Predraft of

Amendment 5 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan

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1 Introduction

This document is a Predraft for Amendment 5 to the Consolidated Atlantic Highly Migratory Species (HMS) Fishery Management Plan (FMP). A Predraft document allows the National Marine Fisheries Service (NMFS) to obtain additional information and input from Consulting Parties on potential alternatives prior to development of the formal Draft Environmental Impact Statement (DEIS) and proposed rule. The Magnuson-Stevens Act requires NMFS to "consult with and consider the comments and views of affected Councils, commissioners and advisory groups appointed under Acts implementing relevant international fishery agreements pertaining to highly migratory species, and the [HMS] advisory panel in preparing and implementing any fishery management plan or amendment." As such, we are requesting comments and views on this Predraft document for Amendment 5 to the 2006 Consolidated HMS FMP. An electronic version of the Predraft is also available on the website of the HMS Management Division at: http://www.nmfs.noaa.gov/sfa/hms.

NMFS is developing Amendment 5 to the Consolidated HMS FMP in response to the results of several recent shark stock assessments, and will mainly deal with species in the large coastal shark (LCS) and small coastal shark (SCS) complexes. The first assessment initially was published in a peer-reviewed professional journal and later reviewed by NMFS scientists and adopted as a stock assessment for use in domestic shark management (76 FR 23794; April 28, 2011). The other assessments (sandbar, dusky, Atlantic blacknose, and Gulf of Mexico blacknose sharks) were conducted as part of the Southeast Data, Assessment, and Review (SEDAR) process (76 FR 62331; October 7, 2011).

NMFS anticipates that the proposed rule and DEIS will be available in mid-2012 and that Final Amendment 5 to the Consolidated HMS FMP and its related documents will be available in Spring 2013. Given the short time frame, NMFS requests receipt of any comments on this document by April 13, 2012.

Any written comments on the Predraft should be submitted to Peter Cooper, HMS Management Division, F/SF1, Office of Sustainable Fisheries, 1315 East West Highway, Silver Spring, MD 20910 or faxed to (301) 713 1917 by April 13, 2012. For further information, contact Peter Cooper or Karyl Brewster-Geisz at (301) 427-8503.

This Predraft includes a summary of the anticipated purpose and need (Chapter 1) of the amendment and tables summarizing the potential environmental, social, and economic impacts of management alternatives that NMFS is considering at this time (Chapter 2). The alternatives outlined in Chapter 2 may be modified, removed, or supplemented based on any comments received, additional analyses, and other factors, as appropriate.

NMFS specifically solicits opinions and advice on the potential range of alternatives and whether there are additional alternatives that should be addressed and considered in the rulemaking process. Additionally, NMFS solicits opinions and advice on the impacts described for each alternative.

1.1 Management History

On November 28, 1990, the President of the United States signed into law the Fishery Conservation Amendments of 1990 (Pub. L. 101-627). This law amended the Magnuson Fishery Conservation and Management Act (later renamed the Magnuson-Stevens Fishery Conservation and Management Act or Magnuson-Stevens Act) and gave the Secretary of Commerce (Secretary) the authority (effective January 1, 1992) to manage HMS in the exclusive economic zone (EEZ) of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea under authority of the Magnuson-Stevens Act (16 U.S.C. §1811). This law also transferred from the Fishery Management Councils to the Secretary, effective November 28, 1990, the management authority for HMS in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea (16 U.S.C. §1854(f)(3)). At that time, the Secretary delegated authority to manage Atlantic HMS to NMFS.

The HMS Management Division within NMFS develops regulations for HMS fisheries, although some actions (e.g., Large Whale Take Reduction Plan) are taken by other NMFS offices if the main legislation (e.g., Marine Mammal Protection Act) requiring action is not the Magnuson-Stevens Act or the Atlantic Tunas Convention Act (ATCA). NMFS manages HMS species at the international, national, and state levels because of the highly migratory nature of these species. NMFS primarily coordinates the management of HMS fisheries in Federal waters (domestic) and the high seas (international) while individual states establish regulations for HMS in state waters. There are exceptions to this generalization. For example, Federal bluefin tuna regulations apply by law in most state waters, and federally permitted shark and swordfish fishermen, as a condition of their permit, are required to follow Federal regulations in all waters, including state waters, unless the state has more restrictive regulations. Additionally, the Atlantic States Marine Fisheries Commission (ASMFC) recently developed an interstate coastal shark FMP. This interstate FMP coordinates management measures among all states along the Atlantic coast (Florida to Maine). NMFS participated in the development of this interstate shark FMP, which became effective in 2010.

1.1.1 Pre-1999 Atlantic Shark Fisheries and Management

In the early 1900s, a Pacific shark fishery supplied limited demands for fresh shark fillets and fish meal as well as a more substantial market for dried fins of soupfin sharks (*Galeorhinus zyopterus*). In 1937, the price of soupfin shark liver skyrocketed when it was discovered to be the richest source of vitamin A available in commercial quantities. A shark fishery in the Caribbean Sea, off the coast of Florida, and in the Gulf of Mexico developed in response to this demand (Wagner, 1966). At that time, shark fishing gear included gillnets, hook and line, anchored bottom longlines (BLL), floating longlines, and benthic lines for deepwater fishing. These gear types are slightly different than the gears used today and are fully described in Wagner (1966). By 1950, the availability of synthetic vitamin A caused most shark fisheries to be abandoned (Wagner, 1966).

