

8.0 BYCATCH, INCIDENTAL CATCH, AND PROTECTED SPECIES

Bycatch in commercial and recreational fisheries is an important issue for the fishing industry, resource managers, scientists, and the public. Bycatch can result in death or injury to the discarded fish, and it is essential that this component of total fishing-related mortality be incorporated into fish stock assessments and evaluation of management measures. Bycatch precludes other more productive uses of fishery resources and decreases the efficiency of fishing operations. Although not all discarded fish die, bycatch can become a large source of mortality, which can slow the rebuilding of overfished stocks. Bycatch imposes direct and indirect costs on fishing operations by increasing sorting time and decreasing the amount of gear available to catch target species. Incidental catch concerns also apply to populations of marine mammals, sea turtles, seabirds, and other components of ecosystems which may be protected under other applicable laws and for which there are no commercial or recreational uses but for which existence values may be high.

In 1998, NMFS developed a national bycatch plan, *Managing the Nation's Bycatch* (NMFS, 1998), which includes programs, activities, and recommendations for Federally managed fisheries. The national goal of the Agency's bycatch plan activities is to implement conservation and management measures for living marine resources that will minimize, to the extent practicable, bycatch and the mortality of bycatch that cannot be avoided. Inherent in this goal is the need to avoid bycatch, rather than create new ways to utilize bycatch. The plan also established a definition of bycatch as fishery discards, retained incidental catch, and unobserved mortalities resulting from a direct encounter with fishing gear.

8.1 Bycatch Reduction and the Magnuson-Stevens Act

The Magnuson-Stevens Act defines bycatch as fish are harvested in a fishery, but are not sold or kept for personal use, and includes economic and regulatory discards. Fish is defined as finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds. Birds and marine mammals are therefore not considered bycatch under the MSA but are examined as incidental catch. Bycatch does not include fish released alive under a recreational catch-and-release fishery management program.

National Standard 9 of the Magnuson-Stevens Act requires that fishery conservation and management measures shall, to the extent practicable, minimize bycatch and minimize the mortality of bycatch that cannot be avoided. In many fisheries, it is not practicable to eliminate all bycatch and bycatch mortality. Some relevant examples of fish caught in Atlantic HMS fisheries that are included as bycatch or incidental catch are marlin, undersized swordfish, and bluefin tuna caught and released by commercial fishing gear; undersized swordfish and tunas in recreational hook and line fisheries; species for which there is little or no market such as blue sharks; and species caught and released in excess of a bag limit.

There are benefits associated with the reduction of bycatch, including the reduction of uncertainty concerning total fishing-related mortality, which improves the ability to assess the status of stocks, to determine the appropriate relevant controls, and to ensure that overfishing

levels are not exceeded. It is also important to consider the bycatch of HMS in fisheries that target other species as a source of mortality for HMS and to work with fishery constituents and resource manager partners on an effective bycatch strategy to maintain sustainable fisheries. This strategy may include a combination of management measures in the domestic fishery, and if appropriate, multi-lateral measures recommended by international bodies such as ICCAT or coordination with Regional Fishery Management Councils or States. The bycatch in each fishery is summarized annually in the SAFE report for Atlantic HMS fisheries. The effectiveness of the bycatch reduction measures is evaluated based on this summary.

A number of options are currently employed (*) or available for bycatch reduction in Atlantic HMS fisheries. These include but are not limited to:

Commercial

1. *Gear Modifications (including hook and bait types)
2. *Circle Hooks
3. *Time/Area Closures
4. Performance Standards
5. *Education/Outreach
6. *Effort Reductions (*i.e.*, Limited Access)
7. Full Retention of Catch
8. *Use of De-hooking Devices (mortality reduction only)

Recreational

1. *Use of Circle Hooks (mortality reduction only)
2. Use of De-hooking Devices (mortality reduction only)
3. Full Retention of Catch
4. *Formal Voluntary or Mandatory Catch-and-Release Program for all Fish or Certain Species
5. Time/Area Closures

There are probably no HMS fisheries in which there is zero bycatch because none of the currently legal fishing gears are perfectly selective for the target species of each fishing operation (with the possible exception of the swordfish/tuna harpoon fishery and speargun fishery). Therefore, to totally eliminate bycatch of all non-target species in Atlantic HMS fisheries would be impractical. The goal then is to minimize the amount of bycatch to the extent practicable and minimize the mortality of species caught as bycatch.

8.1.1 Standardized Reporting of Bycatch

Section 303(a)(11) of the Magnuson-Stevens Act requires that a fishery management plan establish a standardized reporting methodology to assess the amount and type of bycatch

occurring in the fishery. In 2004, NMFS published a report entitled “*Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs*,” which described the current status of and guidelines for bycatch monitoring programs (NMFS, 2004a). The data collection and analyses that are used to estimate bycatch in a fishery constitute the “standardized bycatch reporting methodology” (SBRM) for that fishery (NMFS, 2004a). Appendix 5 of the report specifies the protocols for SBRMs established by NMFS throughout the country.

As part of the Agency’s National Bycatch Strategy, NMFS established a National Working Group on Bycatch (NWGB) to develop a national approach to standardized bycatch reporting methodologies and monitoring programs. This work is to be the basis for regional teams, established in the National Bycatch Strategy, to make fishery-specific recommendations.

The NWGB reviewed regional issues related to fisheries and bycatch and discussed advantages and disadvantages of various methods for estimating bycatch including: (1) fishery-independent surveys; (2) self-reporting through logbooks, trip reports, dealer reports, port sampling, and recreational surveys; (3) at-sea observation, including observers, digital video cameras, digital observers, and alternative platform and remote monitoring; and (4) stranding networks. All of these methods may contribute to useful bycatch estimation programs, but at-sea observation (observers or electronic monitoring) provides the best mechanism to obtain reliable and accurate bycatch estimates for many fisheries. Often, but not always, observer programs also will be the most cost-effective of these alternatives (NMFS, 2004a).

The effectiveness of any SBRM depends on its ability to generate estimates of the type and quantity of bycatch that are both precise and accurate enough to meet the conservation and management needs of a fishery. The National Bycatch Report (NMFS, 2004a) contains an in-depth examination of the issues of precision and accuracy in estimating bycatch. Accuracy refers to the closeness between the estimated value and the (unknown) true value that the statistic was intended to measure. Precision refers to how closely multiple measurements of the same statistic cluster to one another when obtained under the same protocol. The more precise an estimate is, the tighter the cluster. The precision of an estimate is often expressed in terms of the coefficient of variation (CV) defined as the standard error of the estimator divided by the estimate. The lower the CV, the more precise the estimate is considered to be. A precise estimate is not necessarily an accurate estimate. The National Bycatch Report (NMFS, 2004a) contains an extensive discussion of how precision relates to sampling and to assessments.

The other important aspect of obtaining bycatch estimates that are useful for management purposes is accuracy. Accuracy is the difference in the mean of the sample and the true value of that property in the sampled universe (NMFS, 2004a). In other words, accuracy refers to how correct the estimate is. Efficient allocation of sampling effort within a stratified survey design improves the precision of the estimate of overall discard rates (Rago *et al.*, 2005). Accuracy of sample estimates can be evaluated by comparing performance measures (*e.g.*, landings, trip duration) between vessels with and without observers present. While there are differences between the terms accuracy and bias, they have been used interchangeably. A “biased” estimate is inaccurate while an “accurate” estimate is unbiased (Rago *et al.*, 2005).

The NWGB recommended that at-sea sampling designs should be formulated to achieve precision goals for the least amount of observation effort, while also striving to increase accuracy (NMFS, 2004a). This can be accomplished through random sample selection, developing appropriate sampling strata and sampling allocation procedures, and by implementing appropriate tests for bias. Sampling programs will be driven by the precision and accuracy required by managers to address management needs for estimating management quantities such as allowable catches through a stock assessment, for evaluating bycatch relative to a management standard such as allowable take, and for developing mitigation mechanisms.

The recommended precision goals for estimates of bycatch are defined in terms of the coefficient of variation (CV) of each estimate. For marine mammals and other protected species, including seabirds and sea turtles, the recommended precision goal is a 20 to 30 percent CV for estimates of interactions for each species/stock taken by a fishery. For fishery resources, excluding protected species, caught as bycatch in a fishery, the recommended precision goal is a 20 to 30 percent CV for estimates of total discards (aggregated over all species) for the fishery; or if total catch cannot be divided into discards and retained catch, then the goal is a 20 to 30 percent CV for estimates of total catch (NMFS, 2004a). The report also states that attainment of these goals may not be possible or practical in all fisheries and should be evaluated on a case-by-case basis.

The CV of an estimate can be reduced and the precision increased by increasing sample size. In the case of observer programs, this would entail increasing the number of trips or gear deployments observed. Increasing the number of trips observed increases both the cost in terms of funding, but also the logistical complexities and safety concerns. However, the improvements in precision will decline at a decreasing rate as sample size is increased to a point where it will not be cost-effective to increase sample size any further. This concept is illustrated in Figure 1 of the National Bycatch Report (NMFS, 2004a). As a result of this statistical relationship, fishery managers select observer coverage levels that should achieve the desired or required balance between precision of bycatch estimates and cost.

While the relationship between precision and sample size is relatively well known (NMFS, 2004), the relationship between sample size and accuracy is not reliable. Observer programs strive to achieve samples that are representative of both fishing effort and catches. Representativeness of the sample is critical not only for obtaining accurate (*i.e.*, unbiased) estimates of bycatch, but also for collecting information about factors that may be important for mitigating bycatch. Bias may be introduced at several levels: when vessels are selected for coverage, when hauls are selected for sampling, or when only a portion of the haul can be sampled (NMFS, 2004a).

Rago *et al.*, (2005) examined potential sources of bias in commercial fisheries of the Northeast Atlantic by comparing measures of performance for vessels with and without observers. Bias can arise if the vessels with observers onboard consistently catch more or less than other vessels, if trip durations change, or if vessels fish in different areas. Average catches (pounds landed) for observed and total trips compared favorably and the expected differences of the stratum specific means and standard deviations for both kept weight and trip duration was near zero (Rago *et al.*, 2005). Although mean trip duration was slightly longer on observed trips,

the difference was not significantly different from zero. The spatial distribution of trips matched well based on a comparison of VMS data with observed trips (Murawski *et al.*, 2005). The authors concluded that the level of precision in discard ratios as a whole was high and that there was little evidence of bias. The results of this study indicate that bias may not be as large an issue in self-reported data as has been suggested by Babcock *et al.* (2003), but additional analyses would need to be conducted to determine the applicability to HMS fisheries.

A simplistic approach in trying to get more accurate bycatch estimates is to increase observer coverage. A report by Babcock *et al.* (2003) suggests that relatively high percentages of observer coverage are necessary to adequately address potential bias in bycatch estimates from observer programs. However, the examples cited by Babcock *et al.* (2003) as successful in reducing bias through high observer coverage levels are fisheries comprised of relatively few vessels compared to many other fisheries, including the Atlantic HMS fisheries. Their examples are not representative of the issues facing most observer programs and fishery managers, who must work with limited resources to cover large and diverse fisheries. It is also incorrect to assume that simply increasing observer coverage ensures accuracy of the estimates (Rago *et al.*, 2005). Bias due to unrepresentative sampling may not be reduced by increasing sample size due to logistical constraints, such as if certain classes of vessels cannot accommodate observers. Increasing sample size may only result in a larger, but still biased, sample.

Although the precision goals for estimating bycatch are important factors in determining observer coverage levels, other factors are also considered when determining actual coverage levels. These may result in lower or higher levels of coverage than that required to achieve the precision goals for bycatch estimates. Factors that may justify lower coverage levels include lack of adequate funding; incremental coverage costs that are disproportionately high compared to benefits; and logistical consideration such as lack of adequate accommodations on a vessel, unsafe conditions, and lack of cooperation by fishermen (NMFS, 2004a).

