagic longline fishery in 1999. The June 2000 draft BO indicated that the continued operation of the Atlantic pelagic longline fleet is likely to jeopardize the continued existence of loggerhead turtles. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. Therefore, any increase in turtle takes as a result of effort redistribution must be carefully considered. NMFS has initiated efforts to address the BO, including possible regulatory and non-regulatory actions.

Relative to the other time/area closures considered in this document, this alternative would result in lower bycatch of blue marlin, white marlin, and sailfish, would decrease the impact on sea turtles and pelagic sharks but would also decrease the target catch of swordfish. Conversely, this alternative would decrease the bycatch reduction benefits to large coastal sharks (Figure 7.5).

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This closure had the smallest impacts on fishermen, dealers, and communities of any of the closures considered in the DSEIS because both GulfB and SAtlE are the smallest in terms of areas closed. However, the final action of the FSEIS considers a temporally and spatially reduced version of SAtlE and eliminates the western Gulf of Mexico closure (GulfB) in favor of a smaller area closure in the northeastern Gulf. In addition, the GulfB and SAtlE alternative could potentially increase the landings of BAYS tunas more than any other option, except for the final action, through redistribution of effort to high CPUE areas. In general, businesses and communities in the center of any closed area are likely to suffer the greatest loss in gross revenues while those businesses and communities along the edges of the closed area might not notice any differences. Businesses and communities outside the closed area might notice increased benefits as effort is moved to the open areas.

The ex-vessel gross revenues of the fishery as a whole might decrease by over $14 million if all the effort is not redistributed (Table 7.11). However, if the redistribution does occur, the ex-vessel gross revenues of the fishery might increase by about $3 million. As described above, the actual impact of this closure is probably somewhere between these two values.

Table 7.11. Impact on fishermen that results from the projected change in ex-vessel gross revenues based on change in number of target species caught in 1997 (in millions of dollars) for closing GulfB+SAtlE

Species	Change in Ex-Vessel Gross Revenues (millions of $)	
	No Displacement Model	Displaced Effort Model
Swordfish	$-4.77	$-1.61
BAYS tunas	$-8.22	$5.50
Bluefin tuna	$-0.03	$0.01
Pelagic sharks	$-0.11	$0.09
Large Coastal Sharks	$-0.30	$-0.18
Dolphin	$-0.77	$-0.48
Wahoo	$-0.16	$-0.03
Total	$-14.36	$3.32

Changes in the Distribution of Benefits and Costs

The economic impact of the GulfB+SAtlE closure on pelagic longline target species was estimated by multiplying the percent change in target catch predicted by the no redistribution and redistribution models by the total Atlantic annual catch of each species by U.S. vessels. The resultant values are summarized in Table 7.10. Negative numbers indicate fewer fish would be caught under this closure scenario, while positive numbers indicate more fish caught. The economic impact from this alternative would be an increase by more than $3 million under the displaced effort model. Dealers outside closed areas are likely to benefit due to increased effort close to their locations. On the contrary, dealers in close proximity to closed areas may be directly impacted.

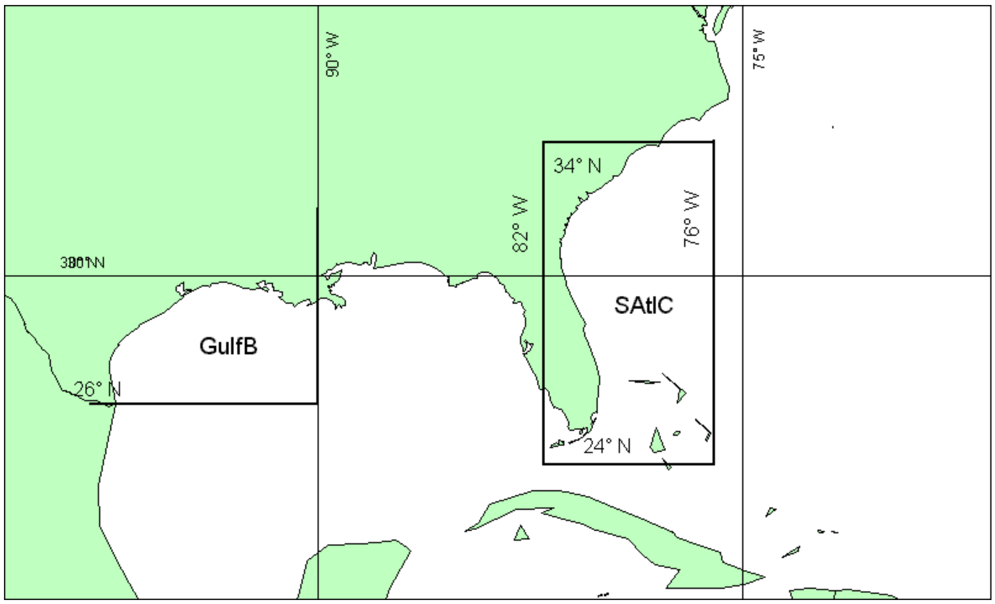
The dollar values in Table 7.11 represent the change in gross revenues only to fishermen. Under the redistribution model, it is likely that fishing costs would increase as well, therefore exacerbating any decrease in gross revenues, or offsetting any increase in revenues. Localized increases in recreational success for billfish, tunas and swordfish are likely following reduction of pelagic longline effort in the closed areas. The analytical approach used in the FSEIS does not quantify the possible increase in recreational opportunities, therefore any potential increase in angler consumer surplus and net economic benefit cannot accurately be estimated. However, it is also possible that concomitant increases in vessel manufacture and purchase, dock and fuel services, tackle and gear supplies, charters, as well as other businesses in support of the recreational fishing industry, could be experienced.

Summary

Although this option was identified in the DSEIS and proposed rule as the preferred time/area closure, this alternative is rejected in the final action because similar conservation benefits can be achieved through a combination of other actions (final time/area action and the prohibition of live bait) that have a smaller economic and social impact than anticipated with a closure of GulfB and SAtlE.

Rejected Option: Closure of GulfB (March through September) and SAtlC (year-round)

Figure 7.6. Geographic boundaries of Gulf B and SAtlC.



Population Effects on Bycatch Species

This alternative would close an area in the Southeast U.S. Atlantic area (SAtlC) during January through December and March through September in the Gulf of Mexico (Figure 7.6). The SAtlC +GulfB closure would eliminate approximately 210,000 nm^2 of ocean to the use of pelagic longline gear by U.S. commercial fishermen. The **no effort redistribution** model from the 1995 through 1998 pelagic logbook database resulted in the following percent reductions of incidental catch and bycatch (Figure 7.7): swordfish discards, 43%; blue marlin discards, 27%; white marlin discards, 22%; sailfish discards, 45%; and sea turtles, 3%. Under this model, target landings are also reduced, including: swordfish, 28%; BAYS tunas, 17% (yellowfin tuna, 20%; bigeye tuna, 1%); dolphin, 58%, pelagic sharks (kept and discarded), 13% and 3%, respectively; and large coastal sharks (kept and discarded), 39% and 52%, respectively.

Under the **redistribution of effort** model, the SAtlC+GulfB closure provided the following percent *reductions* in bycatch and incidental catches for 1995 through 1998, including: swordfish discards, 24%; blue marlin, 0.2%, and sailfish discards, 13%. The discards of white marlin *increased* by 3% when effort was redistributed from the SAtlC+GulfB closure. Target landings of swordfish were *reduced* under this closure alternative (10%), as were dolphin (37%), but landings of target species *increased* when pelagic longline effort was redistributed, including BAYS tunas (yellowfin tuna, 9% and bigeye tuna 0%), and pelagic sharks (9%). The incidental catch of sea turtles also *increased* (9%) with pelagic longline effort redistribution.

Blue marlin, white marlin and sailfish discard rates generally increase when effort is redistributed from the closed areas along the SE U.S. Atlantic coast to the remaining open areas of the Atlantic and Gulf of Mexico, including locations of relatively high CPUE for billfish. Pelagic longline vessels fishing out of the east coast of Florida to North Carolina are generally smaller than other areas along the eastern seaboard, with vessel lengths generally 50 feet or smaller. Due to the distance of these areas from the continental United States and the size of many of the vessels operating off Florida, Georgia and South Carolina, it seems unlikely that much effort from the SE U.S. would be redistributed into the open Caribbean or southwest Atlantic Ocean. Therefore, the impact of effort redistribution on Atlantic billfish discards may be lower than that predicted by the effort redistribution model. Table 7.12 shows the estimated change in total weight (lbs) of target catch estimated by the model from reported levels for 1995 through 1998 from pelagic logbooks.

Figure 7.7. Percent change in catch resulting from closure of area GulfB (March to September), S-SAtlC (year-round), 1995 through 1998. Swd-swordfish, BFT-bluefin tuna, BUM-blue marlin, WHM-white marlin, SAI-sailfish, Psh-Pelagic sharks, LCS-large coastal sharks, Turt-turtles, YFT-yellowfin tuna, BET-bigeye tuna, Dol-dolphin, D indicates discards, K indicates fish kept.

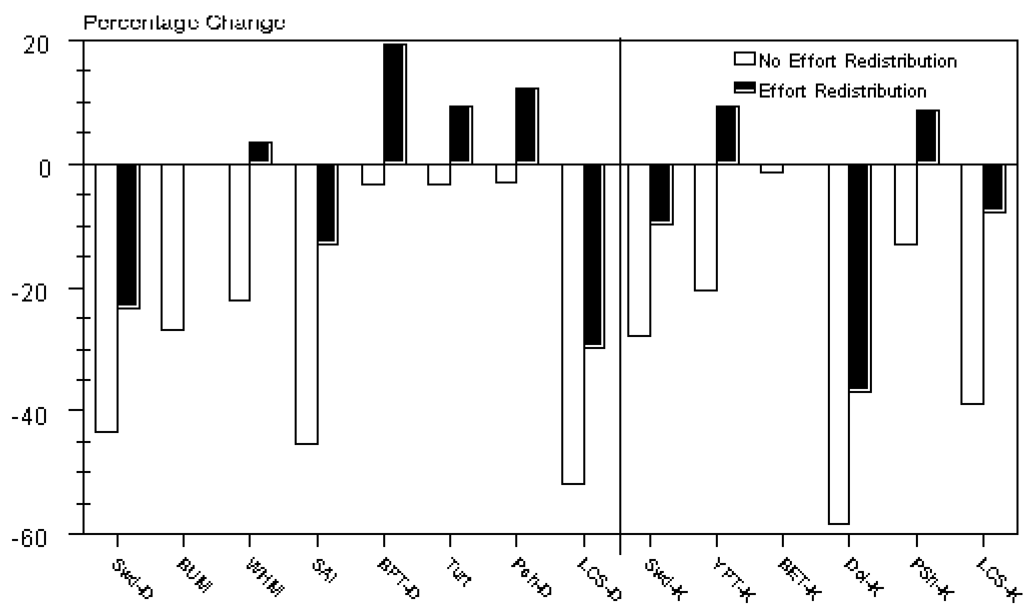


Table 7.12. **Impact of the GulfB + SAtlC closure on the estimated weight of target catch (x 100,000 lbs) "with" and "without" redistribution of effort.**

Species	1995		1996		1997		1998	
	Without	With	Without	With	Without	With	Without	With
Swordfish	-12.05	-1.88	-15.27	-1.91	-14.52	-4.07	-18.59	-11.21
BAYS tunas	-44.41	5.57	-42.46	18.10	-42.42	19.91	-27.55	19.90
Bluefin tuna	-0.14	0.04	-0.17	-0.02	-0.08	0.02	-0.08	0.02
Pelagic sharks	-1.82	1.47	-2.84	1.55	-1.65	1.58	-1.46	0.20
Large Coastal Sharks	-14.40	-0.96	-11.61	-5.46	-5.67	-2.93	-4.36	-3.44
Dolphin	-6.00	-3.85	-3.10	-0.84	-5.43	-3.32	-1.41	-0.97
Wahoo	-1.15	-0.37	-0.85	-0.03	-0.88	-0.09	-0.69	0.10

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

Under the no effort redistribution model, the bycatch and incidental catch of all species would be reduced. However, when effort redistribution is modeled, the incidental catch of pelagic sharks increases for the GulfB+SAtlC closure, while incidental catch of large coastal sharks decreases. A similar observation is noted for sea turtles, with reductions of 3.2% with no effort redistribution, while bycatch of sea turtles could increase by over 9% under the redistribution of effort model. As noted in Section 5.8, NMFS reinitiated consultation under Section 7 of the ESA due to sea turtle take levels for the pelagic longline fishery in 1999. The June 2000 draft BO indicated that the continued operation of the Atlantic pelagic longline fleet is likely to jeopardize the continued existence of loggerhead turtles. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. Therefore, any increase in turtle takes as a result of effort redistribution must be carefully considered. NMFS has initiated efforts to address the BO, including possible regulatory and non-regulatory actions.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

The ex-vessel gross revenue of the fishery as a whole might decrease by over almost $17 million if the effort is not redistributed (Table 7.13). However, if the redistribution does occur, the ex-vessel gross revenue of the fishery might increase by almost $3 million. As described above, the actual impact of this closure is probably somewhere between these two values. In general, businesses and communities in the center of any closed area are likely to suffer the greatest loss in gross revenues while those businesses and communities along the edges of the closed area might not notice any differences. Businesses and communities outside the closed area might notice increased benefits as effort is moved to the open areas.

Table 7.13. Impact on fishermen that results from the projected change in ex-vessel gross revenue based on change in number of target species caught in 1997 (in millions of dollars) for closing GulfB+SAtlC

Species	Change in Ex-Vessel Gross Revenues (millions of $)	
	No Redistribution Model	Redistributed Effort Model
Swordfish	-$5.27	-$1.48
BAYS tunas	-$10.52	$4.94
Bluefin tuna	-$0.03	$0.01
Pelagic sharks	-$0.12	$0.11
Large Coastal Sharks	-$0.32	-$0.16
Dolphin	-$0.81	-$0.49
Wahoo	-$0.16	-$0.02
Total	**-$17.24**	**$2.91**

Changes in the Distribution of Benefits and Costs

The economic impact of the GulfB+SAtlC closure on pelagic longline target species was estimated by multiplying the percent change in target catch predicted by the no redistribution and redistribution models by the total Atlantic annual catch of each species. The resultant values are summarized in Table 7.12. Negative numbers indicate fewer fish would be caught under this closure scenario, while positive numbers indicate more fish caught. Dealers outside closed areas are likely to benefit due to increased effort close to their locations. On the contrary, dealers in close proximity to closed areas may be directly negatively impacted.