The U.S. Atlantic shark fishery developed rapidly in the late 1970s due to increased demand for shark meat, fins, and cartilage. At the time, sharks were perceived to be underutilized as a fishery resource. The high commercial value of shark fins led to the

controversial practice of finning, or removing the valuable fins from sharks and discarding the carcass at sea. Growing demand for shark products encouraged expansion of the commercial fishery throughout the late 1970s and the 1980s. Tuna and swordfish vessels began to retain a greater proportion of their shark incidental catch and conduct some directed fishing. The Secretary published the Preliminary FMP for Atlantic Billfish and Sharks in 1978, which noted, among other things, the need for international management regarding sharks. Catches accelerated through the 1980s, with peak commercial landings of large coastal and pelagic sharks reported in 1989.

In 1989, the five Atlantic Fishery Management Councils (Councils) asked the Secretary to develop a Shark FMP. The Councils were concerned about the late maturity and low fecundity of sharks, the increase in fishing mortality, and the possibility of the resource being overfished. The Councils requested that the FMP cap commercial fishing effort, establish a recreational bag limit, prohibit "finning," and begin a data collection system.

In 1993, the Secretary of Commerce, through NMFS, implemented the FMP for Sharks of the Atlantic Ocean (1993 Shark FMP). At that time, NMFS identified large coastal sharks (LCS) as overfished and pelagic and small coastal sharks (SCS) as fully fished. The quotas were 2,436 mt dressed weight (dw) for LCS and 580 mt dw for pelagic sharks. No quota was established for the SCS complex to limit SCS fishing. Under the rebuilding plan established in the 1993 FMP, the LCS quota was expected to increase every year from 1993 to 1995 up to 3,787 mt dw, which was the maximum sustainable yield estimated in the 1992 stock assessment.

A number of difficulties arose in the initial year of implementation of the 1993 Shark FMP that resulted in a short season and low ex-vessel prices. To address these problems, a commercial trip limit of 4,000 lb dw for permitted vessels for LCS was implemented on December 28, 1993 (58 FR 68556), and a control date for the Atlantic shark fishery was established on February 22, 1994 (59 FR 8457). A final rule implementing additional measures authorized by the FMP published on October 18, 1994 (59 FR 52453).

In 1994, under the rebuilding plan implemented in the 1993 Shark FMP, the LCS quota was increased to 2,570 mt dw. However, a new stock assessment was completed in March 1994 that indicated LCS rebuilding could take as long as 30 years and suggested a more cautious approach for pelagic sharks and SCS. A final rule that capped quotas for LCS and pelagic sharks at the 1994 levels was published on May 2, 1995 (60 FR 21468).

In June 1996, NMFS convened another stock assessment to examine the status of LCS stocks. The 1996 stock assessment found no clear evidence that LCS stocks were rebuilding and concluded that "[a]nalyses indicate that recovery is more likely to occur with reductions in [the] effective fishing mortality rate of 50 [percent] or more." In response to these results, in 1997, NMFS reduced the LCS commercial quota by 50 percent to 1,285 mt dw and the recreational retention limit to two LCS, SCS, and pelagic sharks combined per trip with an additional allowance of two Atlantic sharpnose sharks (*Rhizoprinodon terraenovae*) per person per trip (62 FR 16648, April 2, 1997). In this same rule, NMFS established an annual commercial quota for SCS of 1,760 mt dw and prohibited possession of five species (sand tiger, bigeye sand tiger, whale, basking, and white sharks). As a result of litigation, NMFS prepared additional economic

analyses on the 1997 LCS quotas and was allowed to maintain those quotas during resolution of the case.

In June 1998, NMFS conducted another LCS stock assessment. The 1998 stock assessment found that LCS were overfished and would not rebuild under the 1997 harvest levels. Based in part on the results of the 1998 stock assessment, in April 1999, NMFS published the 1999 FMP for Atlantic Tunas, Swordfish, and Sharks (1999 FMP), which included numerous measures to rebuild or prevent overfishing of Atlantic sharks in commercial and recreational fisheries. The 1999 FMP replaced the 1993 Atlantic Shark FMP. Management measures related to sharks that changed in the 1999 FMP included, but were not limited to, reducing commercial LCS and SCS quotas, modifying the pelagic shark quotas, reducing the recreational retention limits for all sharks, establishing a recreational minimum size for all sharks except Atlantic sharpnose, expanding the list of prohibited shark species to 19 species, implementing limited access in commercial shark fisheries, and establishing a shark public display quota. Finally, the 1999 FMP identified essential fish habitat (EFH) for all Atlantic tunas, swordfish, and sharks. As part of the 1999 FMP, the regulations for all Atlantic HMS, including billfish, were consolidated into one part of the Code of Federal Regulations, 50 CFR Part 635.

The implementing regulations were published on May 28, 1999 (64 FR 29090). However, in July 1999, the District Court for the Middle District of Florida enjoined implementation of the 1999 shark regulations because of ongoing litigation on the 1997 quotas. A year later, on June 12, 2000, the case was settled and the court issued an order clarifying that NMFS could proceed with implementation and enforcement of the 1999 prohibited species provisions (64 FR 29090, May 28, 1999).