Factors that may justify higher coverage levels include incremental coverage benefits that are disproportionately high compared to costs and other management focused objectives for observer programs. The latter include total catch monitoring, in-season management of total catch or bycatch, monitoring bycatch by species, monitoring compliance with fishing regulations, monitoring requirements associated with the granting of Experimental Fishery Permits, or monitoring the effectiveness of gear modifications or fishing strategies to reduce bycatch. In some cases, management may require one or even two observers to be deployed on every fishing trip. Increased levels of coverage may also be desirable to minimize bias associated with monitoring “rare” events with particularly significant consequences (such as takes of protected species), or to encourage the introduction of new “standard operating procedures” for the industry that decrease bycatch or increase the ease with which bias can be monitored (NMFS, 2004a).

NMFS utilizes self-reported logbook data (Fisheries Logbook System or FLS, and the supplemental discard report form in the reef fish/snapper-grouper/king and Spanish mackerel/shark logbook program), at-sea observer data, and survey data (recreational fishery dockside intercept and telephone surveys) to produce bycatch estimates in HMS fisheries. These data are collected with respect to fishing gear type (see Section 8.1.1). The number and location

of discarded fish are recorded, as is the disposition of the fish (*i.e.*, released alive vs. released dead). Post-release mortality of HMS can be accounted for in stock assessments to the extent that the data allow.

The fishery logbook systems in place are mandatory programs, and it is expected that the reporting rates are generally high (Garrison, 2005). Due to the management focus on HMS fisheries, there has been close monitoring of reporting rates, and observed trips can be directly linked to reported effort. In general, the gear characteristics and amount of observed effort is consistent with reported effort. However, under-reporting is possible, which can lead to a negative bias in bycatch estimates. Cramer (2000) compared dead discards of undersized swordfish, sailfish, white and blue marlin, and pelagic sharks from HMS logbook and Pelagic Observer Program (POP) data in the U.S. Atlantic pelagic longline fishery. Cramer (2000) provided the ratio of catch estimated from the POP data divided by the reported catch in the HMS logbooks. The ratio indicated the amount of underreporting for each species in a given area. However, the data analyzed by Cramer (2000), was based on J-hook data from 1997 – 1999 and that gear is prohibited now. In some instances, logbooks are used to provide effort information against which bycatch rates obtained from observers is multiplied to estimate bycatch. In other sectors/fisheries, self-reporting provides the primary method of reporting bycatch because of limited funding, priorities, etc.

The following section provides a review of the bycatch reporting methodologies for all HMS fisheries currently in place. Future adjustments may be implemented based on evaluation of the results of studies developed as part of the HMS Bycatch Reduction Implementation Plan, or as needed due to changing conditions in the fisheries. In addition, NMFS is in the process of developing a National Bycatch Report which may provide additional insight and guidance on areas to be addressed for each fishery. Further analyses of bycatch in the various HMS fisheries may be conducted as time, resources and priorities allow.

8.1.1.1 U.S. Atlantic Pelagic Longline Fishery

NMFS utilizes both self-reported data (mandatory logbooks for all vessels) and observer data to monitor bycatch in the pelagic longline fishery. The observer program has been in place since 1992 to document finfish bycatch, characterize fishery behavior, and quantify interactions with protected species (Beerkircher *et al.*, 2002). The observer program is mandatory for those vessels selected and all vessels with directed and indirect swordfish permits are selected. The program had a target coverage level of five percent of the U.S. fleet within the North Atlantic (waters north of 5⁰ N. latitude), as was agreed to by the United States at ICCAT. Actual coverage levels achieved from 1992 – 2003 ranged from two to nine percent depending on quarter and year (Table 4.1) Observer coverage was 100 percent for vessels participating in the NED experimental fishery during 2001 – 2003. Overall observer coverage in 2003 was 11.5 percent of the total sets made, including the NED experiment. The program began requiring an eight percent coverage rate due to the requirements of the 2004 Biological Opinion for Atlantic Pelagic Longline Fishery for HMS. Observer coverage in 2005-07 ranged from 7.5 – 10.8 percent. Since 1992, data collection priorities have been to collect catch and effort data of the U.S. Atlantic pelagic longline fleet on highly migratory fish species, although information is also collected on bycatch of protected species.

Fishery observer effort is allocated among eleven large geographic areas and calendar quarter based upon the historical fishing range of the fleet (Walsh and Garrison, 2006). The target annual coverage is eight percent of the total reported sets, and observer coverage is randomly allocated based upon reported fishing effort during the previous fishing year/quarter/statistical reporting area (Beerkircher *et al.*, 2002). Bycatch rates of protected species (catch per 1,000 hooks) are quantified based upon observer data by year, fishing area, and quarter (Garrison, 2005). The estimated bycatch rate is then multiplied by the fishing effort (number of hooks) in each area and quarter reported to the FLS program to obtain estimates of total interactions for each species of marine mammal and sea turtle (Garrison, 2005).

Purse Seine Fishery

Vessels operating in the bluefin tuna purse seine fishery submit either Vessel Trip Reports (NERO) or HMS logbooks (Southeast) based on the type of Federal permits they hold in addition to their HMS permit. Observers were placed on purse seine vessels operating in this fishery in 1996 and 2001 in order to monitor groundfish bycatch in closed areas in the Northwest Atlantic (B. McHale, pers. comm., 2005). The purse seine fishery was observed to have very little bycatch of groundfish or other species of fish and no protected species interactions. As a result, observer coverage has not been used recently to document bycatch or validate logbook reports. In addition, the lack of effort in recent years has not warranted consideration for additional observer coverage.

Shark Bottom Longline Fishery

Vessels participating in the bottom longline fishery for sharks are required to submit snapper/grouper/reef fish/shark logbooks to report their catch and effort, including bycatch species. All vessels having Shark Limited Access Permits are required to report. Observers have monitored the shark bottom longline fishery since 1994. The program has been mandatory for vessels selected to carry observers beginning in 2002. Prior to that, it was a voluntary program relying on cooperating vessels/captains to take observers. From 2002 – 2005, the objective of the vessel selection was to achieve a representative five percent level of coverage of the total fishing effort in each fishing area (North Atlantic, South Atlantic, and Gulf of Mexico) and during each fishing season of that year (Smith *et al.*, 2006). Beginning in 2006, target coverage level will be 3.9 percent of the total fishing effort. This level is estimated to attain a sample size needed to provide estimates of sea turtle, smalltooth sawfish, or marine mammal interactions with an expected CV of 0.3 (Carlson, unpubl., as cited in Smith *et al.*, 2006)

Effective August 1, 2001, selected Federal permit holders that report on the Gulf of Mexico reef fish, South Atlantic snapper-grouper, king and Spanish mackerel, and shark fisheries logbook must report all species and quantities of discarded (alive and dead) sea turtles, marine mammals, birds, and finfish on a supplemental discard form. A randomly selected sample of 20 percent of the vessels with active permits in the above fisheries is selected each year. The selection process is stratified across geographic area (Gulf of Mexico and South Atlantic), gear (handline, longline, troll, gillnet, and trap), and number of fishing trips (ten or less trips and more than 11 trips). Shark fishermen can use the pelagic longline logbook or the northeast vessel trip reports depending on the permits held by the vessel. If they use either the

PLL logbook or VTR, they need to report all of the catch and effort, as well as all the bycatch or incidental catch.

The Final Rule for Amendment 2 to the Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP) (73 FR 35778, June 24, 2008, corrected at 73 FR 40658, July 15, 2008) established, among other things, a shark research fishery to maintain time series data for stock assessments and to meet NMFS' 2009 research objectives. The shark research fishery permits authorize participation in the shark research fishery and the collection of sandbar and non-sandbar large coastal sharks (LCS) from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the purposes of scientific data collection subject to 100 percent observer coverage. The commercial vessels selected to participate in the shark research fishery are the only vessels authorized to land/harvest sandbars subject to the sandbar quota available for each year. The base quota is 87.9 mt dw/year through December 31, 2012, although this number may be reduced in the event of overharvests, if any, and 116.6 mt dw/year starting on January 1, 2013. The selected vessels would also have access to the non-sandbar LCS, small coastal shark (SCS), and pelagic shark quotas. Commercial vessels not participating in the shark research fishery may only land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits and quotas per 50 CFR 635.24 and 635.27, respectively.

Shark Gillnet Fishery

Vessels participating in the gillnet fishery for sharks are required to submit logbooks to report their catch and effort, including bycatch species. An observer program for the directed shark gillnet fishery has been in place from 1993 – 1995 and from 1998 to the present. The objectives of this program are to obtain estimates of catch and bycatch and bycatch mortality rates of protected species, juvenile sharks, and other fish species. Catch and bycatch estimates are produced to meet the mandates of the Atlantic Large Whale Take Reduction Plan and the May 2008 Biological Opinion. During right whale calving season (15 November to 15 April), 100 percent observer coverage is required for shark gillnet vessels operating from West Palm Beach, FL, to Sebastian Inlet, FL. Outside right whale calving season, observer coverage is equal to that which would obtain a sample size needed to provide estimates of sea turtle or marine mammal interactions with an expected CV of 0.3 (in 2003, this was 33.8 percent of the total trips) (Carlson and Baremore, 2002).

Starting in 2005, a pilot observer program was begun to include all vessels that have an active directed shark permit and fish with sink gillnet gear (Carlson and Bethea, 2006). These vessels were not previously subject to observer coverage because they were either targeting non-highly migratory species or were not fishing gillnets in a drift or strike fashion. These vessels were selected for observer coverage in an effort to determine their impact on finetooth shark landings and their overall impact on shark resources when not targeting sharks.

Commercial Handgear Fishery

The commercial handgear fishery includes vessels using handline, harpoon, rod and reel, or bandit gear to fish for HMS. NMFS has the authority to use observers to collect bycatch information from commercial vessels fishing for tunas. Many of these vessels are already

required to complete Federal and/or state logbooks (*e.g.*, the NMFS Northeast Region Vessel Trip Report (VTR) Program), in which they are required to report all fishing information, including that for HMS and bycatch. NMFS is currently evaluating various alternatives to increase fishery data collection of vessels fishing for HMS with handgear, such as selecting additional HMS permitted vessels to report in logbooks or to be selected for observer coverage, and is investigating alternatives for electronic reporting. Therefore, no estimates of bycatch are available at this time. Bycatch and bycatch mortality are considered to be low due to the nature of the gear but this should be validated in the future.

Recreational Handgear Fishery

NMFS collects recreational catch-and-release data from dockside surveys (the Large Pelagics Survey and the Marine Recreational Fishery Statistics Survey) for the rod and reel fishery and uses these data to estimate total landings and discards of bycatch or incidental catch. Statistical problems associated with small sample size remain an obstacle to estimating bycatch reliably in the rod and reel fishery. CVs can be high for many HMS (rare event species in the MRFSS) and the LPS does not cover all times/geographic areas for non-bluefin tuna species. New survey methodologies are being developed, however, especially for the Charter/Headboat sector of the rod and reel fishery, which should help to address some of the problems in estimating bycatch for this fishery. In addition, selecting recreational vessels for voluntary logbook reporting may be an option for collecting bycatch information for this sector of the HMS fishery.

NMFS has the authority to use observers to collect bycatch information from vessels with HMS Charter/Headboat or Angling category permits. Many of the charter/headboat vessels are required to complete Federal and/or state logbooks (*e.g.*, the NMFS Northeast Region Vessel Trip Report (VTR) Program), in which they are required to report all fishing information, including that for HMS and bycatch. NMFS is currently evaluating various alternatives to increase logbook coverage of vessels fishing for HMS, such as selecting additional HMS vessels to report in logbooks or be selected for observer coverage, and is investigating alternatives for electronic reporting.

The National Academy of Sciences assembled a committee to review current marine recreational fishing surveys at the request of NMFS (NAS, 2006). The committee was tasked with developing recommendations for improvements to current surveys and to recommend the implementation of possible alternative approaches. The committee's final report was published in April 2006, and NMFS is in the process of evaluating the recommendations. At the present time, no other alternative approach is available.