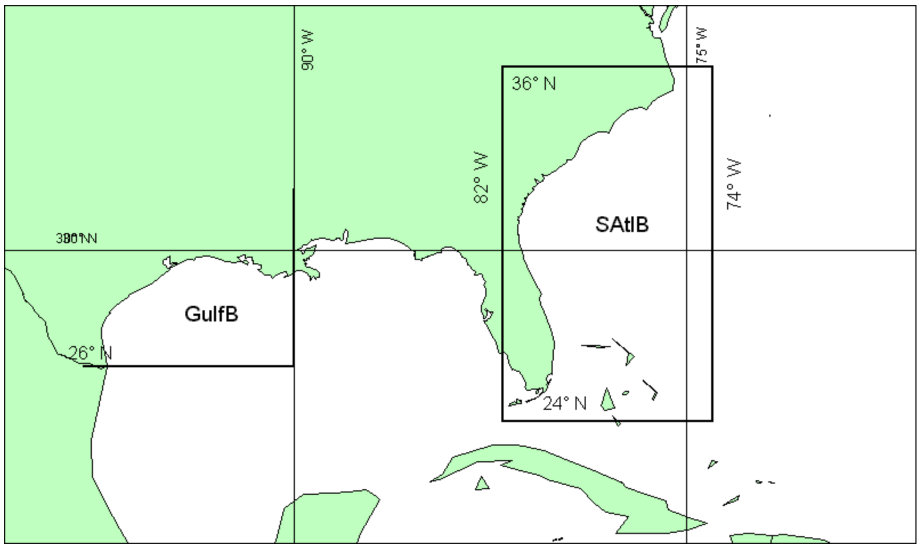
The dollar values in Table 7.13 represent the change in gross revenue only to fishermen. Under the redistribution model, it is likely that fishing costs would increase as well, therefore exacerbating any decrease in gross revenues. Also, this approach ignores the possible increase in recreational opportunities and therefore angler consumer surplus and net economic benefit, as previously discussed for the other time/area alternatives.

Summary

This alternative is rejected because it is not as effective at reducing swordfish discards, and would have greater potential negative economic and social impacts on participants in the pelagic longline fishery and support businesses and communities than the final action option. NMFS' objective is to optimize target catch while reducing bycatch and incidental catch.

Rejected Option: Closure of GulfB (March to September) and SAtlB (January to December)

Figure 7.8. Geographic boundaries of GulfB and SAtlB.



Population Effects on Bycatch Species

This alternative would close the largest area considered in Southeast U.S. Atlantic area (SAtlB) during January through December and the Gulf B area in the Gulf of Mexico during March through September (Figure 7.8). The SAtlB+GulfB closure would eliminate approximately 320,000 nm^2 of ocean to the use of pelagic longline gear by U.S. commercial fishermen. With the **no effort redistribution** model from the 1995 through 1998 pelagic logbook database, the following percent reductions of incidental catch and bycatch (Figure 7.9) are noted: swordfish discards, 48%; blue marlin discards, 29%; white marlin discards, 29%; sailfish discards, 46%; and sea turtles, 4%. Under this model, target and incidental landings are also reduced, including: swordfish, 30%; BAYS tunas, 28% (yellowfin tuna, 34% and bigeye tuna, 3%); dolphin, 64%; pelagic sharks (kept and discarded), 38 % and 11 %, respectively; and large coastal sharks (kept and discarded), 67% and 69%, respectively.

The **redistribution of effort** model for the SAtlB+GulfB closure from logbook data for 1995 through 1998 predicted *reductions* in discards of swordfish, 23% and sailfish, 4%. The discards of all Atlantic marlin *increased* when effort was redistributed from the SAtlB+GulfB closure, including: blue marlin, 8% and white marlin, 5%. Landings of target species were *reduced* under this closure alternative, including swordfish (4%), dolphin (40%), and pelagic sharks (15 %), but landings of BAYS tunas *increased* by 5% (yellowfin tuna, 3% increase; bigeye tuna, 1% decrease). The bycatch of sea turtles also *increased* (16 %) with pelagic longline effort redistribution. Table 7.14 shows the estimated change in total weight (lbs) of target catch estimated by the model from reported levels for 1995 through 1998 in pelagic logbooks.

Figure 7.9. **Percent change in catch resulting from closure of area GulfB (March to September), SAtlB (year-round), 1995 through 1998.** Swd-swordfish, BFT-bluefin tuna, BUM-blue marlin, WHM-white marlin, SAI-sailfish, Psh-Pelagic sharks, LCS-large coastal sharks, Turt-turtles, YFT-yellowfin tuna, BET-bigeye tuna, Dol-dolphin, D indicates discards, K indicates fish kept.

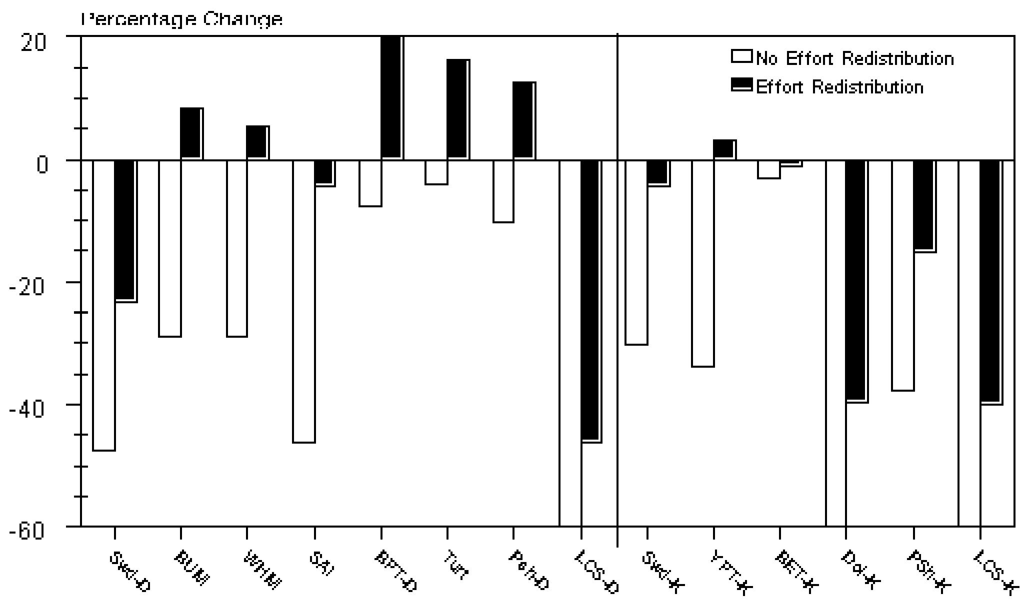


Table 7.14. **Impact of the GulfB+SAtlB closure on the estimated weight of target catch (x 100,000 lbs) "with" and "without" redistribution of effort.**

Species	1995		1996		1997		1998	
	Without	With	Without	With	Without	With	Without	With
Swordfish	-13.17	2.96	-16.41	1.59	-15.50	-1.97	-20.40	-10.6
BAYS tunas	-81.64	-10.23	-66.73	8.79	-55.87	20.24	-41.19	17.96
Bluefin tuna	-0.16	0.07	-0.20	-0.02	-0.11	0.01	-0.10	0.03
Pelagic sharks	-5.23	-1.44	-6.66	-1.56	-5.54	-2.52	-4.11	-2.62
Large Coastal Sharks	-26.73	-14.27	-17.25	-11.80	-11.89	-10.72	-6.08	-5.39
Dolphin	-6.74	-4.28	-3.38	-0.64	-5.78	-3.40	-1.63	-1.16
Wahoo	-1.17	-0.17	-0.88	0.15	-0.90	0.01	-0.7	0.22

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

This alternative might have negative impacts on turtles or marine mammals depending on the pattern of effort redistribution. Effort redistributed to the Mid-Atlantic is likely to encounter more mammals than those same sets if they were made in the closed areas. Similarly, sets redistributed to the northeast areas might encounter more sea turtles than previously, resulting in an overall increase in turtles interactions of 16%. As noted in Section 5.8, NMFS reinitiated consultation under Section 7 of the ESA due to sea turtle take levels for the pelagic longline fishery in 1999. The June 2000 draft BO indicated that the continued operation of the Atlantic pelagic longline fleet is likely to jeopardize the continued existence of loggerhead turtles. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. Therefore, any increase in turtle takes as a result of effort redistribution must be carefully considered. NMFS has initiated efforts to address the BO, including possible regulatory and non-regulatory actions.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This closure would have significant economic impacts on fishermen, dealers, and communities along the Atlantic of the than the previously considered alternatives. The impact on businesses in the Gulf of Mexico would be the same (GulfB). Overall, the maximum increase in gross revenue under the effort redistribution model could be as much as $3 million. As noted previously, businesses in the open areas would likely notice an increase in revenues while businesses in the closed area would likely notice detrimental impacts ranging from going out of business (particularly likely if the business is in the center of the closed area) or a slight decrease in revenues if any change (particularly likely if the business is located toward the edge of the closed area). The gross revenues of the fishery could increase by over $3 million or decrease by over $20 million depending on the level of redistribution that occurs (Table 7.15).

Table 7.15. Impact on fishermen that results from the projected change in ex-vessel gross revenues based on change in number of target species caught in 1997 (in millions of dollars) from closing GulfB+SAtlB

Species	Change in Ex-Vessel Gross Revenues (millions of $)	
	No Redistribution Model	Redistributed Effort Model
Swordfish	-$5.63	-$0.72
BAYS tunas	-$13.86	$5.02
Bluefin tuna	-$0.05	$0.04
Pelagic sharks	-$0.42	-$0.19
LC Sharks	-$0.67	-$0.60
Dolphin	-$0.86	-$0.51
Wahoo	-$0.17	$0.001
Total	**-$21.64**	**$3.01**

Changes in the Distribution of Benefits and Costs

This option could shift the benefits of the fishery to fishermen fishing in the eastern Gulf of Mexico and the Mid-Atlantic Bight and Northeast regions if fishermen do not redistribute their fishing effort into open areas. The Gulf area is small enough that Gulf fishermen might elect to shift their effort eastward.

The economic impact of the GulfB+SAtlB closure on pelagic longline target species was estimated by multiplying the percent change in target catch predicted by the no redistribution and redistribution models by the total Atlantic annual catch of each species. The resultant values are summarized in Table 7.14. Negative numbers indicate fewer fish would be caught under this closure scenario, while positive numbers indicate more fish caught. Under this alternative, gross revenues would be expected to rise under the effort redistribution model due to increased landings of BAYS tunas. Dealers outside closed areas are likely to benefit due to increased effort close to their locations. On the contrary, dealers in close proximity to closed areas may be directly impacted. A more complete analysis of economic impacts is presented in Section 8.0 based on the most conservative assumption, from an economic standpoint, of no effort redistribution.

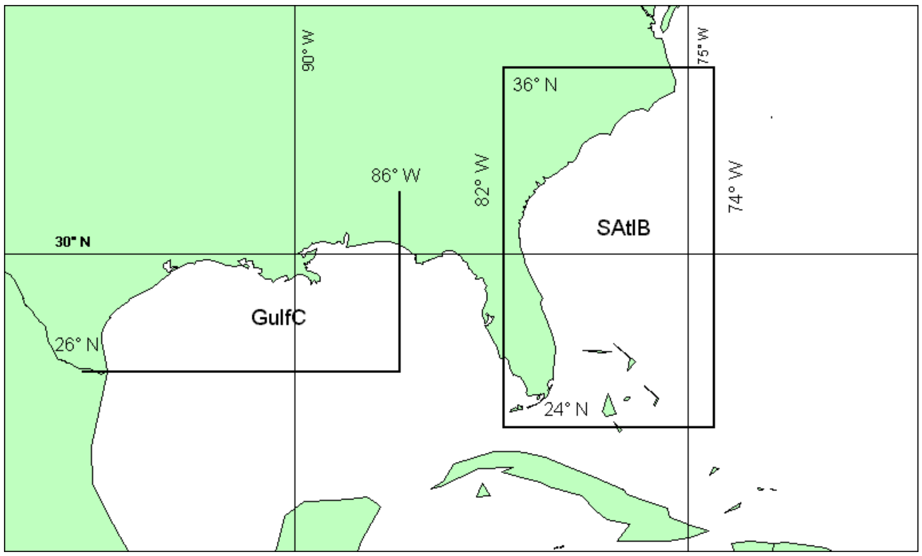
The dollar values in Table 7.15 represent the change in gross revenue only to fishermen. Under the redistribution model, it is likely that fishing costs would increase as well, therefore exacerbating any decrease in gross revenues. Also, this approach ignores the possible increase in recreational opportunities and therefore angler consumer surplus and net economic benefit, as discussed above.

Summary

The GulfB+SAtlB closure had the second highest bycatch and incidental reductions under the no effort redistribution model. However, this option is rejected because of the potential increases in discards of blue and white marlin, and the highest increase in turtle interactions (over 16%) of all time/area options examined for final agency action. Further rationale for rejecting this option is the extensive economic, social and community impacts that could potentially be experienced as a result of this time/area closure. The potential increase in BAYS tunas landings following effort redistribution, was the second lowest of all time/area alternatives, which is inconsistent with the second objective of the FSEIS to minimize impacts on target catches.

Rejected Option: Closure of GulfC (March to September) and SAtlB (January to December)

Figure 7.10. Geographic boundaries of GulfC and SAtlB.



Population Effects on Bycatch Species

This alternative would close the largest area in Southeast U.S. Atlantic area (SAtlB) during January through December and the largest area in the Gulf of Mexico (GulfC) from March through September (Figure 7.10). The SAtlB+Gulf C closure would eliminate approximately 375,000 nm^2 of ocean to the use of pelagic longline gear by U.S. commercial fishermen. Evaluation of the **no effort redistribution** model from the 1995 through 1998 pelagic logbook database resulted in the following reductions in percent change of incidental catch and bycatch (Figure 7.11): swordfish discards, 51%; blue marlin discards, 33%; white marlin discards, 34%; sailfish discards, 58%; and sea turtles, 5%. Under this model, target and incidental landings are also reduced, including: swordfish, 32%; BAYS tunas, 37% (yellowfin tuna, 40%; bigeye tuna, 4%); dolphin, 75%, pelagic sharks (kept and discarded), 40% and 10%, respectively; and large coastal sharks (kept and discarded), 73 % and 75 %.

Evaluation of the **redistribution of effort** model for the SAtlB+GulfC closure must be made with caution. Area GulfC represents approximately 97% of the U.S. waters in the Gulf of Mexico; nearly 95% of all U.S. pelagic longline effort and catches in the Gulf reported in the logbooks are within the boundaries of GulfC. Compressing all effort into the remaining open area in the Gulf of Mexico caused the redistribution of effort model to yield potentially skewed results for several species. The SAtlB+GulfC closure results in the following *increases* in percent change in bycatch and incidental catches, including: swordfish discards, 4%; blue marlin, 10%; white marlin, 9%, and sailfish, 42%. Landings of some target species *decreased* under the SAtlB+GulfC redistributed effort closure scenario, including BAYS tunas (10%), dolphin (29%), and pelagic sharks (10%), but landings of other target species *increased* (swordfish, 6%; large coastal sharks, 35 %). The incidental catch of sea turtles *increased* by over 15% with pelagic longline effort redistribution. Table 7.16 shows the estimated change in total weight (lbs) of target catch estimated by the model from reported levels for 1995 through 1998 in pelagic logbooks.