1.1.2 Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks

As noted in Section 1.1.1, in 1999, a court enjoined the Agency from implementing many of the shark-specific regulations of the 1999 FMP. In 2000, the injunction was lifted when a settlement agreement was entered to resolve the 1997 and 1999 lawsuits. The settlement agreement required, among other things, an independent (i.e., non-NMFS) review of the 1998 LCS stock assessment. The settlement agreement did not address any regulations affecting the pelagic shark, prohibited species, or recreational shark fisheries. Once the injunction was lifted, on January 1, 2001, the pelagic shark quotas adopted in the 1999 FMP were implemented (66 FR 55). On March 6, 2001, NMFS published an emergency rule implementing the settlement agreement (66 FR 13441). This emergency rule expired on September 4, 2001, and established the LCS and SCS commercial quotas at 1997 levels.

In late 2001, the Agency received the results of the peer review of the 1998 LCS stock assessment. These peer reviews found that the 1998 LCS stock assessment was not the best available science for LCS. Taking into consideration the settlement agreement, the results of the peer reviews of the 1998 LCS stock assessment, catch rates, and the best available scientific information (not including the 1998 stock assessment projections), NMFS implemented another emergency rule for the 2002 fishing year that suspended certain measures under the 1999 regulations pending completion of new LCS and SCS stock assessments and a peer review of the

new LCS stock assessment (66 FR 67118, December 28, 2001; extended 67 FR 37354, May 29, 2002). Specifically, NMFS maintained the 1997 LCS commercial quota (1,285 mt dw), maintained the 1997 SCS commercial quota (1,760 mt dw), suspended the commercial ridgeback LCS minimum size, suspended counting dead discards and state landings after a Federal closure against the quota, and replaced season-specific quota accounting methods with subsequent-season quota accounting methods. That emergency rule expired on December 30, 2002.

On October 17, 2002, NMFS announced the availability of the 2002 LCS stock assessment and the workshop meeting report (67 FR 64098). The results of this stock assessment indicated that the LCS complex was still overfished and overfishing was occurring. Additionally, the 2002 LCS stock assessment found that sandbar sharks were no longer overfished but that overfishing was still occurring and that blacktip sharks were rebuilt and overfishing was not occurring.

Based on the results of both the 2002 SCS and LCS stock assessments, NMFS implemented an emergency rule to ensure that the commercial management measures in place for the 2003 fishing year were based on the best available science (67 FR 78990, December 27, 2002; extended 68 FR 31987, May 29, 2003). Specifically, the emergency rule implemented the LCS ridgeback/non-ridgeback split established in the 1999 FMP, set the LCS and SCS quotas based on the results of stock assessments, suspended the commercial ridgeback LCS minimum size, and allowed both the season-specific quota adjustments and the counting of all mortality measures to go into place.

In December 2003, NMFS implemented, by regulation, Amendment 1 to the 1999 FMP (68 FR 74746). These regulations were based on the 2002 small and large coastal shark stock assessments. Some of the measures established in Amendment 1 included revising the rebuilding timeframe for LCS; re-aggregating the LCS complex; establishing a method of changing the quota based on maximum sustainable yield (MSY); updating some shark EFH identifications; modifying the quotas, seasons, and regions; adjusting the recreational bag limit; establishing criteria to add or remove species to the prohibited shark list; establishing gear restrictions to reduce bycatch and bycatch mortality; establishing a time/area closure off North Carolina for BLL fishermen; and establishing VMS requirements for BLL and gillnet fishermen.

In addition, in 2004 ICCAT adopted a recommendation concerning Atlantic sharks. The recommendation included measures regarding shark finning, research on gears and shark nursery areas, stock assessment schedules for shortfin mako (*Isurus oxyrinchus*) and blue sharks (*Prionace glauca*), and submission of shark data. ICCAT completed stock assessments for shortfin mako and blue sharks in 2004. This work included a review of their biology, a description of the fisheries, analyses of the state of the stocks and outlook, analyses of the effects of current regulations, and recommendations for statistics and research. The Standing Committee on Research and Statistics (SCRS) assessment indicated that the current biomass of North and South Atlantic blue sharks was above maximum sustainable yield (MSY) (B>BMSY), however, the SCRS noted that these results were conditional and based on assumptions that were made by the committee. These assumptions indicate that blue sharks were not overfished. This conclusion was conditional and based on limited landings data. The North Atlantic shortfin mako population had experienced some level of stock depletion, as suggested by the historical

catch-per-unit-effort (CPUE) trend and model outputs. The stock may have been below MSY (B<BMSY), suggesting that the species may have been overfished (SCRS, 2004).

1.1.3 The 2006 Consolidated HMS FMP

NMFS issued two separate FMPs in April 1999 for the Atlantic HMS fisheries. As discussed previously above, the 1999 Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks, combined, amended, and replaced previous management plans for swordfish and sharks, and was the first FMP for tunas. Amendment 1 to the Billfish Management Plan updated and amended the 1988 Billfish FMP.