8.2 Bycatch Reduction in HMS Fisheries

The NMFS HMS bycatch reduction program includes an evaluation of current data collection programs, implementation of bycatch reduction measures such as gear modifications and time/area closures (Table 8.1), and continued support of data collection and research relating to bycatch. Additional details on bycatch and bycatch reduction measures can be found in Section 3.5 of the Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (NMFS, 1999), Regulatory Amendment 1 to the 1999 FMP (NMFS, 2000), Regulatory Adjustment 2 to

the 1999 FMP (NMFS, 2002), Amendment 1 to the 1999 FMP (NMFS, 2003a), and in the Consolidated HMS FMP (NMFS, 2006). In addition, an HMS Bycatch Reduction Implementation Plan was developed in late 2003 which identify priority issues to be addressed in the following areas: 1) monitoring, 2) research, 3) management, and 4) education/outreach. Individual activities in each of these areas were identified and new activities may be added or removed as they are addressed or identified.

8.2.1 Evaluation and Monitoring of Bycatch

The identification of bycatch in Atlantic HMS fisheries is the first step in reducing bycatch and bycatch mortality. The Magnuson-Stevens Act requires the amount and type of bycatch to be summarized in the annual SAFE reports. Bycatch reporting is addressed in Section 8.1.1. Additional species and fishery specific data are presented in Section 4.0.

Pelagic longline dead discards of swordfish, billfish, large coastal sharks, and pelagic sharks are estimated using data from NMFS observer reports and pelagic logbook reports. Shark bottom longline and shark gillnet discards can be estimated using logbook data and observer reports as well. Shark gillnet discards have also been estimated using logbook data when observer coverage is equal to 100 percent.

NMFS has not estimated bycatch in the swordfish harpoon fishery. NMFS has limited historical observer data on harpooned swordfish from driftnet trips in which harpoons were sometimes used. Swordfish harpoon fishermen are required to submit pelagic logbooks and NMFS can examine those for their utility in estimating bycatch. NMFS has not estimated bycatch in the bluefin tuna harpoon fishery because these fishermen have not been selected to submit logbooks. NMFS has not estimated bycatch in the General category commercial rod and reel tuna fishery although anecdotal evidence indicates that some undersized bluefin tuna may be captured. Studies of post-release mortality are ongoing.

There is concern about the accuracy of discard estimates in the recreational rod and reel fishery for HMS due to the low number of observations by the LPS and the MRFSS. Recreational bycatch estimates (numbers of fish released alive and dead) are not currently available, except for bluefin tuna. For some species, encounters are considered rare events, which might result in bycatch estimates with considerable uncertainty. Due to improvements in survey methodology, increased numbers of intercepts (interviews with fishermen) have been collected since 2002. NMFS intends to develop bycatch estimates (live and dead discards) and estimates of uncertainty from the recreational fishery from the LPS. These data will be included in future SAFE reports. Bycatch estimates may also be examined by using tournament data for the recreational fishery.

Table 8.1 Summary of bycatch species in HMS fisheries, Marine Mammal Protection Act (MMPA) category, endangered Species Act (ESA) requirements, data collection, and management measures by fishery/gear type. (Excerpted from HMS Bycatch Priorities and Implementation Plan and updated through September 2008)

Fishery/Gear Type	Bycatch Species	MMPA Category	ESA Requirements	Bycatch Data Collection	Management Measures
Pelagic Longline	Bluefin tuna Billfish Undersize target species Marine mammals Sea turtles Seabirds Non-target finfish Prohibited shark species Large Coastal Shark species after closure	Category I	Jeopardy findings in 2000 & 2004; Reasonable and Prudent Alternative implemented 2001-04; ITS, Terms & Conditions, RPMs	Permit requirement (1985); logbook requirement (SWO-1985; SHK - 1993); observer requirement (1992), EFPs (2001-present)	BFT target catch requirements (1981); quotas (SWO - 1985; SHK - 1993); prohibit possession of billfish (1988); minimum size (1995); gear marking (1999); line clippers, dipnets (2000); MAB closure (1999); limited access (1999); limit the length of mainline (1996-1997 only); move 1 nm after an interaction (1999); voluntary vessel operator workshops (1999); GOM closure (2000); FL, Charleston Bump, NED closures (2001); gangion length, corrodible hooks, de-hooking devices, handling & release guidelines (2001); NED experiment (2001-03); VMS (2003); circle hooks and bait requirements (2004); mandatory safe handling and release workshops (2006); sea turtle control device (2008); closed area research (2008)
Shark Bottom Longline	Prohibited shark species Target species after closure Sea turtles Smalltooth sawfish Non-target finfish	Category III	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); handling & release guidelines (2001); line clippers, dipnets, corrodible hooks, de-hooking devices, move 1 nm after an interaction (2004); South Atlantic closure, VMS (2005); shark identification workshops for dealers (2007); sea turtle control device (2008)
Shark Gillnet	Prohibited shark species Sea turtles Marine mammals Non-target finfish Smalltooth sawfish	Category II	ITS, Terms & Conditions, RPMs	Permit requirement (1993); logbook requirement (1993); observer coverage (1994)	Quotas (1993); trip limit (1994); gear marking (1999); deployment restrictions (1999); 30-day closure for leatherbacks (2001); handling & release guidelines (2001); net checks (2002); whale sighting (2002); VMS (2004); closure for right whale mortality (2006); shark identification workshops for dealers (2007)
BFT Purse Seine	Undersize target species Non-target finfish	Category III	ITS, Terms & Conditions	Permit requirement (1982); observer requirement (1996,	Quotas (1975); limited access, individual vessel quotas (1982); minimum size (1982)

Fishery/Gear Type	Bycatch Species	MMPA Category	ESA Requirements	Bycatch Data Collection	Management Measures
				2001 only); EFPs (2002-03)	
BFT & SWO Harpoon	Undersize target species	Category III	ITS, Terms & Conditions	Permit requirement (BFT - 1982; SWO - 1987); SWO logbook requirement (1987)	Quotas (BFT - 1982; SWO - 1985); minimum size (BFT - 1982; SWO - 1985)
Handgear - Commercial	Undersize target species Non-target finfish	Category III	ITS, Terms & Conditions	Permit requirement (BFT - 1982; SWO 1987; SHK - 1993); logbook requirement (SWO - 1985; SHK - 1993)	Regulations vary by species, including quotas, minimum sizes, retention limits, landing form
Handgear - Recreational	Undersize target species Non-target finfish	Category III	ITS, Terms & Conditions	Large Pelagic Survey (1992); MRFSS (1981)	Regulations vary by species, including minimum sizes, retention limits, landing form; BFT quotas

8.2.2 Bycatch Mortality

8.2.2.1 Introduction

The reduction of bycatch mortality is an important component of NS 9. Physical injuries may not be apparent to the fisherman who is quickly releasing a fish because there may be injuries associated with the stress of being hooked or caught in a net. Little is known about the mortality rates of many of the species managed under this FMP but there are some data for certain species. Information on bycatch mortality of these fish should continue to be collected, and in the future, could be used to estimate bycatch mortality in stock assessments.

NMFS submits annual data (Task II) to ICCAT on mortality estimates (dead discards). These data are included in the SAFE reports and National Reports to ICCAT to evaluate bycatch trends in HMS fisheries.

8.2.2.2 Mortality by Fishery

Pelagic Longline Fishery

NMFS collects data on the disposition (released alive or dead) of bycatch species from logbooks submitted by fishermen in the pelagic longline fishery. Observer reports also include disposition of the catch as well as information on hook location, trailing gear and injury status of protected species interactions. These data are used to estimate post-release mortality of sea turtles and marine mammals based on guidelines for each (Angliss and DeMaster 1998, Ryder *et al.* 2006). See Section 0 for estimates of sea turtle and marine mammal bycatch estimates.

Purse Seine Fishery

NMFS has limited observer data on the bluefin tuna purse seine fishery. There are no recorded instances of non-tuna finfish, other than minimal numbers of blue sharks, caught in tuna purse seines. Anecdotal evidence indicates that if fish are discarded, they are easily released out of the net with minimal bycatch mortality.

Bottom Longline Fishery

The shark bottom longline fishery has relatively low observed bycatch rates. Historically, finfish bycatch has averaged approximately five percent in the bottom longline fishery. Observed protected species bycatch (sea turtles) has typically been much lower, less than 0.01 percent of the total observed catch. See Section 0 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

Shark Gillnet Fishery

The shark gillnet fishery has relatively low observed bycatch rates. Finfish bycatch during the 2007 fishery ranged from 1.4 to 13.3 percent of the total catch from directed shark sets. Observed protected species bycatch (sea turtles and marine mammals) was less than 0.1

percent of the total catch by number. See Section 0 for more information. Disposition of discards is recorded by observers and can be used to estimate discard mortality.

Commercial Handgear Fishery

Vessels targeting bluefin tuna with harpoon gear have not been selected for observer coverage since the deliberate fishing nature of the gear is such that bycatch is expected to be low. Therefore, there are no recorded instances of non-target finfish caught with harpoons and NMFS cannot quantify the bycatch of undersized bluefin tuna in this fishery. Bycatch in the swordfish harpoon fishery is virtually if not totally, non-existent. Since bycatch approaches zero in this fishery, it follows that bycatch mortality is near zero. Disposition of bycatch reported in logbooks is used to estimate mortality of bycatch in the hook and line handgear fisheries.

Recreational Handgear Fishery

The LPS collects data on disposition of bycatch (released alive or dead) in recreational HMS fisheries. Rod and reel discard estimates from Virginia to Maine during June through October can be monitored through the expansion of survey data derived from the LPS (dockside and telephone surveys). However, the actual numbers of fish discarded for many species are low. See Section 0 for more information.

Post-release mortality studies have been conducted on few HMS at this time. Immediate mortality in recreational hook and line-caught juvenile bluefin tuna can be high (29.2 percent) due to injuries or predation (Belle, 1997). This is thought to be a conservative estimate because scientific personnel in the study were professionally trained and had extensive experience in fish handling techniques designed to reduce mortality. Mortality often occurs ten minutes or longer after the fish is released under normal circumstances. Injuries may not be readily apparent to the angler and seemingly minor capture injuries may be related to substantial internal injuries. Forty percent of sampled tuna that died during that study did not have injuries that would be apparent to the angler in the boat. Skomal and Chase (1996) provided evidence that the stress of rod and reel angling did not cause immediate post-release mortality in larger bluefin tuna (50 to 150 kg). However, they documented metabolic and pH disturbances in bluefin tuna sampled off Cape Hatteras, NC. The physiological consequences of angling stress are poorly understood for several species of large pelagic fishes (Skomal and Chase, 1996).

A study by Graves *et al.* (2002), investigated short-term (five days) post-release mortality of Atlantic blue marlin using pop-up satellite tag technology. A total of nine recreationally-caught blue marlin were tagged and released during July and August of 1999. All hooks employed in the study were “J” hooks. The attached tags were programmed to detach from the fish after five days and to record direct temperature and inclination of the buoyant tag to determine if the fish were actively swimming after being released. After detachment, the tags floated to the surface and began transmitting recorded position, temperature and inclination data to satellites of the Argos™ system. Three different lines of evidence provided by the tags (movement, water temperature, and tag inclination) suggested that at least eight of the nine blue marlin survived for five days after being tagged and released. One of the tags did not transmit any data which precluded the derivation of a conclusion regarding the tagged marlin’s survival.

The study was continued in 2003 to evaluate post release survival and habitat use of white marlin using pop-up satellite archival tags (PSATs) caught and released from four locations in the western North Atlantic recreational fishery (Horodysky and Graves, 2005). Forty-one tags were attached to white marlin caught using dead baits rigged on straight shank (“J”) hooks (n = 21) or circle hooks (n = 20) offshore of the U.S. Mid-Atlantic, the Dominican Republic, Mexico, and Venezuela. Survival was significantly higher ($p < 0.01$) for white marlin caught on circle hooks (100 percent) relative to those caught on straight-shank (“J”) hooks (65 percent). These results, along with previous studies on circle hook performance, suggest that a change in hook type can significantly increase the survival of white marlin released from recreational fishing gear. Data from these short term deployments also suggest that white marlin strongly associate with warm, near surface waters. However, based on the frequency, persistence, and patterns of vertical movements, white marlin appear to direct a considerable proportion of foraging effort well below surface waters, a behavior that may account for relatively high catch rates of white marlin on some pelagic longline sets. NMFS continues to support studies on recreational post-release mortality and intends to account for this source of mortality when additional information becomes available.