Figure 7.11. **Percent change in catch resulting from closure of area GulfC (March to September), SAtlB (year-round), 1995 through 1998.** Swd-swordfish, BFT-bluefin tuna, BUM-blue marlin, WHM-white marlin, SAI-sailfish, Psh-Pelagic sharks, LCS-large coastal sharks, Turt-turtles, YFT-yellowfin tuna, BET-bigeye tuna, Dol-dolphin, D indicates discards, K indicates fish kept.

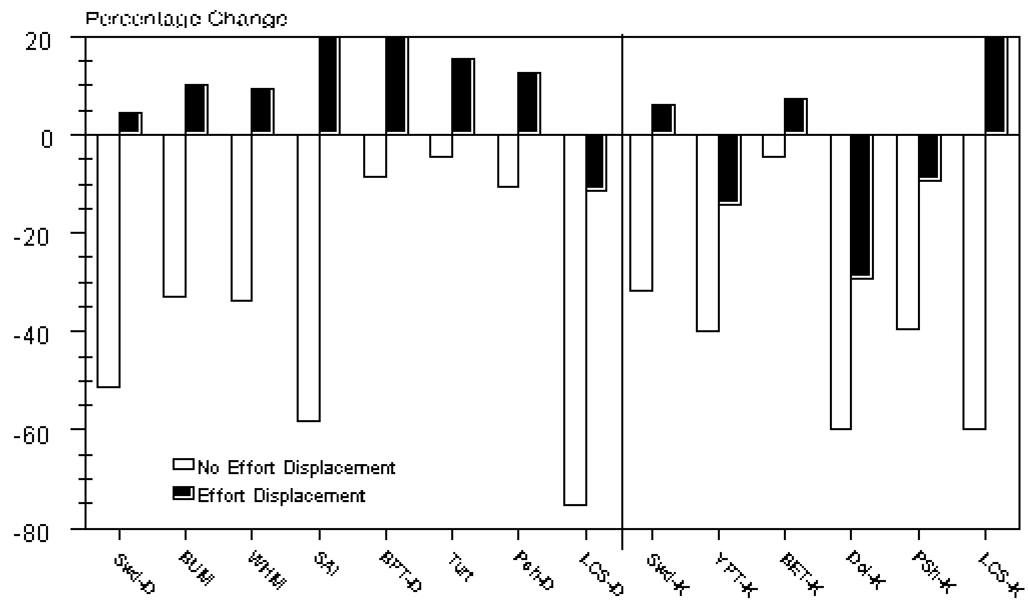


Table 7.16. **Impact of the GulfC+SAtlB closure on the estimated weight of target catch (x 100,000 lbs) "with" and "without" redistribution of effort.**

Species	1995		1996		1997		1998	
	Without	With	Without	With	Without	With	Without	With
Swordfish	-14.00	4.62	-17.63	8.43	-16.62	4.47	-21.10	8.51
BAYS tunas	-91.71	-27.62	-88.91	-27.48	-76.39	-19.51	-57.68	-11.50
Bluefin tuna	-0.21	-0.02	-0.23	-0.08	-0.14	-0.02	-0.12	0.19
Pelagic sharks	-5.48	-0.78	-6.99	-0.03	-5.85	-1.92	-4.18	3.66
LC Sharks	-30.68	6.08	-18.13	-7.15	-12.17	-9.70	-6.87	-4.54

Species	1995		1996		1997		1998	
Dolphin	-7.41	-3.90	-4.45	1.94	-6.88	-3.46	-1.80	-0.32
Wahoo	-1.47	-0.59	-1.31	-0.02	-1.37	-0.57	-1.19	-1.97

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

If pelagic longline fishermen participate in other fisheries in which bycatch is higher, this alternative could have reduced benefits on Atlantic finfish stocks. However, all federally-managed fisheries are mandated by the Magnuson-Stevens Act to minimize bycatch to the extent practicable so it is assumed that redistributed effort in other fisheries, if it results in increased bycatch, would be addressed through other regulatory measures. NMFS is unable at this time to estimate which fisheries these fishermen may transfer into given that many fisheries are limited access but have transferable permits. Selection of this option could increase sea turtle encounters by more than 15%. As noted in Section 5.8, NMFS reinitiated consultation under Section 7 of the ESA due to sea turtle take levels for the pelagic longline fishery in 1999. The June 2000 draft BO indicated that the continued operation of the Atlantic pelagic longline fleet is likely to jeopardize the continued existence of loggerhead turtles. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. Therefore, any increase in turtle takes as a result of effort redistribution must be carefully considered. NMFS has initiated efforts to address the BO, including possible regulatory and non-regulatory actions.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This closure could have the greatest impact of all the areas considered. The impact on businesses and communities along the Atlantic would be the same as in the previous alternative. However, the impacts on businesses and communities in the Gulf of Mexico would be larger. In this case, even under the redistribution model, the ex-vessel gross revenue of the fishery would decrease, ranging from over $4 million (effort redistribution) to over $27 million with no redistribution of effort (Table 7.17).

Table 7.17. Impact on fishermen that results from the projected change in ex-vessel gross revenues based on change in number of target species caught in 1997 (in millions of dollars) for closing GulfC+SAtlB

Species	Change in Ex-Vessel Gross Revenues (millions of $)	
	No Redistribution Model	Redistributed Effort Model
Swordfish	-$6.04	$1.62
BAYS tunas	-$18.94	-$4.84
Bluefin tuna	-$0.06	-$0.01
Pelagic sharks	-$0.44	-$0.14
LC Sharks	-$0.68	-$0.54

Species	Change in Ex-Vessel Gross Revenues (millions of $)	
	No Redistribution Model	Redistributed Effort Model
Dolphin	-$1.03	-$0.52
Wahoo	-$0.26	-$0.11
Total	**-$27.44**	**-$4.53**

Changes in the Distribution of Benefits and Costs

This alternative is likely to redistribute benefits to fishermen on the North Gulf coast of Florida and in the Mid-Atlantic Bight and Northeast areas. Alternatively, if affected fishermen choose to re-locate their home port, additional costs would accrue to them but they would reap the benefits of remaining in the fishery.

The dollar values in Table 7.17 represent the change in gross revenue only to fishermen. Under the redistribution model, it is likely that fishing costs would increase as well, therefore exacerbating any decrease in gross revenues. Also, this approach ignores the possible increase in recreational opportunities and therefore angler consumer surplus and net economic benefit, as discussed above.

Summary

Although this alternative closes the largest geographic area to pelagic longline fishing, this option is rejected because it inconsistent with the first three objectives of the FSEIS. Bycatch of all billfish species would increase under effort redistribution, as would swordfish discards and sea turtle interactions (Objective 1). Several target species would also be reduced (Objective 2), with only minimal increase in swordfish kept. Bluefin tuna interactions (discards and landings) also increase under this alternative (Objective 3). This alternative closed the largest area of all the time/area alternatives considered and also resulted in one of the highest increases in turtle interactions (15.3 percent) when effort is redistributed. The economic, social and community impact associated with this closure is also potentially greater than the other alternatives considered.

Rejected Option: Prohibit use of pelagic longline gear by U.S.-flagged fishing vessels operating in the Atlantic Ocean

This alternative would prohibit the use of pelagic longline gear in Atlantic HMS fisheries year-round. NMFS received written and verbal comment during the development of this rulemaking, as well as for the HMS FMP, from public hearings, comment periods, and from some HMS AP members, expressing the view that pelagic longline gear is non-selective, resulting in excessive unintentional mortality of target and non-target finfish, sea turtles, and marine mammals. Many of those advocated prohibition of pelagic longline gear in HMS fisheries as an enhancement to rebuilding overfished stocks and reducing incidental catch mortality. Conversely, comments were received noting the relatively low bycatch, bycatch mortality and incidental catch rates of pelagic longline gear relative to other fishing techniques. All comments are addressed in the preamble of the final rule, and are also provided in Appendix B of this document.

Population Effects on Bycatch Species

Elimination of the use of pelagic longline gear would have the greatest impact on reducing bycatch, bycatch mortality, and incidental catch by U.S. pelagic longline fishermen of any of the alternatives considered in this document. Prohibiting pelagic longline gear would also decrease landings by U.S. fishermen of target species, including swordfish, BAYS tunas, dolphin, pelagic sharks, large coastal sharks and other species. However, this alternative might not reduce stock-wide fishing mortality of target species because other nations may replace the landings that would have been made by U.S. fishermen beyond the U.S. EEZ, and will likely export these fishery products to the United States. A summary of the total pelagic longline catch for 1995, 1996, 1997, and 1998 by U.S. commercial fishermen, as reported in the mandatory pelagic logbook system, is provided in Table 6.2 to illustrate the possible magnitude of this rejected option on the pelagic longline catch composition.

Ecological Effects Due to Changes in Bycatch of Those Species

The pelagic longline catch of undersized swordfish, billfish, bluefin tuna, and other bycatch or incidental catch by U.S. fishermen would be eliminated. The expected magnitude of reduction in discards from this fishery alone, include: 20,000 to 30,000 undersized swordfish/year; 2,500 to 3,500 blue marlin and white marlin/year; and 1,000 to 2,000 sailfish/year. These figures assume that there would be no change in longline effort by other countries in areas outside the U.S. EEZ, which might be unlikely (see economic effects below).

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

Elimination of pelagic longline gear would also eliminate the bycatch and incidental catches of other species by U.S. pelagic longline gear, including 500 to 3,000 bluefin tuna/year; 80,000 to 90,000 pelagic sharks/year; 8,000 to 11,000 large coastal shark discards/year; and 250 to 1,200 turtles/year, with the caveat noted above regarding increased longline effort by foreign vessels.

Effects on Marine Mammals and Birds

Prohibiting the use of this gear would reduce the number of marine mammal entanglements and mortalities caused by U.S. fishermen (see Section 5.7). Sea bird interactions with pelagic longline gear are rare (see Section 5.9), but prohibiting longline gear would eliminate those interactions.

Changes in Fishing, Processing, Disposal, and Marketing Costs

Abolishing the use of pelagic longline gear by U.S. commercial fishing vessels would have an immediate and significant impact on all support industries associated with swordfish, tuna, dolphin and other pelagic fisheries, including: docking facilities, fish houses and processors; fuel, ice and fishing equipment suppliers; brokers of fresh and frozen product markets; and vessel construction and repair. Employment in these sectors would obviously decline as well. However, importers of HMS fishery products from foreign markets would likely see an increase in business as restaurants, fresh seafood markets, and other businesses would seek alternative sources to replace seafood products previously purchased from U.S. pelagic longline fishermen. Because the United States is already an important import market for these species, particularly swordfish, fishing effort (notably longlining) by other nations would probably increase in areas outside the U.S. EEZ. Depending on their regulations regarding minimum size, bycatch, and other conservation measures, total bycatch could actually increase stock-wide. As a result of the drop in domestic supply, U.S. consumers might notice an increase in price. Further, there could also be a decrease in quality (less fresh product, less quality control), as well as an increase in price (depending on market conditions), so there could be a decrease in consumer surplus, and therefore a decrease in net economic benefit.

Changes in Fishing Practices and Behavior of Fishermen

Pelagic longline vessel captains, crew and owners would need to re-rig fishing vessels to find alternative means to target HMS or other fisheries to stay in the fishing business, or leave the fishery and find alternative sources of employment. If fishermen switched to other fisheries, this alternative might have negative impacts on other species or fisheries, particularly if those species are fully fished or overfished or if the fisheries are overcapitalized.

Changes in Research, Administration, and Management Effectiveness

Administrative and management costs would likely decrease in association with the need to process fewer fishing vessel permits, pelagic logbooks, and observer programs as vessels either re-rig to alternative means to capture HMS or other target species, or discontinue fishing.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

The elimination of an entire sector of the U.S. Atlantic commercial fishery would likely have an impact on other commercial and recreational fisheries. Some fishermen would shift effort to target other fisheries (or the same species with different gear), although many alternatives might be unavailable due to limited access programs based on prior participation. Localized reductions in discards and/or catch of billfish, tuna, dolphin, and other species by pelagic longline fishermen would also likely increase recreational opportunities, which would have associated benefits for businesses and communities that support recreational activities, including for example, charters, boat construction and sales, tackle and gear manufacturers and sales, dockage, fuel, and other businesses.

Changes in the Distribution of Benefits and Costs

Banning the use of pelagic longline gear might benefit other fishermen who target and land swordfish, tunas, and sharks using other gear types, including users of handgear (rod and reel, bandit gear, handline, and harpoon). This alternative might also benefit fishermen who catch these species incidentally such as squid trawl and bottom longline fishermen. The major source of swordfish in the United States is from the pelagic longline fleet so it is assumed that benefits and costs of harvesting many of these species would be transferred predominantly to foreign fishermen, which would disadvantage U.S. fishermen. Table 7.18 indicates the proportion of the U.S. catch that is taken by pelagic longlines.

Table 7.18. Estimated 1998 Pelagic Longline Landings (metric tons whole weight). Source: NMFS 1999c.

	1998 Longline Landings	Percent of Total U.S. Catch Caught with Longline
Swordfish	3159.9	98.6 %
Yellowfin Tuna	2447.9	44%
Bigeye Tuna	695.3	75%
Bluefin Tuna	48.7	4%
Albacore Tuna	180.1	22%
Skipjack Tuna	1.3	1%

Social Effects

Total elimination of the pelagic longline fishery would have a significant effect on swordfish, shark, and tuna longline permit holders. NMFS records indicate that as of March 23, 2000, there were approximately 450 swordfish directed and incidental permit holders, many of whom fish with pelagic longlines. Further, NMFS records show that there are 114 dealers who reported selling swordfish from 9/1/98 through 8/31/99. Since most swordfish that are sold commercially are caught by U.S. longline vessels, it can be assumed that these dealers would be negatively impacted by this alternative, even if they are dependent on other commercial fisheries.

Impacts would not just be economic, because elimination of an entire sector of the commercial fishery would have social impacts, both directly on the families that work or own the fishing vessels that would have to either re-rig or discontinue fishing, as well as indirectly on the local communities that support the pelagic longline fishery. The HMS FMP provides a review of several communities along the eastern U.S. seaboard where pelagic longlining is an important component of the local community.

Summary

This alternative is rejected for several reasons. In 1998, more than 98 percent of all U.S.-caught North Atlantic swordfish and 100 percent of the U.S.-caught South Atlantic swordfish were harvested by pelagic longline fishermen. In addition, Table 7.18 indicates that a significant portion of tunas, particularly yellowfin and bigeye, are caught on pelagic longlines. This gear type clearly provides a substantial proportion of fresh seafood product to the U.S. market.