During the time that these two FMPs co-existed, there had been a growing recognition by the Agency of the interrelated nature of these fisheries and the need to consolidate management actions. In addition, the Agency had identified some adverse ramifications stemming from separation of the plans, including administrative redundancy and complexity, loss of efficiency, and public confusion over the management process. Therefore, NMFS proposed to improve coordination of the conservation and management of the domestic fisheries for Atlantic swordfish, tunas, sharks and billfish by consolidating all HMS management measures into one FMP. The final Consolidated HMS FMP was completed in July 2006 and the implementing regulations were published on October 2, 2006 (71 FR 58058).

The 2006 Consolidated HMS FMP changed certain management measures, adjusted regulatory framework measures, and continued the process for updating HMS EFH. Measures that are specific to the shark fisheries include mandatory workshops and certifications for all vessel owners and operators that have PLL or BLL gear on their vessels and that have been issued or are required to be issued any of the HMS limited access permits (LAPs) to participate in HMS longline and gillnet fisheries. The aim of these workshops is to provide information and ensure proficiency with equipment to handle, release, and disentangle sea turtles, smalltooth sawfish, and other non-target species. The Consolidated HMS FMP also requires Federally permitted shark dealers to attend Atlantic shark identification workshops to train shark dealers how to properly identify shark carcasses. Additional measures specific to sharks include the differentiation between PLL and BLL gear based upon the species composition of the catch onboard or landed, the requirement that the second dorsal fin and the anal fin remain on all Atlantic sharks through landing, and a new prohibition making it illegal for any person to sell or purchase any HMS that was offloaded from an individual vessel in excess of the retention limits specified in § 635.23 and 635.24. The 2006 Consolidated HMS FMP also implemented complementary HMS management measures in Madison-Swanson and Steamboat Lumps Marine Reserves and established criteria to consider when implementing new time/area closures or making modifications to existing time/area closures.

Based on the 2002 SCS stock assessment, which found that finetooth sharks (*Carcharhinus isodon*) were not overfished but that overfishing was occurring on the stock, the 2006 Consolidated HMS FMP included a plan to prevent overfishing by expanding observer coverage, collecting more information on where finetooth sharks are landed, and coordinating with other fisheries management entities that were contributing to finetooth shark fishing

mortality. The 2007 stock assessment of SCS in the U.S. Atlantic and Gulf of Mexico (72 FR 63888, November 13, 2007), found, among other things, that finetooth sharks were not experiencing overfishing, but blacknose sharks (*Carcharhinus acronotus*) were overfished with overfishing occurring. This peer reviewed assessment, which was conducted according to the SEDAR process, provides an update from the 2002 stock assessment on the individual status of SCS stocks and projects their future abundance under a variety of catch levels in the U.S. Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. The 2007 assessment includes updated catch estimates, new biological data, and a number of fishery-independent catch rate series, as well as fishery-dependent catch rate series.

In 2007, NMFS expanded the equipment required for the safe handling, release, and disentanglement of sea turtles caught in the Atlantic shark BLL fishery (72 FR 5633, February 7, 2007). As a result, equipment required for BLL vessels is now consistent with the requirements for the PLL fishery. Furthermore, this action implemented several year-round BLL closures to protect EFH.

1.1.4 Amendment 2 to the Consolidated HMS FMP

On April 10, 2008, NMFS released the Final Environmental Impact Statement (FEIS) for Amendment 2 to the Consolidated HMS FMP (Amendment 2) based on several stock assessments that were completed in 2005/2006. Assessments for dusky (*Carcharhinus obscurus*) and sandbar sharks (*Carcharhinus plumbeus*) indicated that these species were overfished with overfishing occurring and that porbeagle sharks (*Lamna nasus*) are overfished. NMFS implemented management measures consistent with recent stock assessments for sandbar, porbeagle, dusky, blacktip (*Carcharhinus limbatus*), and the LCS complex. The implementing regulations were published on June 24, 2008 (73 FR 35778; corrected version published July 15, 2008; 73 FR 40658). Management measures implemented in Amendment 2 included, but were not limited to, establishing rebuilding plans for porbeagle, dusky, and sandbar sharks consistent with stock assessments, implementing commercial quotas and retention limits consistent with stock assessment recommendations to prevent overfishing and rebuild overfished stocks, modifying recreational measures to reduce fishing mortality of overfished/overfishing stocks, modifying reporting requirements, requiring that all Atlantic sharks be offloaded with fins naturally attached, collecting shark life history information via the implementation of a shark research program, and implementing time/area closures recommended by the South Atlantic Fishery Management Council.