8.3 Code of Angling Ethics

NMFS developed a Code of Angling Ethics as part of implementing Executive Order 12962 – Recreational Fisheries. NMFS implemented a national plan to support, develop, and implement programs that were designed to enhance public awareness and understanding of marine conservation issues relevant to the wellbeing of fishery resources in the context of marine recreational fishing. This code is consistent with National Standard 9, Minimizing Bycatch and Bycatch Mortality, and is reproduced below. These guidelines are discretionary, not mandatory, and are intended to inform the angling public of NMFS’ views regarding what constitutes appropriate angling behavior. Part of the code covers catch-and-release fishing and is directed towards minimizing bycatch mortality.

Code of Angling Ethics

- Promotes, through education and practice, ethical behavior in the use of aquatic resources.
- Values and respects the aquatic environment and all living things in it.
- Avoids spilling, and never dumps any pollutants, such as gasoline and oil, into the aquatic environment.
- Disposes of all trash, including worn-out lines, leaders, and hooks, in appropriate containers, and helps to keep fishing sites litter-free.
- Takes all precautionary measures necessary to prevent the spread of exotic plants and animals, including live baitfish, into non-native habitats.
- Learns and obeys angling and boating regulations, and treats other anglers, boaters, and property owners with courtesy and respect.
- Respects property rights, and never trespasses on private lands or waters.

- Keeps no more fish than needed for consumption, and never wastefully discards fish that are retained.
- Practices conservation by carefully handling and releasing alive all fish that are unwanted or prohibited by regulation, as well as other animals that may become hooked or entangled accidentally.
- Uses tackle and techniques, which minimize harm to fish when engaging in “catch-and-release” angling.

8.4 Interactions of HMS Fishing Gears with Protected Species

This section examines the interaction between protected species and Atlantic HMS fisheries managed under this FMP. As a point of clarification, interactions are different than bycatch. Interactions take place between fishing gears and marine mammals, and seabirds while bycatch consists of the incidental take and discards of non-targeted finfish, shellfish, mollusks, crustaceans, sea turtles, and any other marine life other than marine mammals and seabirds. Following a brief review of the three acts (Marine Mammal Protection Act, Endangered Species Act, and Migratory Bird Treaty Act) affecting protected species, the interactions between HMS gears and each species is examined. Additionally, the interaction of seabirds and longline fisheries are considered under the auspices of the United States “National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries” (NPOA – Seabirds).

8.4.1 Interactions and the Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 as amended (MMPA) is one of the principal Federal statutes that guide marine mammal species protection and conservation policy. In the 1994 amendments, section 118 established the goal that the incidental mortality or serious injury of marine mammals occurring during the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality rate goal (ZMRG) and serious injury rate within seven years of enactment (*i.e.*, April 30, 2001). In addition, the amendments established a three-part strategy to govern interactions between marine mammals and commercial fishing operations. These include the preparation of marine mammal stock assessment reports, a registration and marine mammal mortality monitoring program for certain commercial fisheries (Category I and II), and the preparation and implementation of take reduction plans (TRP).

NMFS relies on both fishery-dependent and fishery-independent data to produce stock assessments for marine mammals in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Draft stock assessment reports are typically published around January and final reports are typically published in the Fall. Final 2007 and draft 2008 stock assessment reports are available and can be obtained on the web at:

http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html

The following marine mammal species occur off the Atlantic and Gulf Coasts that are or could be of concern with respect to potential interactions with HMS fisheries.

Common Name

Atlantic spotted dolphin
Blue whale
Bottlenose dolphin
Common dolphin
Fin whale
Harbor porpoise
Humpback whale
Killer whale
Long-finned pilot whale
Minke whale
Northern bottlenose whale
Northern right whale
Pantropical spotted dolphin
Pygmy sperm whale
Risso's dolphin
Sei whale
Short-beaked spinner dolphin
Short-finned pilot whale
Sperm whale
Spinner dolphin
Striped dolphin
White-sided dolphin

Scientific Name

Stenella frontalis
Balaenoptera musculus
Tursiops truncatus
Delphinis delphis
Balaenoptera physalus
Phocoena phocoena
Megaptera novaeangliae
Orcinus orca
Globicephela melas
Balaenoptera acutorostrata
Hyperoodon ampullatus
Eubalaena glacialis
Stenella attenuata
Kogia breviceps
Grampus griseus
Balaenoptera borealis
Stenella clymene
Globicephela macrorhynchus
Physeter macrocephalus
Stenella longirostris
Stenella coeruleoalba
Lagenorhynchus acutus

Under MMPA requirements, NMFS produces an annual list of Fisheries (LOF) that classifies domestic commercial fisheries, by gear type, relative to their rates of incidental mortality or serious injury of marine mammals. The LOF includes three classifications:

1. Category I fisheries are those with frequent serious injury or mortality to marine mammals;
2. Category II fisheries are those with occasional serious injury or mortality; and
3. Category III fisheries are those with remote likelihood of serious injury or mortality to marine mammals.

The final 2008 MMPA LOF was published on November 27, 2007 (72 FR 66048) and the final 2009 MMPA LOF was published on December 1, 2008 (73 FR 73032). The Atlantic Ocean, Caribbean, and Gulf of Mexico large pelagic longline fishery is classified as Category I (frequent serious injuries and mortalities incidental to commercial fishing) and the southeastern Atlantic shark gillnet fishery is classified as Category II (occasional serious injuries and mortalities). The following Atlantic HMS fisheries are classified as Category III (remote likelihood or no known serious injuries or mortalities): Atlantic tuna purse seine; Gulf of Maine and Mid-Atlantic tuna, shark and swordfish, hook-and-line/harpoon; southeastern Mid-Atlantic and Gulf of Mexico shark bottom longline; and Mid-Atlantic, southeastern Atlantic, and Gulf of Mexico pelagic hook-and-line/harpoon fisheries. Commercial passenger fishing vessel

(charter/headboat) fisheries are subject to Section 118 and are listed as a Category III fishery. Recreational vessels are not categorized since they are not considered commercial fishing vessels. Beginning with the 2009 LOF, high seas fisheries are included in the LOF. Many fisheries operate in both U.S. waters and on the high seas thereby making the high seas component an extension of a fishery already on the LOF. NMFS categorizes the majority of high seas fisheries on the LOF as Category II based on the lack of marine mammal stock abundance information from the high seas. Exceptions to this are high seas fisheries that also operate in U.S. waters that have already been categorized as I, II, or III. For additional information on the fisheries categories and how fisheries are classified, see <http://www.nmfs.noaa.gov/pr/interactions/lof/>.

Fishermen participating in Category I or II fisheries are required to register under the MMPA and to accommodate an observer aboard their vessels if requested. Vessel owners or operators, or fishermen, in Category I, II, or III fisheries must report all incidental mortalities and serious injuries of marine mammals during the course of commercial fishing operations to NMFS. There are currently no regulations requiring recreational fishermen to report takes, nor are they authorized to have incidental takes (*i.e.*, they are illegal).

NMFS continues to investigate serious injuries to marine mammals as they are released from fishing gear. In April 1999, NMFS held a joint meeting of the three regional scientific review groups to further discuss the issue. NMFS is continuing to develop marine mammal serious injury guidelines and until these are published, NMFS will apply the criteria listed by the review groups to make determinations for specific fisheries. The current Biological Opinions for Atlantic HMS fisheries have resulted in a conclusion of no jeopardy for marine mammals. The 1999 HMS FMP implemented several of the recommendations of the Atlantic Offshore Cetacean Take Reduction Team (AOCTRT) including: 1) a requirement that vessels fishing for HMS move one nautical mile (nm) after an entanglement with protected species; 2) limiting the length of the mainline to 24 nm in the MAB from August 1, 1999 through November 30, 2000; 3) voluntary vessel operator education workshops for HMS pelagic longline vessels; 4) handling and release guidelines; and 5) limited access for swordfish, shark and tuna longline permits.

More recently, a Pelagic Longline Take Reduction Team (PLTRT) was formed which replaced the disbanded AOCTRT. The PLTRT developed a draft Take Reduction Plan (TRP) and was published along with a proposed rule to implement it on June 24, 2008 (73 FR35623). The PLTRT recommended a suite of management strategies to reduce mortality and serious injury of pilot whales and Risso's dolphins in the Atlantic pelagic longline fishery. NMFS proposes the following three regulatory measures: (1) Establish a Cape Hatteras Special Research Area (CHSRA), with specific observer and research participation requirements for fishermen operating in that area; (2) set a 20-nm (37.02-km) upper limit on mainline length for all pelagic longline sets within the MAB; and (3) develop and publish an informational placard that must be displayed in the wheelhouse and the working deck of all active pelagic longline vessels in the Atlantic fishery. A summary of the observed and estimated marine mammal interactions with the pelagic longline fishery is presented in Table 4.6 and Table 4.7.

8.4.2 Interactions and the ESA

The Endangered Species Act of 1973 as amended (16 U.S.C. 1531 *et seq.*) provides for the conservation and recovery of endangered and threatened species of fish, wildlife, and plants. The listing of a species is based on the status of the species throughout its range or in a specific portion of its range in some instances. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. §1532(20)] if no action is taken to stop the decline of the species. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. §1532(20)]. Species can be listed as endangered without first being listed as threatened. The Secretary of Commerce, acting through NMFS, is authorized to list marine and anadromous fish species, marine mammals (except for walrus and sea otter), marine reptiles (such as sea turtles), and marine plants. The Secretary of the Interior, acting through the United States Fish and Wildlife Agency (USFWS), is authorized to list walrus and sea otter, seabirds, terrestrial plants and wildlife, and freshwater fish and plant species.

In addition to listing species under the ESA, the service agency (NMFS or USFWS) generally must designate critical habitat for listed species concurrently with the listing decision to the “maximum extent prudent and determinable” [16 U.S.C. §1533(a)(3)]. The ESA defines critical habitat as those specific areas that are occupied by the species at the time it is listed that are essential to the conservation of a listed species and that may be in need of special consideration, as well as those specific areas that are not occupied by the species that are essential to their conservation. Federal agencies are prohibited from undertaking actions that are likely to destroy or adversely modify designated critical habitat.

Marine Mammals

	<u>Status</u>
Blue whale (<i>Balaenoptera musculus</i>)	Endangered
Fin whale (<i>Balaenoptera physalus</i>)	Endangered
Humpback whale (<i>Megaptera novaeangliae</i>)	Endangered
Northern right whale (<i>Eubalaena glacialis</i>)	Endangered
Sei whale (<i>Balaenoptera borealis</i>)	Endangered
Sperm whale (<i>Physeter macrocephalus</i>)	Endangered

Sea Turtles

Green turtle (<i>Chelonia mydas</i>)	*Endangered/Threatened
Hawksbill sea turtle (<i>Eretmochelys imbricata</i>)	Endangered
Kemp’s ridley sea turtle (<i>Lepidochelys kempii</i>)	Endangered
Leatherback sea turtle (<i>Dermochelys coriacea</i>)	Endangered
Loggerhead sea turtle (<i>Caretta caretta</i>)	Threatened
Olive ridley sea turtle (<i>Lepidochelys olivacea</i>)	Threatened

Critical Habitat

Northern right whale	Endangered
----------------------	------------

Finfish

Smalltooth sawfish (*Pristis pectinata*)

Endangered

*Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between the populations away from the nesting beaches, green sea turtles are considered endangered wherever they occur in U.S. waters.

8.4.2.1 Sea Turtles

NMFS has taken several steps in the past few years to reduce sea turtle bycatch and bycatch mortality in domestic longline fisheries. On March 30, 2001, NMFS implemented via interim final rule requirements for U.S. flagged vessels with pelagic longline gear on board to have line clippers and dipnets to remove gear on incidentally captured sea turtles (66 FR 17370). Specific handling and release guidelines designed to minimize injury to sea turtles were also implemented. NMFS published a final report which provides the detailed guidelines and protocols (Epperly *et al.*, 2004) and a copy can be found at http://www.nmfs.noaa.gov/sfa/hms/Protected%20Resources/TM_524.pdf

A Biological Opinion completed on June 14, 2001, found that the actions of the pelagic longline fishery jeopardized the continued existence of loggerhead and leatherback sea turtles. This document reported that the pelagic longline fishery interacted with an estimated 991 loggerhead and 1,012 leatherback sea turtles in 1999. The estimated take levels for 2000 were 1,256 loggerhead and 769 leatherback sea turtles (Yeung 2001).