Under ATCA, the United States cannot implement measures which have the effect of raising or lowering quotas, although NMFS has the ability to change the allocation of that quota among different gear groups. Since it is unlikely that the handgear sector would be able to catch the swordfish quota given the size distribution of the stock (large swordfish availability to harpooners), the small number of handgear permit holders (123 as of March 23, 2000), and the relative inexperience of many permitted fishermen to commercially catch swordfish with rod and reel, prohibiting longline gear would essentially have the effect of lowering the United States quota. Further, Section 304(1)(G)(ii) of the Magnuson-Stevens Act requires conservation and measures "take into consideration traditional fishing patterns of fishing vessels of the United States ..." Prohibiting the use of pelagic longline gear would alter traditional fishing patterns beyond that needed to achieve the goals of the FMPs and this final action to reduce bycatch, as required under NS9. It is likely that ICCAT would allocate North Atlantic swordfish quota share away from the United States in response to implementation of this alternative. U.S. consumers would pay higher prices for many of the affected species, and product quality would likely decline. U.S. supply of swordfish, tuna, and other species caught primarily on pelagic longline gear would therefore have to come from imports. As foreign fisheries expand to meet this increased demand, catch of target species, including billfish which is landed for marketing by other countries, and associated bycatch would likely increase which may be detrimental to overfished stocks.

This alternative is rejected because conservation measures required under NS9 can be achieved using other strategies that will not have as severe an economic and/or social impact on the pelagic longline fishermen, related industries, and the communities of which they are a part.

Rejected Option: No Action (Status Quo)

This rejected alternative would maintain existing regulations for the pelagic longline fishery along the Atlantic coast of the United States. The HMS FMP and previous management actions have resulted in the reduction of bycatch, bycatch mortality, and incidental catch from some portion of the pelagic longline fishery. These regulatory measures include: the Mid-Atlantic Bight closure for bluefin tuna discards; limited access for swordfish, tuna, and sharks; and restrictions on retention for swordfish, bluefin tuna, yellowfin tuna and bigeye tuna. Currently, commercial vessels utilizing pelagic longline gear are prohibited from retaining, possessing or selling all Atlantic marlin, and any Atlantic swordfish under 33 pounds dw, and all west Atlantic sailfish and longbill spearfish in or from the U.S. EEZ. However, providing no additional management actions to reduce bycatch of overfished HMS in the Atlantic pelagic longline fishery is not acceptable under NS 9, and to the extent that reduced bycatch and bycatch mortality augments juvenile and reproductive fish populations, *may* not be consistent with rebuilding plans to restore overfished stocks.

Population Effects on Bycatch Species

Current levels of bycatch, bycatch mortality and incidental catch of billfish, bluefin tuna, small swordfish, and other overfished HMS might hinder rebuilding efforts for these species. For populations as depressed as marlins in the Atlantic Ocean, any source of mortality may be detrimental to the stock. Billfish are managed domestically, as well as internationally, and the United States supports the development of a rebuilding program for these species. Because U.S. Atlantic longline fishermen are not allowed to sell these species, 2,500-4,000 billfish a year are discarded dead in the Atlantic Ocean and the Gulf of Mexico (Table 6.7). Even more billfish are released alive (Table 6.3), although research is needed to determine post-release survival rates of these species.

SCRS (1999) indicated that if mortality on undersized swordfish (age 0-2 years) would decrease, gains in yield could accrue. In 1998, 443 mt of swordfish were discarded by the U.S. pelagic longline fleet (NMFS, 1999c), most because they were undersized. Under the 1999 ICCAT recommendation, the total North Atlantic dead discard allowance is 400 mt for the 2000 fishing season (for United States, the fishing year is June 1 through May 31); the U.S. receives 80 percent of the North Atlantic dead discard allowance. In 2001, the total dead discard allowance is reduced to 300 mt, in 2002 it is 200 mt, and will be phased out by 2004. If fishing activity results in an amount of dead discards in excess of the allowance, then the country must deduct the dead discard overage from its allocation of catch that can be retained in the following year. Therefore, any swordfish discards above the allowance will be taken off the top of the U.S. quota. In order to be consistent with the intent of the ICCAT program to rebuild swordfish, the United States needs to reduce discards to protect young fish. The status quo alternative would not address this concern.

Status quo might have detrimental effects on sea turtles because of the serious injuries inflicted by pelagic longline gear (see Section 5.8 and Appendix A for more information regarding turtle takes). The number of turtles that pelagic longline fishermen are allowed to interact with is limited by the Incidental Take Statement under the authority of the Endangered Species Act in an attempt to protect vulnerable stocks from this source of mortality. In 1999, Atlantic pelagic longline fishermen exceeded their turtle take limit for loggerhead turtles. As noted in Section 5.8, NMFS reinitiated consultation under Section 7 of the ESA due to sea turtle take levels for the pelagic longline fishery in 1999. The June 2000 draft BO indicated that the continued operation of the Atlantic pelagic longline fleet is likely to jeopardize the continued existence of loggerhead turtles. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. NMFS has initiated efforts to address the BO, including possible regulatory and non-regulatory actions.

Ecological Effects Due to Changes in Bycatch of Those Species

Because no changes in the pelagic longline fishery would be experienced under this alternative, there would not be any changes in the associated ecological effects on the target species or on the bycatch species.

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

This measure would not alter the current level of bycatch of other species (those not previously encountered), and therefore is not expected to affect the population or ecosystem of other species.

Effects on Marine Mammals and Birds

This management alternative would not change the impact of the commercial HMS pelagic longline fishery on marine mammals or sea birds. A summary of impacts on these organisms and other protected or endangered species, of pelagic longline gear under the status quo, is provided in Section 5.0 of this document.

Changes in Fishing, Processing, Disposal, and Marketing Costs

The status quo alternative would not change the current costs of commercial fishing, nor of any of the associated support industries. Marketing costs might increase in the future under the status quo if the current public perception of the pelagic longline fishery results in activities such as a boycott of swordfish. A boycott was organized in 1997 and continues through the present time. The pelagic longline fishermen and dealers might need to increase marketing efforts in order to maintain sales and/or prices of swordfish.

Changes in Fishing Practices and Behavior of Fishermen

No changes in fishing practices or behavior of pelagic longline fishermen would be expected under the status quo alternative.

Changes in Research, Administration, and Management Effectiveness

No additional management actions accompany this alternative, therefore there would not be any concomitant changes in research, administrative or management effectiveness.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This alternative would not be expected to change the economic, social or cultural value of fishing activities because no changes in current regulations would be enacted under this alternative. The status quo alternative would also not address the 1999 ICCAT recommendation relative to establishing a North Atlantic swordfish dead discard allowance that is incrementally reduced to zero by 2004. Any discards of swordfish by U.S. pelagic longlines beyond the dead discard allowance will subsequently be discounted from the following year's quota. Therefore, gross revenues and economic activities (processing, etc.) could potentially be negatively impacted as a result of a smaller quota. A shorter fishing season could also be a result of a lack of management to reduce the level of discards of swordfish from the North Atlantic pelagic longline fishery.

Changes in the Distribution of Benefits and Costs

This alternative would not be likely to change the distribution of costs or benefits.

Social Effects

This alternative would have the least amount of social and economic impact on pelagic longline fishermen and their respective communities of any alternatives considered in this document in the short-term, because this alternative would not change current management of the U.S. pelagic longline fishery in the Atlantic Ocean. However, if the status quo has long-term negative impacts on rebuilding (e.g., slows population growth), it might also have long-term impacts on fishing communities, as would continued discards because the 1999 ICCAT recommendation requires dead discards to be subtracted from the amount of swordfish that can be retained in subsequent fishing years.

Summary

The HMS FMP and Atlantic Billfish FMP amendment were clear in outlining the need for further management actions beyond those in the final consolidated regulations to address bycatch and incidental catch issues in commercial pelagic longline gear. Management under the status quo would not achieve the necessary changes mandated by NS9. Further, the North Atlantic swordfish rebuilding program adopted by ICCAT in 1999 will reduce the U.S. quota by approximately 5 percent; however, the dead discard allowance will have a progressively greater impact beginning with the 2000 fishing year (discards must be reduced by 120 mt from 1998 levels), through a zero discard allowance by 2004. As noted previously, any discards beyond the allowance level will be taken off the following year's quota. The status quo alternative will not provide any mechanism to change pelagic longline fishing patterns to reduce dead discards toward compliance with this 1999 ICCAT recommendation. Therefore, NMFS rejects the status quo in terms of management measures that would reduce bycatch and incidental catches in pelagic longline fisheries.

Summary of Time/Area Closure Alternatives

The final time/area closures in the DeSoto Canyon (year-round), East Florida Coast (year-round), Charleston Bump (February to April) appear to be effective in reducing finfish bycatch in pelagic longline fisheries, as compared to the proposed rule preferred alternative (Table 7.19). These options, however, would likely have a significant economic impact and social impact on a significant portion of the fishermen. In addition, these options would have a significant impact on seafood dealers who rely on HMS to support their small businesses, as discussed at length in Section 8.0 and 9.0 of this document. The effectiveness of the time/area closures is further enhanced, particularly for reducing billfish discards, when live bait is prohibited in the Gulf of Mexico (see Section 7.2).

Table 7.19. Closure effectiveness of selected options under the time/area closure alternative, 1995 through 1998.

Area	Portion of Catch Attempting to Reduce								Minimize Impacts on this Portion of Catch				
	Swd discard	BUM discard	WHM discard	SAI discard	BFT discard	Turtle caught	P. sharks discard	LCS discard	Swd kept	BAYS KEPT	Dolphin kept	P. sharks kept	LCS kept
No Displacement Model: 1995 through 1998													
Gulf of Mexico													
GulfB closed Mar - Sept	-3.08	-11.70	-13.12	-17.29	-1.50	-1.11	-0.17	-2.82	-2.21	-10.41	-5.34	-1.74	-2.46
DeSoto Canyon closed Jan - Dec	-5.31	-1.36	-1.84	-5.20	-0.29	-0.29	-0.16	-6.51	-2.45	-2.04	-3.69	-2.38	-5.58
Atlantic													
SAtlE closed all year	-38.03	-11.36	-5.94	-25.82	-0.93	-1.86	-2.29	-45.81	-23.67	-4.00	-50.86	-9.03	-36.61
Charleston Bump closed Feb-Apr; East Florida Coast closed all year	-36.20	-10.56	-4.54	-24.38	-0.70	-1.65	-1.83	-36.55	-22.02	-3.21	-26.60	-7.10	-26.50
Combined Gulf of Mexico and Atlantic (NOT including BFT closure as in DSEIS)													
Gulf B+ SAtlE	-41.11	-23.06	-19.06	-43.11	-2.43	-2.97	-2.46	-48.63	-25.88	-14.41	-56.20	-10.77	-39.07
DeSoto Canyon, Charleston Bump, East FL Coast	-41.51	-11.96	-6.39	-29.58	-0.99	-1.89	-1.96	-42.51	-24.55	-5.24	-29.29	-9.48	-32.08

Area	Portion of Catch Attempting to Reduce								Minimize Impacts on this Portion of Catch				
	Swd discard	BUM discard	WHM discard	SAI discard	BFT discard	Turtle caught	P. sharks discard	LCS discard	Swd kept	BAYS KEPT	Dolphin kept	P. sharks kept	LCS kept
Displacement Model 1995 through 1998													
Gulf of Mexico													
GulfB closed Mar - Sept	3.87	-6.98	-7.44	-1.81	-0.28	-0.44	0.30	7.63	0.90	-1.43	6.76	1.40	12.71
DeSoto Canyon closed Jan - Dec	-4.09	1.16	1.07	-0.75	0.04	0.00	-0.10	-5.42	-1.69	1.35	-1.37	-1.82	-3.73
Atlantic													
SAtlE closed all year	-27.69	7.74	11.40	-11.30	17.31	8.41	10.18	-35.53	-10.76	10.42	-42.56	7.00	-22.05
Charleston Bump closed Feb-Apr; East Florida Coast closed all year	-27.32	5.36	9.71	-13.20	10.75	7.13	8.45	-27.86	-11.29	8.33	-16.44	5.89	-14.74
Combined Gulf of Mexico and Atlantic													
Gulf B+ SAtlE	-23.82	0.76	3.96	-13.11	17.03	7.97	10.48	-27.90	-9.86	8.99	-35.8	8.40	-9.34
DeSoto Canyon, Charleston Bump, East FL Coast	-31.41	6.53	10.77	-13.96	10.74	7.13	8.35	-33.32	-12.98	9.95	-17.77	4.08	-18.48

7.2 Use of Gear Restrictions and Modifications to Reduce Bycatch, Bycatch Mortality, and Incidental Catch from Pelagic Longline Gear in the Atlantic Ocean

Time/area closures alone may not be the only strategy to minimize bycatch in the pelagic longline fishery. NMFS has identified a need to further protect bycatch species in areas open to pelagic longline fishing gear, particularly sea turtles (see Section 5.8). The following alternatives examine the utility and effectiveness of restrictions on pelagic longline fishing methods and gear modifications that would reduce bycatch and incidental catch, and/or increase survival rates of bycatch caught on pelagic longline gear. Further, these alternatives were considered as possible mechanisms to reduce the spatial and temporal constraints of time/area closures, thereby alleviating economic, social and community burdens associated with closures, by providing an alternative means to achieve the over-arching conservation goals of the agency to comply with NS9.

Final Action: Prohibit use of live bait on pelagic longline gear used in the Gulf of Mexico

The proposed rule included a closure of the western Gulf of Mexico primarily to reduce the level of billfish discards from pelagic longline gear. The IRFA and RIR in the DSEIS clearly discussed the economic impacts associated with time/area closures in U.S. waters. Further, public comments on the proposed rule indicated that the Vietnamese-American community in the Gulf of Mexico may be differentially impacted by the western Gulf closure, leading to environmental justice concerns as discussed in Section 7.1. An additional issue raised during the comment period relates to the effectiveness of the proposed closures relative to cumulative Atlantic-wide billfish mortality levels as reported to ICCAT by member entities. Pelagic longline fisheries account for approximately 70 percent of blue marlin, 94 percent of white marlin, and 98 percent of the sailfish mortalities that the U.S. reported to ICCAT during 1996 to 1998; however, the total *U.S.* billfish mortality (commercial discards and recreational landings) generally represents 3 to 5 percent, or less, of stock-wide mortality levels (Table 6.4).

Atlantic blue marlin, Atlantic white marlin, and west Atlantic sailfish have all been designated as overfished. A stock assessment for blue and white marlin will be conducted in July 2000; a west Atlantic sailfish assessment is scheduled for 2001. However, based on information provided from the previous assessment (SCRS, 1996) and Amendment One of the Atlantic Billfish FMP, Atlantic-wide reductions on the order of 1,400 mt of blue marlin and 310 mt of white marlin from reported 1998 landings are necessary to begin to rebuild these overfished stocks within a 10-year time frame. Even if all U.S. sources of billfish mortality were removed, considerable additional measures would be required by other ICCAT member entities to achieve necessary levels. However, this does not remove the requirement that the United States take necessary, reasonable, and appropriate actions.