1.1.5 Amendment 3 to the Consolidated HMS FMP

Based on the 2007 SCS stock assessment (SEDAR 13), which was an update to the 2002 SCS stock assessment, NMFS determined blacknose sharks to be overfished with overfishing occurring in 2008 (73 FR 25665, May 7, 2008). In 2008, the ICCAT SCRS conducted an updated species-specific stock assessment for North Atlantic shortfin mako sharks. The ICCAT stock assessment found the stock is experiencing overfishing and is not overfished, but is approaching an overfished condition. Based on this stock assessment, NMFS determined that

North Atlantic shortfin mako sharks had been experiencing overfishing as of December 31, 2008 (74 FR 29185, July 19, 2009). To address the results of these stock assessments, NMFS released the FEIS for Amendment 3 to the Consolidated HMS FMP (Amendment 3) to implement management measures to rebuild blacknose sharks and end overfishing of blacknose and shortfin mako shark. This amendment also added smoothhound sharks (smooth dogfish (*mustelus canis*) and Florida smoothhound (*Mustelus norrisi*)) under NMFS management. The implementing regulations were published on June 1, 2010 (75 FR 30484; June 1, 2010). Management measures implemented in Amendment 3 included, but were not limited to, establishing a non-blacknose SCS quota of 221.6 mt dw, and a blacknose shark quota of 19.9 mt dw. Quotas are linked so that both fisheries close when one of the quotas is reached.

Implementation of smoothhound management measures analyzed in Amendment 3 was initially delayed until the 2012 fishing season. However, the later enacted Shark Conservation Act of 2010 required NMFS to re-evaluate its shark management measures. Therefore, NMFS delayed the effective date of implementation to fully consider the Shark Conservation Act implications and allow time for Section 7 consultation under the Endangered Species Act (ESA) to be completed. The final rule to delay these measures became effective in December 2011 (76 FR 70064, November 10, 2011). The relevant regulatory sections will be re-established, with any needed amendments, in a final rule that implements both the smoothhound shark provisions of the Shark Conservation Act and any requirements of the Section 7 consultation regarding smoothhound sharks.

1.1.6 2011 Oceanic Whitetip and Hammerhead Shark ICCAT Rule

While not an amendment to the Consolidated HMS FMP, NMFS published a final rule (76 FR 53652, August 29, 2011) that implemented ICCAT recommendations 10-07 and 10-08 which prohibit the retention, transshipping, landing, storing, or selling of hammerhead sharks in the family *Sphyrnidae* (except for bonnethead sharks, *Sphyrna tiburo*) and oceanic whitetip sharks (*Carcharhinus longimanus*) caught in association with fisheries managed by ICCAT. This final rule, which became effective on September 28, 2011, prohibits the retention of hammerhead and oceanic whitetip sharks for Atlantic HMS commercially permitted vessels that have PLL gear on board, and recreational fishermen fishing with a General Category permit when participating in a HMS tournament or fishing under an HMS Angling or Charter/Headboat permit where tunas, swordfish, and/or billfish are also retained. Commercial shark bottom longline, gillnet, or handgear fisheries, and shark recreational fisheries when tunas, swordfish, and billfish are not retained, were not impacted by this rule because they are not considered ICCAT fisheries (i.e., fisheries that target tunas, swordfish, and/or billfish) and can continue to retain oceanic whitetip and hammerhead sharks.

1.2 Recent Stock Assessments

In October 2009, Hayes et al. (2009) published in the North American Journal of Fisheries Management a stock assessment of the Atlantic population of scalloped hammerhead sharks in U.S. waters. The stock assessment utilized a surplus production model, an approach

commonly used in data poor scenarios, and incorporated commercial and recreational landings, fisheries dependent data, fisheries independent data from NMFS observer programs, and scientific surveys. NMFS reviewed this paper and concluded that: the assessment is complete; the assessment is an improvement over a 2008 aggregated species assessment for hammerhead sharks; and the assessment is appropriate for U.S. management decisions (76 FR 23794; April 28, 2011). Based on the results of this paper, NMFS determined on April 28, 2011 that scalloped hammerhead sharks were overfished and experiencing overfishing (76 FR 23794).

Recent assessments of sandbar, dusky, and blacknose sharks were completed through the SEDAR process (76 FR 61092; October 3, 2011). The SEDAR process is a cooperative process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and U.S. Caribbean. These assessments were conducted under SEDAR 21, using two face-to-face workshops and a series of webinars. The Data Workshop was a week-long face-to-face meeting, during which fisheries, monitoring, and life history data were reviewed and compiled. The SEDAR 21 Data Workshop was held June 21-25, 2010, in Charleston, SC (May 4, 2010, 75 FR 23676). The Assessment Process was conducted via a series of webinars, during which assessment models were developed and population parameters were estimated using the information provided from the Data Workshop. The SEDAR 21 Assessment Process was held via 18 webinars between September 2010 and January 2011 (August 26, 2010, 75 FR 52510; October 12, 2010, 75 FR 62506; November 17, 2010, 75 FR 70216; December 16, 2010, 75 FR 78679). Finally, the Review Workshop was a week-long face-to-face meeting during which independent experts reviewed the input data, assessment methods, and assessment products. The Review Workshop for these assessments was held in Annapolis, MD, on April 18-22, 2011 (March 15, 2011, 76 FR 13985). All meetings were open to the public, and all materials from these meetings are available on the SEDAR website or upon request.

In each assessment, a base model was used to assess the individual populations. In addition, numerous sensitivity analyses were conducted during the assessment cycle for each assessment, which provided verification that the results of the assessment were robust to the assumptions about the underlying stock productivity and assumed levels of removal. Of these sensitivity runs, the Review Panel of the SEDAR 21 Review Panel Workshop selected which runs represented plausible "states of nature" of the stocks and requested projections of these and the base model. The ranges based on these selected sensitivity runs and the base models are given in the stock assessment descriptions for sandbar, dusky, and blacknose shark below. However, details on the different sensitivity analyses and projections are provided in the SEDAR 21 Stock Assessment Report for each assessment.