On July 13, 2001 (66 FR 36711), NMFS published an emergency rule that closed the Northeast Distant (NED) area to pelagic longline fishing (effective July 15, 2001), modified how pelagic longline gear may be deployed effective August 1, 2001, and required that all longline vessels (pelagic and bottom) post safe handling guidelines for sea turtles in the wheelhouse. On December 13, 2001 (66 FR 64378), NMFS extended the emergency rule for 180 days through July 8, 2002. On July 9, 2002, NMFS published a final rule (67 FR 45393) that closed the NED to pelagic longline fishing. As part of the Reasonable and Prudent Alternative, the BiOp required NMFS to conduct an experiment with commercial fishing vessels to test fishery-specific gear modifications to reduce sea turtle bycatch and mortality. This rule also required the length of any gangions to be 10 percent longer than the length of any floatline on vessels where the length of both is less than 100 meters; prohibited stainless steel hooks; and required gillnet vessel operators and observers to report any whale sightings and required gillnets to be checked every 0.5 to 2 hours.

The experimental program required in the BiOp was initiated in the NED area in 2001 in cooperation with the U.S. pelagic longline fleet that historically fished on the Grand Banks fishing grounds. The goal of the experiment was to test and develop gear modifications that might prove useful in reducing the incidental catch and post-release mortality of sea turtles captured by pelagic longline gear while striving to minimize the loss of target catch. The experimental fishery had a three-year duration and utilized 100 percent observer coverage to assess the effectiveness of the measures. The gear modifications tested in 2001 included blue-dyed squid and moving gangions away from floatlines. In 2002, the NED experimental fishery

examined the effectiveness of whole mackerel bait, squid bait, circle and “J” hooks, and reduced daylight soak time in reducing the capture of sea turtles. The experiment tested various hook and bait type combinations in 2003 to verify the results of the 2002 experiment.

On November 28, 2003, based on the conclusion of the three-year NED experiment, and preliminary data that indicated that the Atlantic pelagic longline fishery may have exceeded the Incidental Take Statement in the June 14, 2001, BiOp, NMFS published a Notice of Intent to prepare an SEIS to assess the potential effects on the human environment of proposed alternatives and actions under a proposed rule to reduce sea turtle bycatch (68 FR 66783). A new BiOp for the Atlantic pelagic longline fishery was completed on June 1, 2004. The BiOp concluded that long-term continued operation of the Atlantic pelagic longline fishery, authorized under the 1999 FMP, was not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp’s ridley, or olive ridley sea turtles; and was likely to jeopardize the continued existence of leatherback sea turtles.

On July 6, 2004, NMFS implemented additional regulations for the Atlantic pelagic longline fishery to further reduce the mortality of incidentally caught sea turtles (69 FR 40734). These measures include requirements on hook type, hook size, bait type, dipnets, lineclippers, and safe handling guidelines for the release of incidentally caught sea turtles. These requirements were developed based on the results of the 2001 – 2003 NED experiment (Watson *et al.*, 2003; Watson *et al.*, 2004a; Shah *et al.*, 2004). These requirements are predicted to decrease the number of total interactions, as well as the number of mortalities, of both leatherback and loggerhead sea turtles (Table 8.2) (NMFS, 2004c). Post-release mortality rates are expected to decline due to a decrease in the number of turtles that swallow hooks which engage in the gut or throat, a decrease in the number of turtles that are foul-hooked and improved handling and gear removal protocols. NMFS is working to export this new technology to pelagic longline fleets of other nations to reduce global sea turtle bycatch and bycatch mortality. U.S gear experts have presented this bycatch reduction technology and data from research activities at approximately 15 international events that included fishing communities and resource managers between 2002 and mid-2005 (NMFS, 2005).

Internationally, the United States is pursuing sea turtle conservation through international, regional, and bilateral organizations such as ICCAT, the Asia Pacific Fisheries Commission, and FAO Committee on Fisheries (COFI). The United States intends to provide a summary report to FAO for distribution to its members on bycatch of sea turtles in U.S. longline fisheries and the research findings as well as recommendations to address the issue. At the 24th session of COFI held in 2001, the United States distributed a concept paper for an international technical experts meeting to evaluate existing information on turtle bycatch, to facilitate and standardize collection of data, to exchange information on research, and to identify and consider solutions to reduce turtle bycatch. COFI agreed that an international technical meeting could be useful despite the lack of agreement on the specific scope of that meeting. The United States has developed a prospectus for a technical workshop to address sea turtle bycatch in longline fisheries as a first step. Other gear-specific international workshops may be considered in the future.

8.4.2.2 Smalltooth sawfish

On April 1, 2003, NMFS listed smalltooth sawfish as an endangered species (68 FR 15674) under the Endangered Species Act (ESA). After reviewing the best scientific and commercial information, the status review team determined that the U.S. DPS (Distinct Population Segment) of smalltooth sawfish is in danger of extinction throughout all or a significant portion of its range from a combination of the following four listing factors: the present or threatened destruction, modification, or curtailment of habitat or range; over utilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting its continued existence. NMFS is working on designating critical habitat for smalltooth sawfish.

NMFS believes that smalltooth sawfish takes in the shark gillnet fishery are rare given the high rate of observer coverage. The fact that there were no smalltooth sawfish caught during 2001, when 100 percent of the fishing effort was observed, indicates that smalltooth sawfish takes (observed or total) most likely do not occur on an annual basis. Based on this information, the 2003 BiOp estimates that one incidental capture of a sawfish (released alive) over the next five years, will occur as a result of the use of gillnets in this fishery (NMFS, 2003a).

Smalltooth sawfish have been observed caught (eight known interactions, seven released alive, one released in unknown condition) in shark bottom longline fisheries from 1994 through 2004 (NMFS, 2003a). Based on these observations, expanded sawfish take estimates for 1994-2002 were developed for the shark bottom longline fishery (NMFS, 2003a). A total of 466 sawfish were estimated to have been taken in this fishery during 1994 - 2002, resulting in an average of 52 per year. All were released alive except one. Estimates of sawfish bycatch for 2003-06 have been developed and range from 0 to 161 interactions per year (Richards, 2007a; 2007b). However, due to the sparseness of observations (interactions) and effort variables chosen for the various approaches to estimating total interactions, the results were not very precise. A small bottom longline time-area closure to protect smalltooth sawfish southwest of Key West, FL, was considered during the development of the Consolidated HMS FMP (NMFS, 2006) but not implemented due to the lack of information regarding critical habitat for this species. A proposed rule to designate critical habitat for smalltooth sawfish was published on November 20, 2008 (73 FR 70290).

8.4.3 Interactions with Seabirds

Observer data from 1992 through 2007 indicate that seabird bycatch is relatively low in the U.S. Atlantic pelagic longline fishery (Table 4.10) (NMFS, 2008). Since 1992, a total of 141 seabird interactions have been observed, with 101 observed killed (71.6 percent). In 2007, there were 117 active U.S. pelagic longline vessels fishing for swordfish in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea that reportedly set approximately 6.1 million hooks. A total of six seabirds were observed taken. Extrapolated estimates of seabird bycatch varied substantially from 1992-2007, ranging from 0 in 1996 to a high of 1,109 in 1997 (Table 4.13). The average extrapolated estimate of seabird bycatch was 210 per year while the extrapolated estimate of dead seabird bycatch was 150 per year, ranging from 0 to 623 (Table 4.14).

The National Plan of Action (NPOA) for Reducing the Incidental Catch of Seabirds in Longline Fisheries was released in February 2001. The NPOA for Seabirds calls for detailed assessments of longline fisheries, and, if a problem is found to exist within a longline fishery, for measures to reduce seabird bycatch within two years. NMFS, in collaboration with the appropriate Councils and in consultation with the U.S. Fish and Wildlife Service, will prepare an annual report on the status of seabird mortality for each longline fishery. The United States is committed to pursuing international cooperation, through the Department of State, NMFS, and U.S. Fish and Wildlife Service, to advocate the development of National Plans of Action within relevant international fora. NMFS intends to meet with longline fishery participants and other members of the public in the future to discuss possibilities for complying with the intent of the plan of action. Because interactions appear to be relatively low in Atlantic HMS fisheries, the adoption of immediate measures is unlikely.

Bycatch of seabirds in the shark bottom longline fishery has been virtually non-existent. A single pelican has been observed killed from 1994 through 2007. No expanded estimates of seabird bycatch or catch rates for the bottom longline fishery have been made due to the rarity of seabird takes.

8.5 Measures to Address Protected Species Concerns

NMFS has taken a number of actions designed to reduce interactions with protected species over the last few years. Bycatch reduction measures have been implemented through the Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (NMFS, 1999), in Regulatory Amendment 1 to the 1999 FMP (NMFS, 2000), in Regulatory Adjustment 2 to the 1999 FMP (NMFS, 2002), in Amendment 1 to the 1999 FMP (NMFS, 2003a), and in the June 2004 Final Rule for Reduction of Sea Turtle Bycatch and Bycatch Mortality in the Atlantic Pelagic Longline Fishery (69 FR 40734). NMFS closed the Southeast U.S. Restricted Area to gillnet fisheries from February 15, 2006, to March 31, 2006, as a result of an entanglement and subsequent mortality of a right whale with gillnet gear (71 FR 8223). NMFS continues to monitor observed interactions with marine mammals and sea turtles on a quarterly basis and reviews data for appropriate action, if any, as necessary.

Table 8.2 Estimated sea turtle interactions by species in the US Atlantic pelagic longline fishery, 1999-2007, and Incidental Take Levels (ITS).

PLL Fishery	1999	2000	2001	2002	2003	2004	2005	2006	2007	3 year ITS, 2004-06 / 2007-09	
										Total	Annual
Leatherback	1,016	769	1,208	962	1,112	1,362	368	415	500	1,981 / 1,764	660 / 588
Loggerhead	994	1,256	312	575	727	733	282	558	542	1,869 / 1,905	632 / 635
Other/Unidentified Sea Turtles	66	128	0	50	38	0	0	11	1	105 / 105	35 / 35
Marine Mammals	422	403	177	201	300	164	372	313	151	NA	NA

8.6 Bycatch of HMS in Other Fisheries

NMFS is concerned about bycatch mortality of Atlantic HMS in any Federal or state-managed fishery which captures them. NMFS plans to address bycatch of these species in the appropriate FMPs through coordination with the responsible management body. For example, capture of swordfish and tunas incidental to squid trawl operations is addressed in the Squid, Mackerel, and Butterfish FMP. Capture rates of tunas in coastal gillnet fisheries are being explored through issuance of exempted fishing permits and reporting requirements. NMFS continues to solicit bycatch data on HMS from all state, interjurisdictional, and Federal data collection programs. NMFS supports development of an interstate management plan for coastal sharks by the ASMFC to protect sharks caught incidentally in state-managed fisheries. NMFS has requested assistance from the ASMFC, GSMFC, and Atlantic and Gulf Regional Fishery Management Councils in identifying potential sources of bycatch of finetooth sharks in state waters fisheries or other fisheries outside the jurisdiction of this FMP.

8.6.1 Squid Mid-Water Trawl

U.S. squid trawl fishermen, using mid-water gear, landed 8.6 mt ww of yellowfin tuna, skipjack tuna, albacore tuna, bigeye tuna, and swordfish in 2003 incidental to the squid, mackerel, and butterfish trawl fishery (Table 8.3). Bycatch of HMS in other trawl fisheries may be included as a portion of the overall reported trawl landings in Table 8.3. Landings decreased from 2002 for bigeye and albacore tuna, and increased slightly for yellowfin and skipjack tuna. Swordfish landings increased by 50 percent but remain at a low level relative to the directed fishery landings. A retention limit of five swordfish per trip allows squid trawl fishermen with swordfish limited access permits to land some of the swordfish that are encountered, although regulatory discards still occur.

Table 8.3 Atlantic HMS Landed (mt ww) Incidental to Trawl Fisheries, 1998-2007. Source: NMFS, 2003; NMFS, 2005; NMFS, 2008.