Recent studies and discussions with HMS and Billfish AP members suggest that there may be a relationship between billfish bycatch and the use of live bait by pelagic longline fishermen, particularly in the Gulf of Mexico. Public hearings and written comments on the proposed rule to reduce bycatch in the pelagic longline fishery yielded many comments indicating that pelagic longline sets using live bait had differentially higher discards of billfish than those sets using dead bait. NMFS is committed to implementing conservation measures that have a meaningful effect, while being mindful of the economic, social and community burdens of these measures. Therefore, based on the evidence presented by public comment and limited available scientific information, NMFS subsequently conducted further investigations on the relationship between live bait pelagic longline sets and discards of billfish, and the results of that effort are summarized in the following discussion.

Population Effects on Bycatch Species

A recent manuscript from the NMFS Southeast Fisheries Science Center (Scott *et al.*, 2000; Appendix D) has provided an extensive scientific review of available logbook and observer data to evaluate the relationship between U.S. pelagic longline catch rates of billfish in the Gulf of Mexico and the use of live and dead bait. Blue marlin, white marlin and sailfish discards were combined for this analysis; observer data were subset for observations with positive identification of billfish species, and for all billfish species including unidentified billfish (which may contain a limited number of swordfish). In both the logbook and observer data sets, a higher proportion of live bait sets than dead bait sets encountered at least one billfish (Table 7.20, item C). To determine if catch patterns could be explained by other factors as well as bait type (live, dead), Scott *et al.* applied Generalized Linear Models of the probability of billfish capture and of the catch of billfish on *positive* hauls, controlling for year (1992-1998), calendar quarter, fishing zone (east Gulf vs. west Gulf), light stick usage (none, moderate, high), time of day (day, night), hook density (low, high), and depth of set (shallow, deep). A forward entry, stepwise procedure was used for evaluating the significance and order of entry for factors used in the models. In the analysis of both logbook and observer data, the effect of bait type was found to have a significant, measurable effect on catch per hook on hauls with billfish catch and on the proportion of hauls with billfish catch. From these model predictions, overall catch rates by bait type were estimated as the product of these two components (Table 7.20, item E).

Table 7.20. Changes in billfish discards from pelagic longline sets in the Gulf of Mexico. Source: Scott *et al.* (2000).

		Logbook data		Observer data All billfish, including unidentified billfish	
Type of Bait		Live Bait	Dead	Live Bait	Dead
Percent of Gulf sets using bait type	A	13%	87%	21%	79%
Number of sets using bait type (A*20,903)	B	2,717	18,186	4,390	16,513
Percent of sets with at least one billfish	C	24%	16.5%	67%	41%
Number of sets with at least one billfish (C*B)	D	652	3,001	2,941	6,770

		Logbook data		Observer data All billfish, including unidentified billfish	
Estimated billfish catch/1000 hooks [1]	E	1.06	0.56	1.98	1.19
Ratio live bait: dead bait	F	[illegible]:1		[illegible]:1	
Catch by set for bait type (E*D)[2]	G	691	1,638	5,823	8,056
Total catch rate	H	691+1638=2329		5,823+8,056=13,879	
Dead bait catch rate X number of live sets with billfish	I	0.56*652= 365		1.19*2,941= 3,468	
Relative number **fewer** billfish caught if no live bait (G-I)	J	326		2,355	
Percent reduction in Gulf billfish if use dead bait vs. live bait (J/H)*100	K	14.0%		17.0%	

[1]Catch rate = proportion of hauls which catch billfish * catch-per-hook on hauls with billfish catch
[2]Assumes the number of hooks per set are the same on live bait sets and dead bait sets. For comparison purposes it is assumed that each set has 1000 hooks.

Although the predicted average catch rate for live bait hauls is about twice that of dead bait hauls (Table 7.20, item F), the overall proportion of live bait sets (13% from logbook reports, 21% for observer coverage) is lower than those using dead bait (Table 7.20, item A). To more accurately predict the expected reduction in billfish bycatch associated with prohibition of live bait, Scott *et al.* (2000) developed predictive models based on weighted average of live bait and dead bait usage. This method was used to estimate the expected reductions in billfish discards under a one-for-one substitution of dead bait sets for live bait sets, giving a 10.4 percent reduction using logbook data and 12.1 percent reduction with the observer information. They also examined the potential increase in fishing effort as compensation for time no longer used in catching live bait, yielding estimates of 3.6 percent reduction Gulf-wide with logbook data and 1.5 percent with observer data.

The predicted percent reduction in discards of billfish from pelagic longline sets in the Gulf of Mexico provided by Scott *et al.* (2000) was based on the frequency of live bait usage provided in logbook reports (13%). The report also notes that observer coverage in the Gulf of Mexico indicates that 21 percent of observed sets used live bait. The analysis outlined in Table 7.20 expands on the information provided by Scott *et al.* (Section A to F of Table 7.20) to develop estimates of expected reductions in billfish discards if use of live bait is prohibited using both logbook and observer reports. Further, this analysis is based only on expected reduction of billfish discards from positive billfish catches from both dead bait and live bait sets. This method predicts a 14 percent (logbook) to 17 percent (observer) reduction in billfish discard if pelagic longline sets made in the Gulf of Mexico between 1992 through 1998 had used dead bait rather than live bait.

The Scott *et al.* (2000) report and the expanded analysis provide estimates of the reductions in the bycatch of the billfish complex in the Gulf of Mexico if use of live bait is prohibited. However, the percent reductions calculated in the time/area analysis (Section 7.1) are based on Atlantic-wide discard levels, for each individual billfish species. To provide an estimate of the effectiveness of prohibiting live bait on pelagic longline on reducing blue marlin, white marlin, and sailfish discards throughout the operational range of the U.S. Atlantic pelagic longline fishery, an alternative analytical method was employed based on the logbook database used to generate the time/area closures (Section 7.1). Over the five year period between 1993 through 1998, logbook reports from the Gulf of Mexico indicate that 3.3 million hooks used live bait and 12.04 million hooks used dead bait. The catch rate per 1000 hooks of blue and white marlin, sailfish, bluefin tuna (discards) and BAYS tunas are shown in Table 7.21. The ratio of discards from live bait hooks to discards from dead bait hooks indicates that blue marlin are caught over twice as frequently on live bait than on dead bait, white marlin are caught at a rate about 50 percent higher on live bait than on dead bait, and sailfish are caught at nearly five times the rate on live bait.

NMFS also investigated other available scientific studies on differential catch rates of HMS bycatch and target species by pelagic longline gear. Hoey and Moore (1999) examined several existing observer and scientific databases from NMFS, universities and other sources for 1990-1997. Pelagic longline sets using live bait in the Gulf of Mexico accounted for 22 percent of the total sets observed in the Gulf of Mexico (n=954). The catch per 1000 hooks using live and dead bait, and resultant ratio of live bait to dead bait catch rates from information provided by the Hoey and Moore study are presented in Table 7.21. Similar patterns in the ratios between live bait and dead bait for discards of billfish were noted for the observer data relative to logbook reports.

Although marlin are caught about twice as frequently on live bait hooks and sailfish four to five times more often than on dead bait, the relative live bait effort must be compared to dead bait effort in order to estimate the effectiveness of a ban on live bait. Live bait was used on approximately 21 percent of the pelagic longline hooks reporting bait type in the 1993 through 1998 logbooks. An estimate of the percent change in billfish discards by shifting from live to dead bait was made by multiplying the catch rate of each billfish species on dead bait pelagic longline hooks by the number of hooks used with live bait. The products of this calculation were then added to the number of discards from dead bait reported in the logbooks to yield a “revised” discard total (for dead bait only). The change in the observed discards relative to the revised discards with only dead bait provides estimates of the effectiveness of banning live bait for blue marlin, white marlin, sailfish, bluefin tuna and BAYS tunas (Table 7.21). The reductions in billfish discards were then compared to Atlantic-wide discards by the U.S. pelagic longline fleet, to allow consistent comparisons with percent change values presented for the time/area closure analysis. A similar procedure was followed for the observer information provided by Hoey and Moore (1999).

The expected reductions in billfish discards for closing the western Gulf of Mexico (GulfB) under the no effort redistribution and effort redistribution models are presented in Table 7.21 for comparison purposes. The live bait prohibition could potentially be as effective for reducing sailfish discards as closing the western Gulf based on no effort redistribution, and much more effective if any pelagic longline effort from the western Gulf of Mexico is moved to other open areas. The results of banning live bait are not as dramatic for blue and white marlin, particularly with the no effort redistribution model where live bait would be about one-third to one-fourth as effective as the closure. When compared to the results of a western Gulf of Mexico closure under the effort redistribution model, the live bait prohibition is about half as effective as the proposed closure. It should also be noted that the DeSoto Canyon area closures will provide additional benefits for billfish, but not of the same magnitude as the western Gulf of Mexico.

Table 7.21. Comparison of live and dead bait information from logbook and observer databases in the Gulf of Mexico.

		Blue Marlin Discards	White Marlin Discards	Sailfish Discards	Bluefin Tuna Discards	BAYS/YFT Kept
1993 through 1998 Pelagic Logbook						
Catch/1000 Hooks	Live Bait	0.37	0.31	0.60	0.04	15.05
	Dead Bait	0.17	0.20	0.12	0.01	9.43
Ratio	Live: Dead	2.19:1	1.51:1	4.92:1	2.37:1	1.59:1
Observer Programs (Hoey and Moore, 1999)						
Catch/1000 Hooks	Live Bait	1.00	1.04	1.56	n/a	18.22
	Dead Bait	0.41	0.51	0.39	n/a	11.66
Ratio	Live: Dead	2.42:1	2.05:1	3.97:1	n/a	1.56:1
Atlantic-wide Reductions (U.S. pelagic longline fleet)						
Logbook Data (FSEIS)		-3.3%	-2.1%	-15.3%	-0.4%	-3.0%
Observer Data (Hoey)		-3.6%	-3.2%	-14.3%	n/a	-2.9%
DSEIS: GulfB No Effort Redistribution Model		-11.1%	-13.4%	-15.87%	-0.9%	-10.5%
DSEIS: GulfB Effort Redistribution Model		-7.2%	-8.0%	0.6%	0.14%	1.1%

The prohibition on the use of live bait will be delayed by one month from the anticipated publication date of the final rule on August 1, 2000. Delaying this gear restriction for the pelagic longline fishery will allow fishermen time to be notified and comply with the new regulation. Approximately 28% of the blue marlin, 22% of the sailfish, and 20% of the white marlin total annual discards occur during the month of August from live bait sets in the Gulf of Mexico. Therefore, the one month delay in the prohibition of live bait could potentially result in an additional discard of 42 blue marlin, 80 sailfish, and 25 white marlin than would be expected from using only dead bait on pelagic longline gear in the Gulf of Mexico beginning on August 1.

Ecological Effects Due to Changes in Bycatch of Those Species

This alternative would be expected to reduce billfish bycatch and is likely to reduce catch rates of targeted tuna species from 15 tuna per 1000 hooks to 9.4 tuna per 1000 hooks; however, catch of swordfish may increase if fishing practices are shifting toward nocturnal fishing. Biological benefits for sailfish could be most pronounced, relative to the benefits for blue and white marlin.

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

It is not likely that the use of dead bait, exclusively, would have effects on bycatch of other species. Discards of swordfish are not likely to increase since yellowfin sets, using live or dead bait, generally take place during the day. Pelagic longline efforts targeting swordfish occur at night and use additional equipment (e.g., lightsticks) that may prevent tuna fishermen from switching to swordfish. This alternative is not expected to have any significant impact on sea turtle interactions since the catch rate of turtles on both dead bait and live bait is very low in the Gulf of Mexico.

Effects on Marine Mammals and Sea Birds

The effects of live bait vs. dead bait on sea bird and marine mammal mortality are unknown. NMFS does not have sufficient data to explore whether interactions with mammals and birds are increased or decreased with the use of live bait. Intuitively, one could assume that because live fish are likely to sink faster than frozen bait, they would be out of the reach of sea birds sooner and therefore live bait might reduce bycatch of sea birds. However, there is no scientific evidence on the Atlantic pelagic longline fishery to substantiate this.

Changes in Fishing, Processing, Disposal, and Marketing Costs

This final action will have effects on fishing (see below), bait processing and disposal for those currently using live bait, but is not likely to have any effect on processing, disposal or marketing costs. Fishermen in the Gulf of Mexico who use live bait may tend to have trips of longer duration to allow time to catch bait. While they may carry frozen bait on board the vessel, they are more likely to return to structures (e.g., oil rigs) to catch bait instead of using frozen bait reserves. Bait dealers may experience an increase in business under this final action.

Changes in Fishing Practices and Behavior of Fishermen

Pelagic longline fishermen in the Gulf of Mexico utilizing live bait generally set their gear during daylight hours to target yellowfin tuna. Live bait is obtained at the initial portion of a pelagic longline trip by using handline gear around oil rigs or other structures, and can be replenished throughout the trip depending upon need. Some live bait is obtained by attracting bait to the fishing vessel with lights during the night. Live bait is stored on board the fishing vessel, generally in a round holding tank with a pump that provides a constant supply of fresh sea water. Live bait can include jacks (blue runner, hard tail, scad), Spanish sardines and various herrings. Prohibition of live bait would require a change in fishing techniques, and may require purchase and storage of dead bait, although some fishermen may prefer to catch their own bait using the techniques outlined above. If dead bait is purchased prior to departure, it is possible that pelagic longline trips may include more sets given the reduced time spent catching live bait. However, fishing trips are probably more limited by hold capacity and supplies, so it is not likely that trips will be significantly longer in duration. This alternative would cause fishermen to change their practices of buying and/or harvesting bait, however, it would likely be a minor change because dead frozen bait is widely available at many fishing docks. Current live bait fishermen may also need to experiment with the way they set their longline gear if using dead bait in order to minimize the effect on catch rates of target species. As stated previously, live bait is generally used in targeting yellowfin tuna; however, most pelagic longline effort (79% to 87%, Table 7.20) uses dead bait to catch tuna and swordfish. It is unknown whether there is cultural or economic significance associated with using live bait in the Gulf of Mexico; observers note that it is predominantly Vietnamese-American fishermen who follow this practice (D. Lee, NMFS-SEFSC, Miami, FL, pers. comm.).