1.2.1 Scalloped Hammerhead Sharks

Based on the Hayes et al. (2009) stock assessment, in 2005, the population was estimated to be at 45 percent of the biomass that would produce MSY, and fishing mortality was estimated to be 129 percent of fishing mortality associated with MSY. This assessment is the first assessment for this species. Previously, NMFS had assessed scalloped hammerhead sharks as part of the LCS complex. The LCS complex currently has an unknown status.

The assessment estimated that the stock is estimated to be depleted by approximately 83 percent of virgin stock size (i.e., the current population is only 17 percent of the virgin stock size). In addition, it was estimated that a total allowable catch (TAC) of 2,853 scalloped hammerhead sharks per year (or 69 percent of 2005 catch) would allow a 70 percent probability of rebuilding within 10 years. Based on the results of this stock assessment, NMFS determined that scalloped hammerhead sharks are overfished and experiencing overfishing.

1.2.2 Sandbar Sharks

The SEDAR 21 sandbar shark stock assessment evaluated the status of the stock based on new landings and biological data, and projected future abundance under a variety of catch levels in the U.S. Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Sandbar sharks were initially determined to be overfished and experiencing overfishing in a 2005/2006 stock assessment. NMFS established a rebuilding plan for this species in July 2008. Under that rebuilding plan, NMFS determined that sandbar sharks would rebuild by the year 2066 with a TAC of 178 mt ww (128 mt dw). The current TAC for the fishery (220 mt ww or 158.3 mt dw) could result in a greater than 70 percent probability of rebuilding by the current rebuilding date of 2070. Also, as part of that rebuilding plan, NMFS maintained the BLL mid-Atlantic shark closed area, prohibited the landing of sandbar sharks in the recreational fishery, and established a shark research fishery in the commercial fishery. Only fishermen participating in the limited shark research fishery can land sandbar sharks.

The SEDAR 21 assessment includes updated catch estimates, new biological data, and a number of fishery-independent and fishery-dependent catch rate series. The base model used in the SEDAR 21 sandbar shark assessment, an age-structured production model, indicated that the stock is overfished (spawning stock fecundity $[SSF]_{2009}/SSF_{MSY}=0.66$), but no longer experiencing overfishing ($F_{2009}/F_{MSY}=0.62$). In addition, 20 sensitivity runs were performed throughout the assessment cycle. The Review Panel selected seven sensitivity runs in addition to the base model to assess the underlying states of nature of the stock. Current biomass (i.e., SSF) values from these selected sensitivity runs all indicated that the stock is overfished ($SSF_{2009}/SSF_{MSY}=0.51$-$0.72$). In addition, current F values from most of the selected sensitivity runs indicated that the stock is currently not experiencing overfishing ($F_{2009}/F_{MSY}=0.29$-0.93); whereas the low productivity sensitivity run indicated overfishing is occurring ($F_{2009}/F_{MSY}=2.62$). The assessment scientists, however, noted that the low and high productivity scenarios were unlikely to represent the true state of nature of the stock. Based on this, NMFS has determined that sandbar sharks are still overfished, but are no longer experiencing overfishing. Projections of the base model indicated that there is a 70 percent probability of rebuilding by 2066 with a TAC of 178 metric tons (mt) whole weight (ww) (128 mt dressed weight [dw]). There is a 50 percent probability of rebuilding by 2066 with a TAC of 286 mt ww (205.8 mt dw). The rebuilding year determined from the base model in the 2010/2011 assessment was calculated as the year the stock would rebuild with no fishing pressure (i.e., F=0), or 2046, plus one generation time (the generation time for sandbar sharks is 20 years). The target year for rebuilding ranged from 2047 to 2360 depending on the state of nature (i.e., sensitivity run) of the stock. In addition, it was determined that the current TAC for the fishery (i.e., 220 mt ww or 158.3 mt dw)

could result in a greater than 70 percent probability of rebuilding by the current rebuilding date of 2070.

1.2.3 Dusky Sharks

Dusky sharks (*Carcharhinus obscurus)* off the U.S. East Coast were classified as a prohibited species in the 1999 NMFS Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks. In 1997, they were designated by NMFS as a candidate species for listing under the Endangered Species Act (ESA) and as recently as 2004, were listed by the IUCN Red List of Threatened Species as vulnerable in the Northwest Atlantic and Gulf of Mexico. In 2003, in Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks (68 FR 74746), NMFS established a Mid-Atlantic shark closure to protect dusky sharks and juvenile sandbar sharks. NMFS closed this area to bottom longline fishing from January 1 through July 31 of every year, starting in January 2005 due in part to the high catch and mortality rates of dusky sharks on bottom longline gear in this area.