Species	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Yellowfin Tuna	0.7	4.1	1.76	2.7	0.3	2.2	1.6	0.2	0.7	2.4
Skipjack Tuna	0.2	1.0	<0.05	0.2	<0.05	0.5	0.2	0.07	0.7	<0.01
Bigeye Tuna	0.5	1.2	1.7	0.4	0.5	0.03	0.9	0.6	0.0	0.4
Albacore	2.4	0.4	<0.05	0.0	0.3	0.02	2.7	1.7	1.1	0.3
Swordfish	5.9	7.5	10.9	2.5	3.9	5.6	8.3	8.2	3.5	6.5
Total	9.7	14.2	14.46	5.8	5.0	8.35	13.7	10.77	6.0	9.61

8.6.2 Menhaden Purse Seine Fishery

In the menhaden purse seine fishery, sharks were caught incidentally in approximately 30 percent of the purse seine sets observed (deSilva *et al.*, 2001). Ten species of sharks were identified with blacktip sharks being the most common species. Approximately 20 percent of the sharks were not identified to species. An estimated 30,000 sharks were taken in this fishery

annually in 1994 and 1995. At the time of release, 75 percent of sharks were dead, 12 percent were disoriented, and eight percent were healthy. The odds of observing shark bycatch was highest in April and May. Stomach analyses of sharks suggest that their occurrence in the fishery is probably the result of sharks preying on gulf menhaden (deSilva *et al.*, 2001). No new data are available at this time.

Industry workers in this fishery employ a fish excluder device to reduce the retention of sharks and other large species (Rester and Condrey, 1999). In addition, a recently introduced hose cage modification may prove to be effective in reducing shark bycatch. These devices vary in effectiveness and no standards exist for such bycatch reduction measures in this fishery. In addition, there are currently no reporting requirements for takes of sharks in the menhaden purse seine fishery. Recent estimates of large coastal sharks discarded in this fishery range from 24,000 – 26,200 individuals (Cortés, 2005).

8.6.3 Shrimp Trawl Fishery

Shark bycatch in the shrimp trawl fishery consists mainly of sharks too small to be highly valued in the commercial market. As a result, few sharks are retained. Bycatch estimates of LCS in this fishery have been generated and were reviewed in the most recent LCS assessment (Table 8.4) (SEDAR 11, 2006). Bycatch estimates of the small coastal shark complex were generated for both the GOM and SA shrimp trawl fisheries for the most recent SCS stock assessment. Requirements for turtle excluder devices in these fisheries have probably resulted in less bycatch because sharks are physically excluded from entering the gear. Bycatch of the SCS complex in the Gulf of Mexico shrimp trawl fishery consists mainly of Atlantic sharpnose and bonnethead sharks (SEDAR 13, 2007). Finetooth sharks were added as a select species for the shrimp trawl observer program in 2005 to help determine if this fishery has bycatch of finetooth sharks. Prior to this, data on finetooth shark bycatch was not recorded.

Table 8.4 Estimates of bycatch (numbers of fish) of small coastal sharks in the U.S. south Atlantic and Gulf of Mexico shrimp trawl fisheries and bottom longline fishery relative to total catch.
Source: SEDAR 13, 2007.

Year	Shrimp Bycatch (GOM)	Percent of Total Catch (GOM)	Shrimp Bycatch (SA)	Percent of Total Catch (SA)	Bottom Longline Discards	Percent of Total Catch	Total Catch
1992	1172572	81.9	147409	10.3	-	-	1431810
1993	509360	76.4	64034	9.6	-	-	666956
1994	443215	69.3	55718	8.7	-	-	639406
1995	1051681	69.2	132211	8.7	32494	2.1	1520508
1996	920627	71.7	115736	9.0	15627	1.2	1284416
1997	703350	63.2	88421	7.9	9035	0.8	1113361
1998	806300	65.7	101363	8.3	9038	0.7	1228131
1999	641017	59.9	80585	7.5	14379	1.3	1070164
2000	796602	61.9	100144	7.8	22196	1.7	1286476
2001	641786	55	80682	6.9	14365	1.2	1167231
2002	1104353	69.2	138833	8.7	24906	1.6	1595703
2003	544058	59.1	68396	7.4	26518	2.9	919918

Year	Shrimp Bycatch (GOM)	Percent of Total Catch (GOM)	Shrimp Bycatch (SA)	Percent of Total Catch (SA)	Bottom Longline Discards	Percent of Total Catch	Total Catch
2004	797000	67.1	101330	8.5	30165	2.5	1188402
2005	530943	59.9	66893	7.5	29020	3.3	886732

8.6.4 Southeast Gillnet Fishery

Gillnet fisheries operating in the south Atlantic, particularly off Florida, have been shown to incidentally take various species of sharks (see Section 0 for full description). These fisheries are primarily targeting Spanish mackerel and whiting (kingfish). Vessels participating in these fisheries either have a mackerel permit and a commercial shark permit which allows retention and landing of sharks, or may be operating in an unmanaged fishery (whiting) that requires no permit at this time. Vessels operating in these fisheries and holding a Federal permit are required to file trip reports (Coastal Fisheries Logbook). Preliminary data from observed gillnet trips not targeting sharks indicate that Atlantic sharpnose, bonnethead, blacktip, finetooth, scalloped hammerhead, blacknose, spinner and tiger sharks were caught (Carlson and Bethea, 2006). Expanding observer coverage in South Atlantic gillnet fisheries that are landing sharks could provide additional data on the extent of the bycatch of HMS species in these fisheries and thereby improving the stock assessments for these species. NMFS will attempt to continue expanded observer coverage in these fisheries as resources allow.

8.7 Effectiveness of Existing Time/Area Closures in Reducing Bycatch

Since 2000, NMFS has implemented a number of time/area closures and gear restrictions in the Atlantic Ocean and Gulf of Mexico for the PLL fishery to reduce discards and bycatch of a number of species (juvenile swordfish, bluefin tuna, billfish, sea turtles, etc.). Preliminary analyses of the effectiveness of these closures are summarized here.

The combined effects of the individual area closures and gear restrictions were examined by comparing the reported catch and discards from 2005-2007 to the averages for 1997-1999 throughout the entire U.S. Atlantic fishery. Previous analyses attempted to examine the effectiveness of the time/area closures only by comparing the 2001-03 reported catch and discards to the base period (1997-99) chosen and are included here as well for reference. The percent changes in the reported numbers of fish caught and discarded were compared to the predicted changes from the analyses in Regulatory Amendment 1 to the 1999 FMP (NMFS, 2000). Overall effort, expressed as the number of hooks reported set, declined by 30 percent from 1997-99 (Table 8.5). Declines were noted for both the numbers of kept and discards of almost all species examined including swordfish, tunas, sharks, billfish, and sea turtles. The only positive changes from the base period were the numbers of bluefin tuna and dolphin kept and discarded. The reported number of bluefin tuna kept increased by 39.2 percent for 2005-07 compared to 1997-99 (Table 8.5). The number of reported discards of bluefin tuna increased by almost 12 percent between the same time periods, which matches the predicted 11 percent increase from the analyses in Regulatory Amendment 1. The number of dolphin kept was virtually unchanged between time periods and the number of dolphin discards increased by 13

percent, although the absolute number of discards were relatively low (less than one thousand fish) (

Table 8.6). Billfish (blue and white marlin, sailfish) discards reportedly decreased by 61.3 to 76 percent from 1997-99 to 2005-07 (

Table 8.6). The reported discards of spearfish declined by 30.4 percent, although the absolute number of discards was also low (less than 200 fish). The reported number of turtle interactions decreased by 67.5 percent from 1997-99 to 2005-07.

The reported distribution of effort over the same time periods was also examined for changes in fishing behavior (

Table 8.7). Declines in the number of hooks set were noted for almost all areas with the exception of the SAR area, where reported effort had increased seven-fold from the 1997-99 period. However, this effort represents on about two percent of the overall effort reported in this fishery. Overall, reported effort decreased by 30 percent from 1997-99 to 2005-07. Reported effort declined by only 15 percent in the GOM and MAB areas, while reported effort declined by 30 percent or more in all other areas with the exception of the SAR. Although reported effort declined by 65 percent in the SAT area (Tuna North and Tuna South combined), recent effort has shown an increasing trend.

Concern over the status of bluefin tuna and the effects of the pelagic longline fishery on the species led to a re-examination of a previous analysis which compared the reported catch and discards of select species or species groups from the MAB and NEC to that reported in the rest of the fishing areas (Table 8.8). The number of bluefin tuna discards reported from the MAB/NEC has increased over the last few years while the discards from the other areas has remained relatively constant. The increase in bluefin tuna discards in the MAB/NEC does not appear to be effort-related as the reported number of hooks set has also been relatively stable.

Table 8.5 Total number of swordfish, bluefin tuna, yellowfin tuna, bigeye tuna, total BAYS (bigeye, albacore, yellowfin and skipjack tuna), reported landed or discarded in the U.S. Atlantic PLL fishery, 1997 – 2007, and percent change from 1997-99. Predicted values from Regulatory Amendment 1 where Pred ¹ = without redistribution of effort, Pred ² = with redistribution of effort. Source: HMS Logbook data.

Year	Number of hooks set (x1000)	Swordfish kept	Swordfish discards	Bluefin Tuna kept	Bluefin Tuna discards	Yellowfin Tuna kept	Yellowfin Tuna discards	Bigeye Tuna kept	Bigeye Tuna discards	Total BAYS kept	Total BAYS discards
1997	9,674.5	69,222	20,555	207	706	76,211	1,869	21,985	1,618	105,553	4,264
1998	8,031.3	70,627	23,345	237	1,321	55,507	2,710	19,324	876	82,572	4,018
1999	7,893.6	67,544	20,656	270	604	85,307	2,889	22,615	906	116,306	4,389
2000	8,021.9	63,535	16,706	236	738	73,205	1,772	13,908	348	95,294	2,968
2001	7,742.3	49,236	14,448	183	348	53,751	1,811	18,976	559	82,997	3,806
2002	7,229.6	50,439	13,182	178	593	59,758	1,655	14,056	277	80,749	2,599
2003	7,120.4	52,838	12,089	275	881	51,988	2,015	7,539	348	64,601	2,802
2004	7,325.9	46,950	10,704	476	1,031	64,128	1,736	8,266	486	77,989	3,452
2005	5,922.6	41,239	11,158	376	766	43,833	1,316	8,383	369	57,237	2,545
2006	5,662.0	38,241	8,900	261	833	55,821	1,426	12,491	257	73,058	2,865
2007	6,290.6	45,933	11,823	357	1,345	56,062	1,452	8,913	249	70,390	3,031
Mean											
1997-99	8,533.1	69,131	21,519	238	877	72,342	2,489	21,308	1,133	101,477	4,224
A) 2001-03	7,364.1	50,838	13,240	212	607	55,166	1,827	13,524	395	76,116	3,069
B) 2005-07	5,958.4	41,804	10,627	331	981	51,905	1,398	9,929	292	66,895	2,814
% dif (A)	-13.7	-26.5	-38.5	-10.9	-30.7	-23.7	-26.6	-36.5	-65.2	-25.0	-27.3
% dif (B)	-30.2	-39.5	-50.6	39.2	11.9	-28.2	-43.8	-53.4	-74.3	-34.1	-33.4
Pred ¹		-24.6	-41.5		-1.0					-5.2	
Pred ²		-13.0	-31.4		10.7					10.0	

Table 8.6 Total number of pelagic sharks, large coastal sharks, dolphin (mahi mahi), and wahoo reported landed or discarded and number of billfish (blue and white marlin, sailfish, spearfish) and sea turtles reported caught and discarded in the U.S. Atlantic PLL fishery, 1997 – 2007, and percent change from 1997-99. Predicted values from Regulatory Amendment 1 where Pred ¹ = without redistribution of effort, Pred ² = with redistribution of effort. Source: HMS logbook data.