Changes in Research, Administration, and Management Effectiveness

This final action may be difficult to enforce since fishermen catch their bait during the fishing trip, and therefore the prohibition would have to be enforced at sea. A possible enforcement method could include disallowing the use of circular tanks, aerators, live-wells, or any other holding facilities necessary for keeping bait alive for extended periods. Further, comments supporting the prohibition of live bait were received from many within the industry associated with this fishing technique, and they indicated a strong preference for using dead bait rather than having all fishing cease due to an extensive time/area closure. It is anticipated that there will be cooperation among the various user-groups in implementing this gear modification.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

Although the objectives of the final rule for developing gear restrictions for pelagic longline fishing did not address the recreational fishing component of HMS management, any management measure leading to a reduction in discards of billfish from commercial fishing gear, may lead to localized increases in angler success and satisfaction, and resultant economic benefits to associated U.S. recreational industries. Since the live bait prohibition is expected to yield a reduction in billfish mortality, there may also be a concomitant benefit to this measure on the recreational fishery. The total population of billfish anglers has not been quantified; available estimates are based on expansion techniques of recreational fishing databases. Fisher and Ditton (1992) estimated that there were 7,915 U.S. tournament billfish anglers in the west Atlantic Ocean during 1989, making a total of 102,895 billfish fishing trips (90 percent confidence interval = 6,512), including tournament and non-tournament participation. More recently, Ditton and Stoll (1998) reported in summarizing an analysis by the American Sportfishing Association of the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, that 230,000 anglers in the United States spent 2,136,899 days fishing for various billfish species. They noted that the ten states with the highest number of billfish anglers were: 1. Florida (159,575); 2. California (31,162); 3. North Carolina (30,071); 4. Hawaii (26,588); 5. Texas (23,714); 6. New Jersey (17,687); 7. New York (12,671); 8. South Carolina; 9. Maryland (9,959); and 10. Delaware (8,666).

Fisher and Ditton (1992) completed an inventory of 359 billfish tournaments held in 1989 along the U.S. Atlantic coast, including the Gulf of Mexico, as well as Puerto Rico and the U.S. Virgin Islands. A total of 1,984 billfish anglers were surveyed, with 1,171 anglers responding. Respondents reported spending an average of $1,601 (excluding tournament fees) for a billfish fishing trip that lasted an average of 2.59 days, with an average of 13 trips taken each year. The average amount spent annually on billfish tournament fees was $1,856, or $546 per tournament, giving a $2,147 total expenditure per angler per trip. The total annual expenditure estimates generated from the Fisher and Ditton study indicated that in 1989, billfish tournament anglers spent an estimated $180 million in attempting to catch billfish (tournament and non-tournament trips), giving an average equivalent expenditure of $4,242 for each fish caught or $32,381 for each billfish landed. Ditton (1996) reported that the annual net economic benefits for the group surveyed was over $2 million. Fisher and Ditton estimated that there were 7,915 U.S. tournament billfish anglers, which translates to a $262 annual consumers surplus per billfish angler.

Changes in the Distribution of Benefits and Costs

The only predictable changes in the distribution in benefits and costs are that users of live bait might incur some costs from developing avenues for buying dead bait and might need to change the way they prepare for trips and the way they set their gear. There may be an initial change in profitability with a reduced catch-per-unit-effort for tuna that is likely to be experienced in shifting from live to dead bait (15 tuna/1000 hooks vs. 9.4 tuna/1000 hooks). The additional costs in terms of time spent catching live bait would be offset by the costs of purchasing dead bait, although some fishermen may still desire to catch their own bait and use it as dead bait. The fishermen who represent the 79 to 87 percent of pelagic longline sets made in the Gulf of Mexico with dead bait would not need to change their fishing behavior at all, nor would they have to change the current process for buying bait and preparing for a trip.

Social Effects

Although it is not known what cultural values are associated with capturing bait for a pelagic longline trip, this alternative would not be expected to have any social effects on fishermen or fishing communities, with the possible exception of the Vietnamese-American community that utilizes this fishing technique. There will be a period of adjustment for learning new fishing practices which may have some negative social impacts on this community.

Summary

The decision to ban the use of live bait rather than close the western Gulf of Mexico to pelagic longline fishing was made in consideration of the economic, social, and community trade-offs between the proposed closure of the western Gulf of Mexico (Gulf B) with a potential conservation benefit of a 7.2 to 11.1 percent reduction in blue marlin discards, for example, as compared to allowing fishing to continue in the proposed closed area, albeit without live bait, to achieve a 3.3 to 3.6 percent reduction in blue marlin Atlantic-wide discards by U.S. pelagic longline vessels. Use of the live bait prohibition is just as effective in reducing sailfish discards as the western Gulf of Mexico closure. When examined within the context of international mortality levels (U.S. billfish mortalities from commercial dead discards and recreational landings represent only 3 to 6 percent of the entire reported Atlantic billfish mortality levels), banning live bait appears to be a reasonable and prudent conservation measure to achieve the objective of this final action toward compliance with NS9. NMFS will carefully monitor changes in billfish discards by the Gulf of Mexico pelagic longline fleet. Additional measures may be implemented if the live bait prohibition is not as effective as anticipated.

Management Alternatives to Minimize Turtle Bycatch

The Atlantic pelagic longline fishery exceeded the authorized take level for threatened sea turtles during 1999 (see Section 5.8). Based on preliminary observer data analyses provided by NMFS OPR, NMFS OSF requested re-initiation of consultation under Section 7 of the Endangered Species Act. The June 2000 draft BO indicated that the continued operation of the Atlantic pelagic longline fleet is likely to jeopardize the continued existence of the loggerhead turtles. It is possible, pending additional analysis, that the final BO will also include a jeopardy finding for leatherback sea turtles. The BO identified framework RPAs to reduce loggerhead turtle takes, including modifications to fishing methods, gear modifications, exclusion zones (with several experimental alternatives that would allow testing of alternative fishing practices which may reduce the level of interaction with sea turtles) and monitoring actions. If the final BO includes a jeopardy finding for leatherback, the same or similar RPAs and other conservation measures included for loggerhead sea turtles may also apply to leatherback sea turtles. Although the RPAs included several alternatives considered in the proposed rule, which are evaluated here as part of the FSEIS, NMFS is currently initiating efforts to specifically address the BO, including possible regulatory and non-regulatory measures.

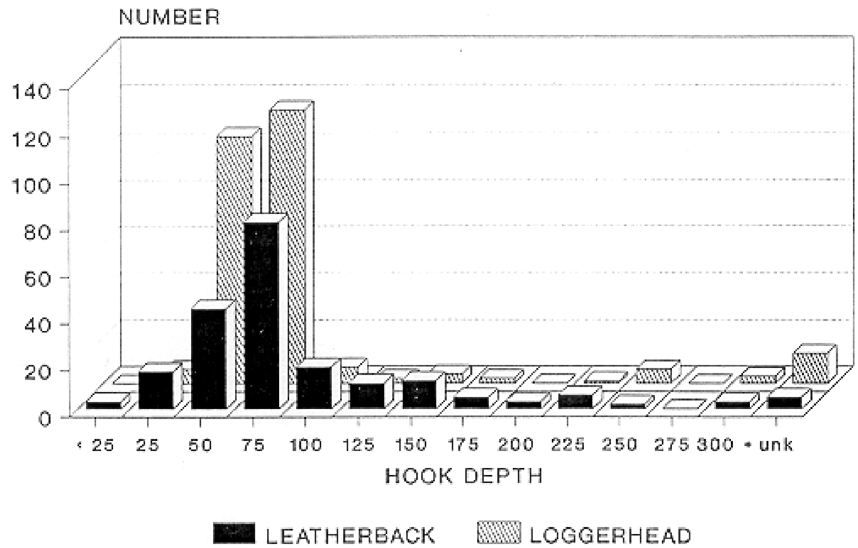
Not Selected at this Time: Measures to rig longlines so hooks are fished deeper in the water column

The June 2000 draft BO indicated as part of the RPAs that prohibiting pelagic longline fishing in the top 15 m of the water column may reduce the number of leatherback and loggerhead sea turtle takes. This alternative would prohibit gangions or hooks within 240 feet of the float or floatline to reduce turtle hookings (240 feet is believed to be the mean depth for hooking swordfish). Alternatively, it might require setting 4 or more hooks between floats and setting longer gangions and droppers.

Population Effects on Bycatch Species

Preliminary data show the rate of turtle takes is higher on hooks near floats (Figure 7.12). However, analyses are preliminary and such a measure would be difficult to enforce. Non-compliance might reduce expected benefits to sea turtle populations. Turtles could still be hooked while setting or hauling longline, thus mitigating bycatch reduction gained by this requirement. This alternative is based on an analysis of observer data, particularly with respect to the high number of interactions in the Grand Banks area. Further, swordfish discard rates in the Northeast Distant region were somewhat lower in observed sets for longlines rigged with 4 or more hooks between floats (31 swordfish per 1,000 hooks for 3 hook rigs compared to 26-27 swordfish per 1,000 hooks for 4 and 5 hook rigs, Hoey and Moore, 1999).

Figure 7.12. The number of turtle interactions with respect to hook depth. Source: Based on observer data; taken from Hoey and Moore, 1999.



Ecological Effects Due to Changes in Bycatch of Those Species

There might be ecological effects from this alternative due to decreased rates of interactions with sea turtles and resulting increased population sizes. Increased turtle stock size might have effects on prey species, however, stocks are currently so depressed that growth in stock size in the next few years is unlikely to have far-reaching ecological effects.

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

This measure might change the catch composition of the longline set if hooks are set deeper. However, the depth change is likely only to be noticeable for those hooks that are closest to the floats. NMFS has not yet analyzed the composition of the target catch on those hooks closest to the floats (preliminary analyses focused on turtles).

Effects on Marine Mammals and Sea Birds

This measure would not be expected to have any effects on marine mammals or birds. NMFS does not know of any studies of hook depth that evaluated mammal or bird capture rates.

Changes in Fishing, Processing, Disposal, and Marketing Costs

There might be higher costs associated with re-rigging and/or extending the length of the longline gear. There would be no other expected changes in costs except for gross revenue foregone because catch rates drop as a result of fewer hooks on the mainline or the increased depth of hooks while the gear is fishing.

Changes in Fishing Practices and Behavior of Fishermen

This alternative would cause fishermen to re-rig their longlines which might take some initial training for the crew. However, once the system is re-rigged, there would be no expected changes in fishing behavior or practices.

This measure would not be expected to have long-term impacts on processing, disposal, or marketing costs. To the extent that a recent boycott on certain seafood products has reduced the demand for longline-caught HMS, and to the extent that an increase in positive media coverage could offset that decrease in demand, this alternative might improve public perception of the fishing practices of the longline fleet. If so, this gear modification might be able to contribute to the increased demand and thus improved prices for U.S.-caught HMS.

Changes in Research, Administration, and Management Effectiveness

This alternative would be difficult to enforce (i.e., must be enforced at sea while the gear is deployed) and therefore might have decreased management effectiveness if fishing vessel operators do not perceive benefits from compliance. From an administrative standpoint, gear modifications are less costly to implement than time/area closures.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This alternative might decrease catch rates of target species (fish per set) since fewer hooks could be set on a mainline. It is difficult to predict how fishermen might respond to this measure. They might choose to set a longer mainline in order to make up for lost swordfish due to fewer hooks per set for their traditional length of line.

From a social or cultural standpoint, longline fishermen might benefit by indicating support for fishing practices that may reduce sea turtle interactions.

Changes in the Distribution of Benefits and Costs

This alternative would not be expected to change the distribution of benefits and costs for the pelagic longline fishery unless there is a change in the composition of the target catch (tunas, swordfish) or other marketable non-target fish (e.g., dolphin, pelagic sharks).

Social Effects

This alternative would not be expected to have social effects on fishing communities.

Summary

Although this alternative is not selected at this time, depth of pelagic longline fishing gear may be included as part of regulatory actions to address concerns in the BO regarding takes of sea turtles. OSF will be working with OPR to develop an experimental design that may include this alternative. Fishermen are encouraged to try this gear modification in order to reduce the probability of encountering sea turtles.

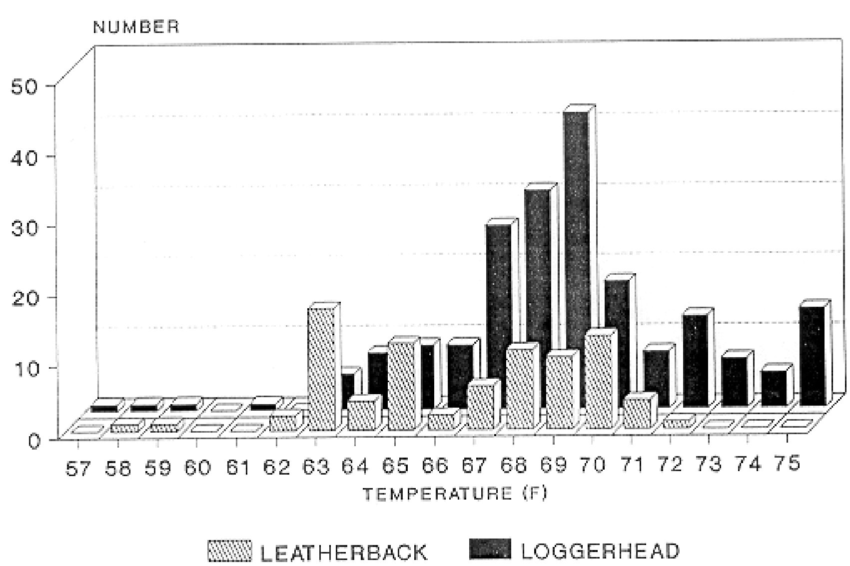
Not Selected at this Time: Prohibit the setting of a pelagic longline in water temperatures greater than 68 degrees F in the Grand Banks area

The June 2000 draft BO indicated as part of the RPAs that pelagic longline fishing should be prohibited where water temperatures with sea surface temperatures exceed 67° F in the Atlantic Ocean north of 35°N latitude to reduce the number of loggerhead sea turtle takes. Compliance with this requirement must be monitored, either through the use of observers or VMS.

Population Effects on Bycatch Species

Preliminary data show the rate of turtle takes is relatively higher in warmer waters of the Gulf Stream (Figure 7.13). This would be likely to have more of a positive impact on loggerhead turtles, which appear to be more closely associated with warmer water than the leatherback turtles.

Figure 7.13. The number of pelagic longline sets made in the Grand Banks area and the number of turtle interactions in 1994-1995. Source: Hoey, 1996.



Ecological Effects Due to Changes in Bycatch of Those Species

There might be ecological effects due to decreased rates of interactions with sea turtles and resulting increased population sizes. Increased turtle stock size might have effects on prey species, however, stocks are currently so depressed that growth in stock size in the next few years is unlikely to have far-reaching ecological effects. If bycatch of sharks increases by forcing longline fishermen to set in cooler waters, this alternative could have increased impacts on those species (e.g., blue sharks).

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

This measure would likely change the catch composition of the longline set if hooks are set in cooler waters. For example, more or less swordfish or sharks might be caught in lower temperature waters. The essential fish habitat portion of the HMS FMP (Chapter 5) summarizes the relationship between distributional patterns and oceanographic features such as warm water gyres. Pelagic longline fishermen often fish along water masses with temperature differentials to increase catch rates.

Effects on Marine Mammals and Sea Birds

This measure would not be expected to have any effects on marine mammals or birds. NMFS does not know of any studies of water temperature that evaluated mammal or bird capture rates.