The SEDAR 21 dusky shark stock assessment evaluated new landings data and biological data, and the previous status determinations from the 2006 dusky shark stock assessment. The 2006 assessment, which used data through 2003, was the first for dusky sharks conducted within the SEDAR process. Length-frequency data and catch rate analyses suggested that the dusky stock was heavily exploited and on a declining trend. The estimated stock depletions were between 62 to 80 percent with respect to virgin biomass. Given the heavy fishing impact on this stock and high vulnerability to exploitation, the assessment scientists recommend that rebuilding for dusky sharks could require 100 to 400 years. Based on these results, NMFS declared the status of dusky sharks as overfished with overfishing occurring (71 FR 65087; November 7, 2006). The 2006 assessment predicted that dusky sharks could rebuild within 100 to 400 years. NMFS established a rebuilding plan for this species in July 2008 with Amendment 2. Because dusky sharks were already prohibited, NMFS refocused the rebuilding plan towards and reducing bycatch. The overall retention limits of non-sandbar LCS on all fishing vessels were reduced with the expectation that this action would in turn reduce incidental encounters with dusky sharks. A research fishery was established to restrict and monitor the sandbar fishery. Other measures included removing dusky sharks from the list of species allowed to be collected under display permits, not allowing similar looking species to be retained by the recreational fishery, maintaining the mid-Atlantic closed area, and implementing additional time/area closures for BLL gear as recommended by the South Atlantic Fishery Management Council in Amendment 14.

The base model used for the SEDAR 21 assessment, an age-structured catch-free production model, showed that dusky sharks continue to be overfished (spawning stock biomass $[SSB]_{2009}/SSB_{MSY}=0.44$) and are still experiencing overfishing ($F_{2009}/F_{MSY}=1.59$). In addition, 19 sensitivity analyses were performed during the assessment cycle. The Review Panel selected four sensitivity runs in addition to the base model to assess the underlying states of nature of the stock. Current biomass (i.e., SSB) values from these selected sensitivity runs all indicated that the stock is overfished ($SSB_{2009}/SSB_{MSY}=0.41$-$0.50$). In addition, current F values from the selected sensitivity runs indicated that the stock is currently experiencing overfishing

(F_{2009}/F_{MSY}=1.39-4.35). Based on this, NMFS has determined that dusky sharks are still overfished and experiencing overfishing. The rebuilding year determined from the base model in the 2010/2011 assessment was calculated as the year the stock would rebuild with no fishing pressure (i.e., F=0), or 2059, plus one generation time (the generation time for dusky sharks is 40 years) or 2099. This is a reduction in years to rebuilding compared to the previous assessment. The target year for rebuilding in the SEDAR 21 assessment ranged from 2081 to 2257 depending on the state of nature (i.e., sensitivity run) of the stock. The base model indicated that the current fishing mortality (F_{2009}=0.06) would have to be reduced by more than half (to F=0.02) in order to have a 70 percent probability of rebuilding by 2099. The base model also estimated that with the current fishing mortality rate there is a low probability (11 percent) of stock recovery by 2408 (or 400 years).

1.2.4 Blacknose Sharks

The SEDAR 21 blacknose shark stock assessment incorporated new landings and biological information that was not available for previous assessments. A 2007 stock assessment for blacknose sharks indicated that SSF in 2005 and during 2001–2005 was smaller than SSF_{MSY} (SSF_{2005}/SSF_{MSY} = 0.48). In addition, the estimate of fishing mortality rate in 2005 and the average for 2001–2005 was greater than F_{MSY}, and the ratio was substantially greater than 1 in both cases (F_{2005}/F_{MSY} = 3.77). Based on these results, NMFS determined that blacknose sharks were overfished and experiencing overfishing (73 FR 25666; May 7, 2008). Rebuilding measures implemented in Amendment 3 to the Consolidated HMS FMP included working with the South Atlantic and Gulf of Mexico Fishery Management Councils to reduce bycatch in shrimp trawl fisheries, changes to the SCS quotas, and the creation of a blacknose quota. The HMS Management Division proposed removing gillnets from the list of authorized gears for Atlantic HMS shark fisheries, increasing the minimum size and reducing the retention limit in the recreational fishery, and the establishment of blacknose time area closures. However, in the final rule, gillnets were kept as an authorized gear due to public comments from fishermen and observer data suggesting that fishermen were capable of avoiding blacknose sharks. Time-area closures were not included in the final rule as a preferred alternative to reduce interactions and mortality.

Unlike the 2007 assessment, the SEDAR 21 assessment assessed blacknose sharks for the first time as two separate stocks: a Gulf of Mexico and an Atlantic stock. After considering the available data, the SEDAR 21 Life History Working Group concluded that blacknose sharks inhabiting the U.S. waters of the western North Atlantic Ocean (including the Gulf of Mexico) should be considered two separate stocks; one in the U.S. waters of the western North Atlantic Ocean (referred to in the document as South Atlantic Bight), and one in the Gulf of Mexico. Since SEDAR 13, tagging efforts have increased and there is still a lack of exchange between the Gulf of Mexico and South Atlantic Bight. While genetic information still doesn't provide data to differentiate between distinct stocks, the continued lack of exchange between the two basins and the difference in reproductive cycle (1 year vs. 2 year) led the group to conclude that the stocks should be split into Atlantic and Gulf of Mexico stocks.