Year	Pelagic Sharks kept	Pelagic Shark discards	Large Coastal Sharks kept	Large Coastal Shark discards	Dolphin kept	Dolphin discards	Wahoo kept	Wahoo discards	Blue Marlin discards	White Marlin discards	Sailfish discards	Spearfish discards	Sea Turtles
1997	5,110	82,022	13,746	7,869	63,530	1,204	4,787	91	2,309	2,436	1,765	384	267
1998	3,731	45,261	6,458	5,577	23,643	299	5,445	305	1,301	1,511	850	103	890
1999	2,852	28,995	6,375	5,477	31,960	321	5,285	128	1,253	1,971	1,411	151	632
2000	3,068	28,048	7,758	6,727	29,272	294	4,232	48	1,163	1,286	1,106	79	271
2001	3,511	23,954	6,510	4,892	27,914	329	3,084	62	659	874	358	142	421
2002	3,071	23,325	4,077	3,968	30,559	185	4,223	33	1,181	1,449	386	161	467
2003	3,129	21,771	5,332	4,882	29,609	452	4,020	126	606	813	280	114	399
2004	3,460	25,414	2,304	5,144	39,561	295	4,674	35	713	1,060	425	172	370
2005	3,150	21,560	3,365	5,881	25,709	556	3,360	280	569	990	367	155	154
2006	2,098	24,113	1,768	5,326	25,658	1,041	3,608	100	439	557	277	142	128
2007	3,504	27,478	546	7,133	68,124	467	3,073	52	611	744	321	147	300
Mean													
1997-99	3,898	52,093	8,860	6,308	39,711	608	5,172	175	1,621	1,973	1,342	213	596
A) 2001-03	3,237	23,017	5,306	4,581	29,361	322	3,776	74	815	1,045	341	139	429
B) 2005-07	2,917	24,384	1,893	6,113	39,830	688	3,347	144	540	764	322	148	194
% dif (A)	-17.0	-55.8	-40.1	-27.4	-26.1	-47.0	-27.0	-57.8	-49.7	-47.0	-74.6	-34.6	-28.1
% dif (B)	-25.2	-53.2	-78.6	-3.1	0.3	13.2	-35.3	-17.6	-66.7	-61.3	-76.0	-30.4	-67.5
Pred ¹	-9.5	-2.0	-32.1	-42.5	-29.3				-12.0	-6.4	-29.6		-1.9
Pred ²	4.1	8.4	-18.5	-33.3	-17.8				6.5	10.8	-14.0		7.1

Table 8.7 Reported distribution of hooks set by area, 1995-2007, and percent change from 1997-99 (CAR=Caribbean, GOM=Gulf of Mexico, FEC=Florida East Coast, SAB=South Atlantic Bight, MAB=Mid-Atlantic Bight, NEC=Northeast Coastal, NED=Northeast Distant, SAR=Sargasso, NCA=North Central Atlantic, and SAT=Tuna North & Tuna South). Source: HMS logbook data.

Year	CAR	GOM	FEC	SAB	MAB	NEC	NED	SAR	NCA	SAT	Total
1995	688,761	2,662,962	647,060	853,095	2,394,484	1,072,438	765,485	16,430	785,749	298,113	10,184,577
1996	651,673	3,612,577	579,064	1,591,526	1,040,205	1,139,399	589,982	87,285	500,262	601,729	10,393,702
1997	473,536	3,418,396	787,834	948,850	1,209,966	1,231,096	689,494	21,640	209,946	683,755	9,674,513
1998	333,766	3,004,727	669,533	720,675	1,320,946	886,459	506,079	3,500	247,457	338,191	8,031,333
1999	177,028	3,615,770	710,373	769,808	1,271,316	587,225	338,719	17,795	117,031	288,532	7,893,597
2000	259,369	3,682,965	718,463	813,972	1,035,296	610,103	543,699	10,959	224,364	122,684	8,021,874
2001	218,013	3,549,658	470,855	730,926	1,109,990	865,281	315,695	11,437	292,383	178,639	7,742,247
2002	172,962	3,597,953	495,245	435,231	1,022,578	559,771	464,868	104,165	241,621	135,252	7,229,628
2003	134,611	3,900,014	500,413	544,368	702,220	448,438	576,727	112,787	132,205	68,600	7,120,383
2004	298,129	4,118,468	264,524	672,973	856,521	462,171	455,862	128,582	20,990	47,730	7,325,950
2005	180,885	3,037,968	323,551	467,680	835,091	356,696	462,490	110,107	55,716	92,382	5,922,566
2006	73,774	2,577,231	281,239	544,647	1,085,640	406,199	339,586	135,575	64,500	153,620	5,662,011
2007	32,650	2,920,725	347,236	739,272	1,319,056	326,532	285,827	100,336	11,409	207,598	6,290,641
Mean											
1997-99	328,110	3,346,298	722,580	813,111	1,267,409	901,593	511,431	14,312	191,478	436,826	8,533,148
A) 2001-03	175,195	3,682,536	488,838	569,965	944,929	624,497	452,430	76,130	222,070	127,497	7,364,086
B) 2005-07	95,770	2,845,308	317,342	583,866	1,079,929	363,142	362,634	115,339	43,875	151,200	5,958,406
% dif (A)	-46.6	10.0	-32.3	-29.9	-25.4	-30.7	-11.5	431.9	16.0	-70.8	-13.7
% dif (B)	-70.8	-15.0	-56.1	-28.2	-14.8	-59.7	-29.1	705.9	-77.1	-65.4	-30.2

Table 8.8 Number of bluefin tuna (BFT), swordfish (SWO), sharks (PEL-pelagic; LCS-Large Coastal Sharks), billfish, and turtles reported kept and/or discarded in the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) areas combined versus all other areas as reported in the pelagic logbook data, 1995-2007. Source: HMS logbook Data.

Area	Year	Hooks set (x1000)	SPECIES									
			BFT kept	BFT discards	SWO kept	SWO discards	PEL shark kept	PEL shark discards	LCS kept	LCS discards	Billfish discards	Turtle interactions
MAB & NEC	1995	3,466.9	96	2,791	5,845	5,399	2,683	36,415	7,747	2,125	1,461	81
	1996	2,179.6	74	1,601	3,124	874	2,520	37,743	6,435	2,004	1,184	20
	1997	2,441.1	96	583	6,330	3,663	3,062	40,515	6,670	958	803	52
	1998	2,207.4	94	1,157	9,684	4,923	2,143	28,579	1,781	890	401	57
	1999	1,858.5	70	335	8,213	4,331	1,680	12,479	1,966	736	818	174
	2000	1,645.4	26	356	8,748	2,846	2,099	13,083	4,744	1,407	240	30
	2001	1,975.3	45	200	10,661	4,000	2,537	9,013	4,383	997	310	69
	2002	1,582.3	18	389	10,986	4,219	2,378	7,308	2,331	1,207	311	41
	2003	1,150.7	67	471	10,888	3,022	2,222	6,929	2,787	1,429	172	42
	2004	1,318.7	128	709	8,486	2,463	2,323	7,594	923	1,488	219	54
	2005	1,191.8	96	575	9,184	2,420	1,912	7,026	2,512	2,433	473	44
	2006	1,491.8	124	737	10,278	2,564	1,428	7,547	1,279	2,180	266	28
2007	1,645.6	137	1,148	14,102	3,082	2,313	8,169	431	2,861	407	55	
All Other Areas (non-MAB/NEC)	1995	6,717.7	156	103	67,191	24,436	3,094	53,937	17,883	6,140	6,176	1,047
	1996	8,214.1	129	115	70,640	23,506	3,044	47,725	14,469	8,292	6,582	474
	1997	7,233.5	111	123	62,892	16,892	2,048	41,507	7,076	6,911	6,091	215
	1998	5,823.9	143	164	60,943	18,422	1,588	16,682	4,677	4,687	3,364	833
	1999	6,035.1	200	269	59,331	16,325	1,172	16,516	4,409	4,741	3,968	458
	2000	6,376.5	210	382	54,787	13,860	969	14,965	3,014	5,320	3,394	241
	2001	5,767	138	148	38,575	10,448	974	14,941	2,127	3,895	1,723	352
	2002	5,647.3	160	204	39,453	8,963	693	15,160	1,746	2,761	2,866	426
	2003	5,969.7	208	410	41,950	9,067	907	14,842	2,565	3,453	1,641	357
	2004	6,007.3	348	322	38,464	8,241	1,137	17,820	1,381	3,656	2,151	316

			SPECIES									
Area	Year	Hooks set (x1000)	BFT kept	BFT discards	SWO kept	SWO discards	PEL shark kept	PEL shark discards	LCS kept	LCS discards	Billfish discards	Turtle interactions
	2005	4,730.8	280	191	32,055	8,738	1,238	14,534	853	3,448	1,608	110
	2006	4,170.2	137	96	27,963	6,336	670	16,566	489	3,146	1,149	100
	2007	4,645.1	200	197	31,831	8,741	1,191	19,309	115	4,272	1,416	245

The reported declines in swordfish kept and discarded, large coastal sharks kept and discarded, and dolphin kept were similar to the predicted values developed for Regulatory Amendment 1. Reported discards of bluefin tuna, pelagic sharks, all billfish (with the exception of spearfish for which no predicted change was developed in Regulatory Amendment 1), and total BAYS tunas kept all declined more than the predicted values.

8.7.1 Prohibition of Live Bait in the Gulf of Mexico

Amendment 1 to the 1999 FMP also prohibited the use of live bait on pelagic longline gear in the Gulf of Mexico due to concerns over the incidental bycatch of billfish. Based on logbook data, the number of hooks reported set with live bait or a combination of live and dead bait in the Gulf of Mexico decreased from 22.7 percent in 2000, to less than 0.1 percent in 2003 (Table 8.9). However, the number of hooks reported set with no bait type specified increased from zero in 1999 – 2001 to 3.7 percent in 2003, declining to less than one percent in 2004. Also, the reported number of hooks set in the Gulf of Mexico has increased in recent years. The reported effort in 2004 represents an increase of 21.8 percent from 2000. NMFS will continue to analyze the effectiveness of the live bait prohibition in the Gulf of Mexico pelagic longline fishery.

Table 8.9 Comparison of the number of hooks (thousands) reported set in the Gulf of Mexico with dead, artificial, or live bait, or a combination of baits, 1999-2007 (numbers in parentheses are percent of the total number of hooks set in the Gulf of Mexico). Source: PLL Logbook data.

Bait Type	1999	2000	2001	2002	2003	2004	2005	2006	2007
Dead	2,336 (70.9)	2,598 (77.3)	3,176.5 (98.3)	3,494.6 (97.6)	3,668.7 (96.3)	4,089.0 (99.8)	2,878.9 (94.8)	2,368.2 (91.9)	2,908.5 (99.6)
Live	372 (11.3)	259 (7.7)	5,500.0 (0.2)	0.7 (<0.1)	1.5 (<0.1)	0 (0)	0 (0)	0 (0)	1.2 (<0.1)
Both (DL)	585 (17.8)	506 (15.0)	49.3 (1.5)	13.1 (0.4)	1 (<0.1)	0 (0)	0.9 (<0.1)	0 (0)	0 (0)
Artificial	-	-	-	-	-	-	0 (0)	8.7 (0.3)	0 (0)
Both (DA)	-	-	-	-	-	-	20.3 (0.7)	14.2 (0.6)	0.7 (<0.1)
Unknown	0 (0)	0 (0)	0 (0)	71.0 (2.0)	139.6 (3.6)	8.0 (0.2)	137.5 (4.5)	186.1 (7.2)	10.4 (0.4)
Total hooks	3,293	3,363	3,231.2	3,579.5	3,810.8	4,097.0	3,037.5	2,577.2	2,920.7

8.7.2 Conclusions

The time/area closures and live bait prohibition in the Gulf of Mexico have been relatively successful at reducing bycatch in the HMS pelagic longline fishery. Reported discards of all species of billfish have declined (

Table 8.6). The reported number of turtles caught, swordfish discarded, bluefin tuna discarded, and pelagic and large coastal shark discards have also declined. However, the reported number of target species kept, such as swordfish and BAYS tuna, have decreased more than was predicted. This is contrary to the other objective of the time/area closures, which was to minimize the reduction in target catch. NMFS will continue to analyze these measures as additional data become available and examine the effects of ongoing regulatory change over time.