Changes in Fishing, Processing, Disposal, and Marketing Costs

There might be higher costs associated with searching for suitable fishing areas with the right water temperature. There are no other expected changes in the above-mentioned costs unless catch rates of target species drop as a result of cooler water sets. If blue shark bycatch increased as a result of this measure, fishermen might experience increased gear replacement costs (i.e., hooks lost to discarded blue sharks).

Changes in Fishing Practices and Behavior of Fishermen

This alternative would change the fishing practices of fishermen as they search for target species in cooler water. However, fishermen might spend less time disentangling turtles. This measure would not be expected to have long-term impacts on processing, disposal, or marketing costs. To the extent that a recent boycott on certain seafood products has reduced the demand for longline-caught HMS, and to the extent that an increase in positive media coverage could offset that decrease in demand, this alternative might improve public perception of the fishing practices of the longline fleet. If so, this gear modification might be able to contribute to the increased demand and resultant increased prices for U.S.-caught HMS.

Changes in Research, Administration, and Management Effectiveness

This alternative could be monitored using VMS technology in connection with satellite data on sea surface temperatures. This approach would require ground-truthing through the NMFS observer program. However, at-sea enforcement would be difficult. It would be difficult for fishermen to comply with this alternative because of changing water conditions and the length of the mainline which might result in parts of the line being fished in one temperature range while the other end might be in another temperature range. This would decrease management effectiveness.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This alternative would not be expected to change the value of fishing activities, except through benefits derived from the non-consumptive use of turtles, e.g., people who value the fact that turtle populations might recover. Pelagic longline fishermen might enjoy improved public perception of their fishery if they could successfully reduce turtle takes.

Changes in the Distribution of Benefits and Costs

This alternative would not be expected to change the distribution of benefits and costs. Fishermen are continually searching for favorable oceanographic conditions in which to fish, therefore this alternative would give them an additional factor to consider.

Social Effects

This alternative would not be expected to have social effects on fishing communities except those derived from the possible improved public perception of the pelagic longline industry for reducing turtle takes.

Summary

Although this alternative is not selected at this time, prohibiting use of pelagic longline gear in water temperatures warmer than 68°F in areas of the Atlantic north of 35°N latitude may be included as part of regulatory actions to address the concerns raised in the June 2000 draft BO regarding sea turtle takes by the pelagic longline fishery.

Not Selected at this Time: Prohibit the setting of pelagic longline gear between 3 p.m. and 9 p.m.

The June 2000 draft BO indicated as part of the RPAs that pelagic longline fishing should be prohibited during certain times of the day to reduce the number of loggerhead sea turtle takes. Compliance with this requirement must be monitored, either through the use of observers or VMS.

Population Effects on Bycatch Species

Preliminary observer data analyses indicate that the rate of turtle takes is higher in sets made in the evening before 9 p.m. Therefore, delaying setting pelagic longline gear until after 9 p.m. might result in fewer turtle interactions.

Ecological Effects Due to Changes in Bycatch of Those Species

There might be ecological effects due to decreased rates of interactions with sea turtles and resulting increased population sizes. Increased turtle stock size might have effects on prey species, however, sea turtle stocks are currently so depressed that growth in stock size in the next few years is unlikely to have far-reaching ecological effects. If there are fewer turtles on hooks, the hooks would be available to other marketable species.

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

This measure might change the catch composition of the longline set if soak time decreases or if haulback extends into late morning or early afternoon. For example, more or less swordfish or sharks might be caught if the gear is in the water for shorter time or for longer periods of daylight.

Effects on Marine Mammals and Sea Birds

This measure would not be expected to have any effects on marine mammals or birds. NMFS does not know of any studies of set time that evaluated mammal or bird capture rates.

Changes in Fishing, Processing, Disposal, and Marketing Costs

There are no other expected changes in revenues unless catch rates of target species drop as a result of late evening sets. This measure would not be expected to have long-term impacts on processing, disposal, or marketing costs. To the extent that a recent boycott on certain seafood products has reduced the demand for longline-caught HMS, and to the extent that an increase in positive media coverage could offset that decrease in demand, this alternative might improve public perception of the fishing practices of the longline fleet. If so, this gear modification might be able to contribute to the increased demand for U.S.-caught HMS.

Changes in Fishing Practices and Behavior of Fishermen

This alternative would change the fishing practices of fishermen as they adjust setting and haulback schedules. However, fishermen might benefit from spending less time dis-entangling turtles. This alternative may have safety implications depending on how fishermen might react to the requirement. Changing the scheduling of longline setting and hauling activities may increase fatigue, which could jeopardize the safety of the captain and crew.

Changes in Research, Administration, and Management Effectiveness

This alternative could be monitored using VMS technology and would be evaluated for effectiveness through the NMFS observer program.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This alternative would not be expected to cause any significant changes in the value of the fishery except those mentioned earlier regarding improved public perception of the fishery.

Changes in the Distribution of Benefits and Costs

This alternative would not change the distribution of benefits and costs.

Social Effects

This alternative would not be expected to have social effects on fishing communities.

Summary

Although this alternative is not selected at this time, restricting the time of day that pelagic longline gear may be included as part of regulatory actions to address the concerns raised in the June 2000 draft BO regarding sea turtle takes by the pelagic longline fishery.

<u>Management Alternatives to Reduce Bycatch Mortality</u>

Not Selected at this Time: Require use of circle hooks on all pelagic longline gear

This alternative would require that all pelagic longlines be rigged with circle hooks. The use or possession of straight shank or "J" hooks would be prohibited if a pelagic longline was on board. Logbook and observer data would be used to determine success in reducing hooking and post-hooking mortality of sea turtles, mammals, and finfish.

Population Effects on Bycatch Species

This measure might increase survival of bycatch finfish and turtles because circle hooks are less likely to be ingested than “J”-hooks (Falterman and Graves, 1999); therefore serious ingestion injuries are likely to occur less frequently. This alternative has the potential to increase survival of pelagic longline bycatch and have a positive impact on the populations of bycatch species. The success of this measure, however, would likely vary by species. For example, some fishes, such as lancetfish and wahoo, experienced 100 percent mortality when retrieved from a pelagic longline, regardless of hook type (Falterman and Graves, 1999). If circle hooks are not strong enough to hold large fish such as bluefin tuna or sharks, there may be beneficial effects if the hook bends and the fish is released before it dies on the line.

In a study conducted in the Venezuelan pelagic longline fishery, tuna catches per-unit-of-effort increased with the use of circle hooks (Falterman and Graves,1999). If this holds true throughout the geographical range of the pelagic longline fleet, and if fishermen targeting tuna are not currently using circle hooks, there might be an incremental portion of tuna longline fishermen who experience higher catches of tuna per set and therefore, lower catches of non-target species. A large portion of the pelagic longline fleet in the Gulf of Mexico targeting tuna currently utilize circle hooks. Therefore, for the remaining portion of the fleet targeting tuna and swordfish with “J” hooks, bycatch composition could change or bycatch could decrease due to a larger number of hooks being utilized by tunas and swordfish.

The qualities and the shape of the circle hook also make it a plausible choice for reducing sea turtle hooking injuries, although there is some evidence of differential effectiveness between loggerhead and leatherback turtles. A study of the effectiveness of using circle hooks to reduce sea turtle takes and associated mortality in the Azores has been funded by NMFS but is not scheduled until later in 2000. Currently, NMFS knows of no data to confirm the turtle-protection effectiveness of circle hooks as opposed to “J” hooks.

Ecological Effects Due to Changes in Bycatch of Those Species

It is unknown to what extent this alternative would affect bycatch composition because CPUE by species for circle hooks has been studied only in limited situations. However, no far-reaching ecological effects would be expected. This measure would be expected, however, to increase survival of all bycatch species.

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

This measure would not be expected to have effects on bycatch of other species, and therefore would not be expected to affect their populations or the ecosystem of other species.

Effects on Marine Mammals and Sea Birds

This measure might increase survival of marine mammals that are entangled in longline gear. However, in 1993-1997, observers documented 24 marine mammals taken by pelagic longline gear. Of these mammals, 11 (or approximately 50%) were noted as being wrapped in the mainline and were not hooked. Only 5 mammals were identified as being hooked. Therefore, it is not expected that changing hook types would have a significant positive impact on marine mammal survival. (Refer to Appendix A for more detailed information)

This measure would not be expected to have significant effects on birds because Atlantic pelagic longline fishermen do not have many interactions with birds. It is not known if hook type affects the hook location in sea birds, nor is it known if hook location in birds accounts for differential mortality between hook types. It is unknown if hook type would increase sea bird mortality. Changing deployment methods, such as mandating the use of line throwers or dyeing bait would be more likely to affect sea bird mortality.

Changes in Fishing, Processing, Disposal, and Marketing Costs

One supplier of fishing hooks has indicated the following approximate per-hook costs: $0.25 for circle hooks and $0.79 for “J” hooks. Therefore, the most conservative estimated cost for the entire Atlantic and Gulf longline fleet to refit their longlines with circle hooks (assuming no longline fishermen use circle hooks now) would be $1.9 million (7.7 million hooks @ $0.25/hook, based on logbook estimates) plus the labor costs of refitting the hooks. There is also the unquantifiable opportunity costs of possible lost swordfish catches. The circle hook cost divided by 210 vessels (reported operating in the fishery during 1998 in logbooks, Cramer and Adams, 2000) would average $9,121 per vessel. This is a high estimate on one hand because many tuna longline fishermen already use circle hooks. However, this is an estimate based on the number of hooks used in the fishery in 1998 (Cramer and Adams, 2000) and does not cover the additional hooks that are kept aboard for replacements. This would affect the portion of the pelagic longline fleet that does not already use circle hooks (i.e., those fishermen who do not report making sets that target yellowfin tuna).

If circle hooks are not strong enough to hold a large swordfish or shark, for example, these fish may be lost and target catch may decrease. It has been reported to NMFS that the hook industry is interested in constructing a stronger circle hook, which may be available in the future.

This measure would not be expected to have long-term impacts on processing, disposal, or marketing costs. To the extent that a boycott on certain seafood products can reduce the demand for longline-caught HMS, and to the extent that an increase in positive media coverage could offset that decrease in demand, this alternative might improve public perception of the pelagic longline fleet and therefore might be able to contribute to the increased demand for U.S.-caught HMS.

Changes in Fishing Practices and Behavior of Fishermen

This measure may change the behavior of fishermen because it is expected that circle hooks could increase survival of bycatch species, requiring an increase in the handling time for fishermen in order to release bycatch and incidental catch alive. Circle hooks also have been shown to increase CPUE for tunas in tuna longline sets. It is unknown how a change in hook type could affect targeted swordfish sets but catch rates of very large fish may decrease if the hooks are not strong enough to hold the fish, therefore it is possible that swordfish catches could be reduced with a ban of "J" hooks. If circle hooks decreased catch rates for target species, fishermen would be expected to fish longer sets or more sets in order to have a viable fishery.

Changes in Research, Administration, and Management Effectiveness

Management effectiveness could decrease because this measure is difficult to enforce. It is difficult to define a "circle hook" and fishermen might manually offset the hook which might result in decreased ecological benefits. However, management effectiveness would be increased if a low-cost gear modification could reduce bycatch and other more economically significant measures are not necessary. In addition, by requiring one type of hook on all vessels utilizing this gear type, this measure could be enforced at the dock and at sea. NMFS continues to fund studies on the effectiveness of circle hooks in increasing survival of released fish.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

If circle hooks can be manufactured to be strong enough to hold large fish, and hooking rates of target finfish do not change significantly, this measure would not have a negative economic impact on fishermen over time. These hooks probably increase catch rates of tunas, but might decrease catches of swordfish, relative to catch rates experienced with "J" hooks. In the short-term, this measure would force many fishermen to buy all new hooks to comply with the requirement. This measure might enhance the social image of pelagic longline fishing activities as longline fishermen would be perceived as "doing their part" to increase survival of discarded species. If circle hooks effectively reduce mortality of marine mammals as well, non-consumptive uses of these species would benefit greatly.

Circle hooks are thinner than "J" hooks and are not made of forged steel. Therefore, they are not used widely among Atlantic coast longline fishermen who target swordfish because they are not strong enough to ensure retention of the larger fish encountered. Using a larger circle hook (to increase strength) makes manipulation of the bait more difficult but may mitigate for the lost fish resulting from the smaller circle hook. If large fish are in the fishing area, the use of larger hooks might result in catches of larger fish (Orsi *et al.*, 1993). Because the swordfish fishery is managed under a limited quota, the use of circle hooks larger than the size of the commonly used "J" hooks might increase the value of the fish because encounters with smaller fish might be reduced.

By increasing the survival rate of hooked fish over a longer period of time, this alternative might increase the value of the landed fish because they would be of a higher quality. A fresher fish might result in a higher price and increased consumer surplus.

Circle hooks are also being utilized more frequently in the recreational fishery for HMS. Recent scientific studies by NMFS (Prince *et al.*, 1999) indicate that use of circle hooks with dead and live bait fishing practices significantly decreases injuries associated with the catch event. Several recent articles in sportfishing magazines also have provided further evidence on the value of circle hooks in reducing injury and mortality of billfish and other species caught on recreational fishing gear.

Changes in the Distribution of Benefits and Costs

Many longline fishermen who target yellowfin tuna in the Gulf of Mexico routinely use circle hooks. Other longline fishermen may also use these hooks already. It is thought that most swordfish and shark pelagic longline fishermen tend to use “J” style hooks. Long-term benefits of switching to circle hooks, however, would be shared by all commercial fishermen who would likely enjoy increased catch rates over time as the survival of released animals increases (many undersized target species). Likewise, recreational fishermen might benefit over the long-term since they might enjoy slightly increased catch rates of billfish because those species would also have decreased bycatch mortality.

Social Effects

This measure would not be likely to have significant social impacts on fishing communities. If fishermen have to make more sets or longer sets in order to maintain current landings of target finfish, this measure would have safety implications due to fatigue or reduced time set aside for maintenance of vessels. However, this measure is not expected to have significant safety concerns. This measure, if effective at increasing the survival of released fish and some species of turtles, could have positive social benefits as other more costly measures could be avoided to protect overfished species. If this measure changed the composition of the catch to include more retained tunas, fishermen might enjoy more gross revenues per set, which would likely have positive social benefits.

Summary

This alternative is not selected at this time until further scientific information can be garnered to support mandating the use of circle hooks. Circle hooks could reduce incidental catch mortality but may reduce swordfish catch rates. During the development of the HMS FMP, the HMS AP debated this alternative and concluded that circle hooks should be recommended for use by fishermen but that requiring circle hooks was not likely to be an effective management measure if enforcement resources remain at current levels. Since that time, NMFS funded a study which indicates that circle hooks can increase the CPUE of tunas on tuna longline sets and that they have a positive influence on hook location in finfish (e.g., jaw vs. stomach) which may be related to increased survival in the Venezuelan longline fishery. NMFS considered mandating this alternative for the tuna fishery in the Gulf of Mexico only, thereby avoiding the economic impact of reducing swordfish catches in the Atlantic fishery but decided to promote the voluntary use of circle hooks throughout the fishery instead. Finally, there are very little data indicating the effects of the use of circle hooks on sea turtles, although there is some evidence of differential mortality rates of some species of sea turtles taken on circle hooks.

Not selected at this time: Reduce pelagic longline soak time

This alternative would decrease the amount of time the longline could be "soaked" (i.e., the time between setting and hauling a longline).

Population Effects on Bycatch Species

This strategy would reduce the amount of time that pelagic longline gear can be deployed in the water and thus would reduce fishing effort (hours/hook) for each longline set. The most common soak time for pelagic longline sets reported in logbooks for each year 1995, 1996, and 1997 was 9 hours (range: 5-13 hours[2]). The reduction in soak time alternative might increase survival of bycatch species because some species survive for long periods of time on a longline. Until results from hook timers (Berkeley and Edwards, 1997), commercial fishermen thought that most fish that were still alive when brought to the boat were alive because they had been hooked during haulback or shortly before haulback. Table 7.22 indicates the proportion alive after various time intervals.

Table 7.22. The proportion of live HMS in various time intervals after being hooked. Source: Berkeley and Edwards, 1997.

Time after hooking (hr)	Yellowfin tuna (proportion alive)	Swordfish (proportion alive)	Blue Marlin (proportion alive)	White Marlin (proportion alive)
0-1	0.71	1.00	1.00	1.00
1-2	0.60	0.5	No observations	1.00
2-3	0.55	0.00	0.00	No observations
3-4	0.42	0.20	1.00	1.00
4-5	0.44	0.00	No observations	1.00
5-6	0.45	0.00	0.67	0.00
6-7	0.44	No observations	0.00	1.00
7-8	0.27	0.00	1.00	0.50
8-9	0.50	1.00	1.00	1.00
9-10	0.80	0.00	0.50	0.00
10-11	0.35	0.00	No observations	1.00
11-12	0.29	0.20	0.00	1.00

Berkeley and Edwards (1997) indicate a 58 percent survival rate after five hours for marlins (blue and white marlins combined) caught in the Gulf of Mexico on circle hooks (less than 5 percent of

[2]In 1996 and 1997, less than 1000 sets were reported to have a soak time of 21 hours. This is expected to be an error by the fishermen in recording a mixture of standard time and military time. NMFS enters the data as it is reported in the logbooks, regardless of apparent errors and therefore does not remove these outliers unless the captain can be contacted in a timely fashion. For practical purposes, however, it is unlikely that these 21 hour soak time sets are a realistic representation of the fleet average.

hooks deployed were “J” hooks). Billfish survived on the longline for many hours if they had been hooked on circle hooks and if they did not become entangled in the gangions (Berkeley and Edwards, 1997). Therefore, the benefits of this measure could be enhanced if combined with the circle hook requirement. Most fishermen in the Gulf of Mexico targeting tunas with pelagic longline gear deploy predominantly circle hooks because they are thought to increase tuna catch per unit effort. After two hours, however, less than 50 percent of yellowfin tuna survived.

NMFS does not have data on when turtles are hooked after a line is set, but a reduction in soak time may reduce turtle catch by simply not being available for longer periods of time and thus decreasing the likelihood of a turtle interaction. However, if fishermen make more sets the benefits would be less. Turtles appear to be injured in several ways by interacting with longlines. They get entangled in the gangions, they ingest hooks or get hooked somewhere on their body, and they drown because they do not have access to the surface. For that portion of hooked turtles that drown, reductions in soak time might increase survival. However, if turtles are hooked longer than 1 hour before haul-back, this alternative would not protect them as they cannot withstand stressed submergence much over an hour. Further, reduction in soak time might reduce stress on the turtle no matter how it is entangled, which might also increase survival or minimize serious injuries.

Since restricting soak time leads to inefficient fishing, it might result in increased fishing effort (number of sets) in the long term if two shorter sets are more effective at catching fish than one long set. In any case, while there might be a higher survival rate for various species, there would be more sets, which might offset the survival rate and would not achieve the objectives of this rulemaking. If the management strategy that applies to pelagic longline fishermen ever evolves into an individually transferable quota system or individually transferable set system, this measure could potentially be useful. Such an effort limitation could be monitored using VMS.

Ecological Effects Due to Changes in Bycatch of Those Species

As a result of this alternative, the bycatch composition by longline fishermen would not be expected to change. However, this measure would be expected to increase survival of some fish and possibly marine mammals, and therefore would have beneficial effects on those species.

Effects on Bycatch of Other Species and Resulting Population and Ecosystem Effects

This measure would not be expected to have effects on bycatch of other species, and therefore is not expected to affect the population or ecosystem of other species.

Effects on Marine Mammals and Sea Birds

This measure might increase survival of marine mammals that are entangled in longline gear. To the extent that this measure increases the survival of yellowfin tuna, predation by pilot whales in the Mid-Atlantic Bight area might decrease and their resulting entanglement might be reduced. Fishermen might also be able to release entangled marine mammals sooner, thereby improving survival of the mammals. The Atlantic Offshore Cetacean Take Reduction Plan advocated reductions in soak time to increase survival of marine mammals. The Team set a goal of reducing marine mammal serious injury and incidental mortality of strategic stocks by 70 percent in the Atlantic Pelagic Fisheries (pair trawl, drift gillnet, and pelagic longline). Pair trawls and driftnets are no longer authorized gears for use in the Atlantic HMS fisheries. NMFS is currently evaluating progress towards that goal and would consider the effects of this measure in the event it is implemented.

To the extent that seabird interactions occur (see Appendix A), it is not likely that survival of sea birds would increase as many birds are drowned at the time the line is set.

Changes in Fishing, Processing, Disposal, and Marketing Costs

An increase in fishing costs would be expected because of reduced efficiency with setting a longline for a short period of time. In response to this alternative, fishermen might make additional sets in a day in order to recoup their losses from reduced landings of target species. This alternative would not be likely to cause changes in processing, disposal, or marketing costs.

Changes in Fishing Practices and Behavior of Fishermen

AP members have commented in the past that a reduced soak time alternative might have serious safety implications because fishermen would continue to make longline sets in order to catch enough fish to make the trip economically viable. This alternative might discourage crew from taking a trip because there would be more setting and hauling expected in one trip in order to land the same number of fish as were landed previous to this alternative being implemented.

Changes in Research, Administration, and Management Effectiveness

Management effectiveness would likely decrease because this measure is difficult to enforce. This measure requires significant at-sea enforcement resources or VMS with sufficient analytical and legal resources. If NMFS analytical staff could develop a process whereby soak time could be estimated from VMS "tracks," the need for enforcement of this measure at-sea would be significantly reduced. In addition, the legal framework would need to be developed around the analytical process so that regulations could be enforced based on remote observation techniques.

Changes in the Economic, Social, or Cultural Value of Fishing Activities and Non-Consumptive Uses of Fishery Resources

This alternative would not be expected to change the economic, social or cultural value of fishing activities because fishermen would be expected to make additional sets to recoup losses from reduced landings of target species. With shorter sets, fishermen would be likely to enjoy improved quality ratings in the seafood markets for their HMS. If quality improved, fishermen might receive higher prices for their fish. Combined with shorter fishing trips and/or the use of circle hooks, fish might not only be brought on board still alive, but might enter the market sooner, possibly fetching higher ex-vessel prices. Industry would likely object to the requirement to reduce soak time as it could alter the economic value of each set.

Changes in the Distribution of Benefits and Costs

This alternative would not be likely to change the distribution of costs or benefits because it would apply to all pelagic longline fishermen.

Social Effects

This measure is not likely to have significant social impacts on fishing communities. If fishermen have to make more sets in order to maintain current landing rates of target finfish, this measure would have safety implications due to fatigue or reduced time set aside for maintenance of vessels. It is difficult to predict how fishermen would react to this alternative. It might have social impacts because it could increase the difficulty in hiring experienced crew for longline fishing operations.

Summary

This alternative is not selected at this time because of a need for further quantitative research on the biological, economic and social impacts of reducing pelagic longline soak time. The practicality of enforcing such a regulation provides further rationale for rejecting this alternative at this time.

7.3 Reduce Pelagic Longline Fishing Effort

Rejected Option: Limit capacity of the Atlantic pelagic longline fleet

In the HMS FMP, NMFS implemented a limited access program with the goal of reducing latent effort and overcapitalization in HMS commercial fisheries and creating a management system to make fleet capacity commensurate with the status of the resource (in other words, create a system to maximize both economic efficiency and biological conservation). NMFS believes that the limited access program implemented in the HMS FMP did reduce latent effort and overcapitalization. However, at this time, NMFS is unsure whether the limited access program made fleet capacity commensurate with the status of HMS stocks. Additional reductions in the fleet capacity may be needed; 208 permit holders reported landings in the pelagic logbook during 1998, although 450 permit holders hold pelagic longline fishing permits. Thus, to achieve economic efficiency, to achieve biological conservation, to mitigate the effects of redistributing effort under a time/area closure strategy, and to achieve bycatch reduction goals, NMFS has considered limiting effort in the Atlantic pelagic longline fishery beyond the original limited access program implemented in the HMS FMP.

There are a number of possibilities that could enhance the current limited access program. These include: a use or lose policy, a 2 for 1 system (fishermen wishing to enter the fishery would have to buy two permits in order to obtain one permit), individual transferable quotas, or non-transferable quotas. With the current quota-limited system, merely removing vessels from the fishery (use or lose or a 2 for 1 system) may not reduce the capability of the fleet to make an equal amount of sets. The remaining permit holders could fish more sets or those permit holders who normally do not land many fish could increase effort given the new "opportunities" afforded them under a new system. A system which gives each vessel a certain amount of the available quota could mitigate this effect but may cause hardship to vessels that do not receive enough of the quota to make a living. At this time, NMFS does not support implementing any of these alternatives until it gains additional knowledge on the success of the current limited access program. In addition, bills that include a buyout of swordfish permits and vessels have been introduced in Congress. If Congress buys the permits of Atlantic pelagic longline fishermen who fish in the proposed closed areas, capacity may be limited. Thus, NMFS rejects this alternative at this time.

7.4 Summary of the Cumulative Impacts of All Alternatives Considered

7.4.1 Impacts on Finfish

Table 7.23 indicates the cumulative impacts of each of the alternatives considered in this document. HMS are likely to benefit from banning longlining by U.S. vessels, although in the long term, foreign vessels might increase fishing effort in response to increased U.S. demand, with possible negative effects on the resource. Closures are likely to have positive and/or negative impacts for finfish, depending on assumptions made about redistribution of effort.

7.4.2 Impacts on Protected Species

Banning longlining would likely increase benefits to marine mammals unless longline fishermen shift into other fisheries that might have higher interactions with mammals. Likewise, if fishermen enter the shrimp fishery, there might be negative impacts on sea turtles. Time/area closures might have positive or negative impacts on protected species, depending on assumptions made about redistribution of effort. Measures to reduce bycatch mortality might increase survival of protected species hooked on longlines. An extensive review of the impact of the interactions between pelagic longline gear fished in the Atlantic and sea turtles is provided in Section 5.8. NMFS has initiated the rulemaking process to address the issues raised in the June 2000 draft BO that will likely have further significant impacts on the pelagic longline fishery.

7.4.3 Impacts on Essential Fish Habitat (EFH)

The HMS FMP and Amendment One to the Atlantic Billfish FMP state that Atlantic HMS occupy pelagic oceanic environments. However, some juvenile and sub-adult sharks occupy coastal and near-shore environments. The HMS FMP describes habitat damage by pelagic longlines as negligible to the pelagic environment. Time/area closures are not anticipated to have a negative effect on the EFH for Atlantic HMS and through reductions in bycatch might actually be beneficial to the ecosystem in the closed area because pelagic longline bycatch would be reduced. The alternatives discussed in this document are anticipated to have no negative impact on the physical environment or essential fish habitat.

Table 7.23. A Summary of the Cumulative Impacts of All Alternatives Considered Relative to the Status Quo
Key: = a positive benefit, - = a negative impact, ~ = no conclusive impact/unchanged, ? = unknown.
Note: Maximum impacts considered under time/area closure alternatives were those from the effort redistribution model

Affected Environment	Status Quo	Ban Long-lining	SAtlE & GulfB	SAtlE & GulfB	SAtlB & GulfB	SAtlB & GulfC	DeSoto & N/S SAtlE	Prohibit live bait in GOM	Fish deeper hooks	Fish cooler than 68°	Set after 9 p.m.	Require circle hooks	Reduce soak time	Reduce Capacity
Mammals	~		-	-	-	-	-	~	~	~	~	?		~
Sea Turtles	-		-	-	-	-	-	~						~
Sea Birds	~		~	~	~	~	~	~	+/~	~	~	~	~	~
Finfish								+	?	?	?	+	+	~
Target														
Swordfish	-	+[3]		-										
Bluefin tuna	~	+				-	-							
BAYS tunas	~	+				-	-							
Pelagic shk.	-	+	-	-	-	-	-							
Lg. coastal shk.	-	+		-										
Bycatch														
Marlins	-		-	-	-	-	-							
Sailfish	-					-	-							
Undersized swordfish	-													
Economic Impact (no effort redistribution model)	N/A	--	-	-	-	--	-	+ / -	-/?	~	~	-/~	~	+/-

[3] Banning longlining does not necessarily increase benefits to target species since quotas would likely not be filled by the United States. Other countries would continue to fish on these stocks and could argue for redistribution of the United States unused quota.

Table 7.24. Gear modifications that might decrease turtle takes in the Atlantic pelagic longline fishery.

Measure	How would it help?	Reasonable Effectiveness
Set longline after 9 p.m.	Might avoid peak turtle feeding times.	Could be considered in the future. Past analyses of observer data indicate that it could be effective if combined with other gear modifications.
Fish hooks deeper	Might avoid water masses that turtles circulate through. In a Hawaii study (Kleiber, 1999), the rate of turtle take is higher on hooks near floats.	Could be considered in the future. Past analyses of observer data indicate that it could be effective if combined with other gear modifications. May be tested in the Hawaii longline fishery by requiring 74 m between the float line and the nearest gangion. Would need to be tested in Atlantic as well.
Dyed Bait	Captive turtles appear to have a color preference against bait that has been dyed blue or black (NOAA, 1985). Moreover, darker -colored bait decreases interactions with sea birds.	May be tested in the Hawaii longline fishery and may be tested as part of the Year 2000 Azores Turtle Workshop.
Circle Hooks	Circle hooks appear to hook turtles in the jaw where the hook can most easily be removed. This minimizes post-release stress and mortality.	May be tested in the Hawaii longline fishery and may be tested as part of the Year 2000 Azores Turtle Workshop
Rotating near-real time closures based on oceanographic front satellite data	Turtles are predominantly associated with oceanographic fronts (as are large predators; target species of longline fishery).	Technology for such a program (satellite and VMS) is being explored at the NMFS Honolulu Laboratory.