8.8 Evaluation of Other Bycatch Reduction Measures

NMFS continues to monitor and evaluate bycatch in HMS fisheries through direct enumeration (pelagic and bottom longline observer programs, shark gillnet observer program), evaluation of management measures (closed areas, trip limits, gear modifications, etc.), and vessel monitoring systems (VMS).

The following section provides a review of additional management measures or issues that may address bycatch reduction:

- Atlantic Large Whale Take Reduction Plan (ALWTRP)

Major changes to the ALWTRP were implemented in a Final Rule that published on October 5, 2007 (72 FR 57104). Regulations that affect HMS fisheries specifically gillnet fisheries, include: 1) a closed area for all gillnet fisheries from November 15 – April 15 from 29° 00' N to 32° 00' N from shore eastward to 80° 00' W and off SC, within 35 nautical miles of the coast (Southeast US Restricted Area North); 2) a restricted area from December 1 – March 31 from 27° 51' N to 29° 00' N from shore eastward to 80° 00' W (Southeast US Restricted Area South); 3) additional seasonal boundaries for EEZ waters east of 80° 00' W from 26° 46.50' N to 32° 00' N (Other Southeast Gillnet Waters); and 4) a monitoring area specific to the Atlantic shark gillnet fishery that extends from the area along the coast from 27° 51' N south to 26° 46.50' N eastward to 80° 00' W (Southeast US Monitoring Area) effective December 1 – March 31. Specific compliance requirements for fishing in these areas varies and are summarized in the Guide to the Atlantic Large Whale Take Reduction Plan. For additional information please see the ALWTRP website <http://www.nero.noaa.gov/whaletrp/index.html>.

- Atlantic Bottlenose Dolphin Take Reduction Team

NMFS published a final rule on April 22, 2006, to implement the TRP. Included in the final rule are: 1) effort reduction measures; 2) gear proximity requirements; 3) gear or gear deployment modifications; and 4) outreach and education measures to reduce dolphin bycatch below the stock's potential biological removal level. The final rule also includes time/area closures and size restrictions on large mesh fisheries to reduce incidental takes of endangered and threatened sea turtles as well as to reduce dolphin bycatch.

- MMPA List of Fisheries Update/Stock Assessment

NMFS continues to update the MMPA List of Fisheries and the 2008 final list is available. The final 2009 List of Fisheries published on December 1, 2008 (73 FR 73032). Final

2007 and draft 2008 stock assessment reports are available and can be obtained on the web at: http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html.

- Pelagic Longline Take Reduction Team (PLTRT)

NMFS appointed a PLTRT in June 2005, to address issues in the longline fishery and marine mammals, specifically pilot whales. A proposed rule to implement the TRP has been developed and published on June 24, 2008 (73 FR35623). The PLTRT recommended a suite of management strategies to reduce mortality and serious injury of pilot whales and Risso's dolphins in the Atlantic pelagic longline fishery. NMFS proposes the following three regulatory measures: (1) Establish a Cape Hatteras Special Research Area (CHSRA), with specific observer and research participation requirements for fishermen operating in that area; (2) set a 20-nm (37.02-km) upper limit on mainline length for all pelagic longline sets within the MAB; and (3) develop and publish an informational placard that must be displayed in the wheelhouse and the working deck of all active pelagic longline vessels in the Atlantic fishery.

- VMS in the pelagic longline fishery

NMFS adopted fleet-wide VMS requirements in the Atlantic pelagic longline fishery in May 1999, but was subsequently sued by an industry group. By order dated September 25, 2000, the U.S. District Court for the District of Columbia prevented any immediate implementation of VMS in the Atlantic pelagic longline fishery, and instructed to "undertake further consideration of the scope of the [VMS] requirements in light of any attendant relevant conservation benefits." On October 15, 2002, the court issued a final order that denied plaintiff's objections to the VMS regulations. Based on this ruling, NMFS implemented the VMS requirement in September 2003.

- VMS in other HMS fisheries

Starting in 2004, gillnet vessels with a directed shark permit and gillnet gear onboard were required to install and operate a VMS unit during the Right Whale Calving Season (November 15 – March 31). In an attempt to better quantify bycatch, NMFS will require all vessels with Limited Access Shark Permits to participate in the Directed Shark Gillnet Observer program. Directed shark bottom longline vessels located between 33° N and 36° 30' N need to install and operate a VMS unit from January through July.

Section 8 References

Babcock, E.A., E.K. Pikitch, and C.G. Hudson. 2003. How much observer coverage is enough to adequately estimate bycatch? Report of the Pew Institute for Ocean Science, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL. 36 pp. On-line version: <http://www.oceana.org/uploads/BabcockPikitchGray2003FinalReport.pdf>

Belle, S. 1997. Mortalities and healing processes associated with hook and line caught juvenile bluefin tuna and two different handling methods; control (untagged) and dart tagging. New England Aquarium Bluefin Tuna Project, Final Report NOAA Award No. NA27FL0199-01.

Beerkircher, L.R., C.J. Brown, and D.W. Lee. 2002. SEFSC Pelagic Observer Program Data Summary for 1992-2000. NOAA Tech. Mem. NMFS-SEFSC-486. 26 pp.

Carlson, J.K. and I.E. Baremore. 2002. The Directed Shark Gillnet Fishery: Non-Right Whale Season, 2002 (catch, bycatch and estimates of sample size). NMFS/SEFSC/SFD Contribution PCB-02/12. Panama City, FL. 10 p.

Carlson, J.K. and D.M. Bethea. 2006. The Directed Shark Gillnet Fishery: Catch and Bycatch, 2005. NOAA, NMFS, Southeast Fisheries Science Center, Panama City, FL. Panama City Lab.-Contribution 06-01.

Cortés, E. 2005. Stock Assessment of Small Coastal Sharks in the U.S. Atlantic and Gulf of Mexico. NOAA, NMFS, Southeast Fisheries Science Center, Panama City, FL. SFD-02/03-177. 222 pp.

Cramer, J. 2000. Pelagic Longline Bycatch. SFD-99/00/115 (Rev), 35 p.

de Silva, J.A., R.E. Condrey, B.A. Thompson. 2001. Profile of Shark Bycatch in the U.S. Gulf Menhaden Fishery. North Amer. Jour. of Fish. Mgmt. 21:111-124.

Epperly, S., L. Stokes, and S. Dick. 2004. Careful Release Protocols for Sea Turtle Release with Minimal Injury. NOAA Tech. Mem. NMFS-SEFSC-524.

Garrison, L.P. 2005. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet during 2004. NOAA Tech. Mem. NMFS-SEFSC-531.

Graves, John E., B.E. Luckhurst, E.D. Prince. 2002. An evaluation of pop-up satellite tags for estimating postrelease survival of blue marlin (*Makaira nigricans*) from a recreational fishery. Fish. Bull. 100(1):134-142 (2002).

Horodysky, A.Z. and J.E. Graves. 2005. Application of pop-up satellite archival tag technology to estimate postrelease survival of white marlin (*Tetrapterus albidus*) caught on circle and straight-shank ("J") hooks in the western North Atlantic recreational fishery. Fish. Bull. 103(1):84-96.

Murawski, S.A. 2005. The New England groundfish resource: a history of population change in relation to harvesting. In: Buschbaum, R., Pederson, J., and Robinson, W.E., eds. *The Decline of Fisheries Resources in New England: Evaluating the Impact of Overfishing, Contamination, and Habitat Degradation*. Cambridge (MA): MIT Sea Grant Program, MITSG 05-5, p. 11-24.

NAS. 2006. *Review of Recreational Fisheries Survey Methods*. Committee on the Review of Recreational Fisheries Survey Methods, National Research Council. ISBN: 0-309-10193-X, 130 p.

NMFS. 1998. *Managing the Nation's Bycatch: Programs, Activities, and Recommendations for the National Marine Fisheries Service*. 174 pp.

NMFS. 1999. *Final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks*. NOAA, NMFS, HMS Management Division.

NMFS. 2000. *Regulatory Amendment One to the 1999 HMS FMP. Reduction of Bycatch, Bycatch Mortality, and Incidental Catch in the Atlantic Pelagic Longline Fishery*, June 14, 2000. NOAA, NMFS, HMS Management Division.

NMFS. 2002. *Regulatory Adjustment 2 to the Atlantic Tunas, Swordfish, and Sharks Fishery Management Plan*. NOAA, NMFS, Highly Migratory Species Management Division, 174 pp.

NMFS. 2003a. *Final Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks*. NOAA, NMFS, HMS Management Division.

NMFS. 2003b. *National Report of the United States: 2003*. NAT/034. 40 pp.

NMFS. 2004a. *Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs*. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-66, 108 p.

NMFS. 2004c. *FSEIS Reduction of Sea Turtle Bycatch and Bycatch Mortality in the Atlantic Pelagic Longline Fishery*. NOAA, NMFS, HMS Management Division, Silver Spring, MD.

NMFS. 2005. *Annual Report of the United States of America*. ANN/2005/038.

NMFS. 2006. *Final Consolidated Atlantic Highly Migratory Species Fishery Management Plan*. NOAA, NMFS, Highly Migratory Species Management Division, 1315 East West Highway, Silver Spring, MD.

NMFS. 2008. *Annual Report of the United States of America*. ANN-043/2008.

Rago, P.J., S.E. Wigley, and M.J. Fogarty. 2005. NEFSC Bycatch Estimation Methodology: Allocation, Precision, and Accuracy. NOAA, NMFS, NEFSC Ref. Doc. 05-09.

Rester, J.K. and R.E. Condrey. 1999. Characterization and evaluation of bycatch reduction devices in the Gulf menhaden fishery. North Amer. Jour. Fish. Mgmt. 19: 42-50.

Richards, P.M. 2007a. Estimated takes of protected species in the commercial directed shark bottom longline fishery 2003, 2004, and 2005. SFD-06/07-08, 21 p.

Richards, P.M. 2007b. Estimated takes of protected species in the commercial directed shark bottom longline fishery 2006. PRBD-07/08-05, 15 p.

SEDAR 11. 2006. Stock Assessment Report: Large Coastal Shark Complex, Blacktip, and Sandbar Shark. NOAA/NMFS, Highly Migratory Species Management Division, 1315 East West Highway, Silver Spring, MD.

SEDAR 13. 2007. Stock Assessment Report: Small Coastal Shark Complex, Atlantic Sharpnose, Blacknose, Bonnethead, and Finetooth Shark. NOAA/NMFS, Highly Migratory Species Management Division, 1315 East West Highway, Silver Spring, MD.

Shah, A., J.W. Watson, D. Foster, and S. Epperly. 2004. Experiments in the Western Atlantic Northeast Distant Waters to Evaluate Sea Turtle Mitigation Measures in the Pelagic Longline Fishery – Summary of Statistical Analysis. NOAA, NMFS, SEFSC, Pascagoula, MS. Unpublished Report.

Skomal, G. and B. Chase. 1996. Preliminary results on the physiological effects of catch-and-release on bluefin tuna (*Thunnus thynnus*) caught off Cape Hatteras, North Carolina. ICCAT SCRS/96/126, 13 pp.

Smith, P.C., L.F. Hale, and J.K. Carlson. 2006. The Directed Shark Longline Fishery: Catch and Bycatch, 2005. NMFS Panama City Laboratory Contr. 06-04. 14 pp.

Walsh, C.F. and L.P. Garrison. 2006. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2005. NOAA Tech. Mem. NMFS-SEFSC-539.

Watson, J.W., D.G. Foster, S. Epperly, and A. Shah. 2003. Experiments in the Western Atlantic Northeast Distant Waters to Evaluate Sea Turtle Mitigation Measures in the Pelagic Longline Fishery – Summary of Statistical Analysis. NOAA, NMFS, SEFSC, Pascagoula, MS. Unpublished Report.

Watson, J.W., D.G. Foster, S. Epperly, and A. Shah. 2004. Experiments in the Western Atlantic Northeast Distant Waters to Evaluate Sea Turtle Mitigation Measures in the Pelagic Longline Fishery: Report on experiments conducted in 2001–2003. February 4, 2004. NOAA, NMFS, SEFSC, Pascagoula, MS. 123 pp.

Yeung, C. 2001. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1999-2000. NOAA Tech. Mem. NMFS-SEFSC-467: 43 p.