In addition, because the assessment model for the Gulf of Mexico stock did not fit the apparent trends in some of the abundance indices and there was a fundamental lack of fit of the model to some of the input data, the Review Panel of the SEDAR 21 Review Panel Workshop did not accept the stock assessment for the Gulf of Mexico blacknose stock. Therefore, NMFS declared the status of the Gulf of Mexico blacknose shark stock as unknown (76 FR 62331; October 7, 2011).

For the Atlantic blacknose shark stock, the base model used for the SEDAR 21 assessment, an age-structured production model, showed that Atlantic blacknose sharks are overfished (SSF_{2009}/SSF_{MSY}=0.60) and experiencing overfishing (F_{2009}/F_{MSY}=5.02). In addition, 14 sensitivity analyses were performed over the assessment cycle. The Review Panel selected five sensitivity runs in addition to the base model to assess the underlying states of nature of the stock. Current biomass (i.e., SSF) values from these selected sensitivity runs all indicated that the stock is overfished (SSF_{2009}/SSF_{MSY}=0.43-0.64). In addition, current F values from the selected sensitivity runs indicated that the stock is currently experiencing overfishing (F_{2009}/F_{MSY}=3.26-22.53). Based on this, NMFS has determined that the Atlantic blacknose shark stock is overfished and experiencing overfishing. Projections of the base model indicated that the stock could rebuild by 2043 with a TAC of 7,300 blacknose sharks. The rebuilding year determined from the base model in the 2010/2011 assessment was calculated as the year the stock would rebuild with no fishing pressure (i.e., F=0), or 2034, plus one generation time (the generation time for Atlantic blacknose sharks is 9 years). The target year for rebuilding ranged from 2033 to 2086 depending on the state of nature (i.e., sensitivity run) of the stock. Thus, Atlantic blacknose sharks would not be able to rebuild by the current rebuilding target of 2027 under the current fishery-wide TAC of 19,200 blacknose sharks.

1.3 Biological Information

To aid in review of the alternatives, below is a brief description of the species life history, and their role in shark fisheries. Note that the management alternatives are related to, and could impact, alternatives in other sections (*e.g.*, quotas could impact retention limits, gear restrictions, and time/area closures).

1.3.1 Scalloped Hammerhead Sharks

Scalloped hammerheads are globally distributed and occur in coastal and adjacent pelagic waters (Compagno 1984). Scalloped hammerheads appear to form a single population in the western North Atlantic, according to genetic data (NMFS 2010). In the western North Atlantic, scalloped hammerheads are found between New Jersey and Brazil, and often reside in coastal warm temperature and tropical seas, but the species is known to make deep dives to depths of 980m or more (Jorgensen et al., 2009).

The scalloped hammerhead shark has a laterally expanded head ("cephalophoil") that resembles a hammer, hence the common name ''hammerhead,'' and belongs to the Sphyrnidae family. Variations in the shape of the cephalophoil are used to distinguish the scalloped hammerhead shark from other hammerheads; the cephalophoil has a marked central indentation

on the anterior margin of the head, along with two more indentations on each side of this central indentation, giving the head a ‘‘scalloped’’ appearance. Scalloped hammerheads may be confused with smooth or great hammerheads, and landings of these species are often just reported as “hammerhead”. Smooth hammerheads (which do not have the central indentation on the cephalophoil) are found in temperate waters along the U.S. East Coast from Maine to the U.S. Virgin Islands, tend to prefer shallower waters (< 65 ft in depth), and grow to roughly the same size as scalloped hammerheads. Smooth hammerheads are not found as often in the Gulf of Mexico. Great hammerheads reach an overall larger size than either the smooth or scalloped hammerhead. Great hammerheads are commonly found in warm temperate and tropical waters south of North Carolina, in the Gulf of Mexico, and in the Caribbean Sea.

Scalloped hammerhead sharks are a late maturing (~age 15), long lived (30+ years) species (Hayes et al. 2009; Piercy et al. 2007). Scalloped hammerhead sharks reach sizes of 3.7 meters (12 feet) or more. Scalloped hammerheads give birth to 10-40 live pups every other year, after a 9-10 month gestation period (Branstetter 1987; Liu and Chen 1999). Males mature at roughly 10 years of age (length at maturity1.5 – 2.3m), while females mature at roughly 15 years (length at maturity 2-2.5m) of age (Branstetter 1987); Piercy et al. (2007) estimated maximum ages of 30.5 years for both sexes. Scalloped hammerheads are a schooling shark species, making them vulnerable to exploitation. Female sharks are thought to move offshore sooner than male sharks to exploit additional food resources (Klimley 1987). Baum et al. (2003) noted that life history characteristics make scalloped hammerhead sharks among the more vulnerable species of shark to exploitation, and have experienced an 89% decline in number between 1986 and 2003. Hammerhead sharks are obligate ram ventilators, and are noted to have extremely high at-vessel mortality (>90%) in bottom-longline fisheries (Morgan and Burgess 2007; Piercy et al. 2007).

Great (*Sphyrna mokarran*), scalloped (*S. lewini*), and smooth (*S. zygaena*) hammerhead sharks are managed in the U.S. Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. The majority of hammerhead sharks landed in Atlantic HMS fisheries are by directed shark permit holders using BLL gear. However, to a lesser degree, hammerhead sharks are caught incidentally in the PLL fisheries for tuna and tuna-like species. Currently, directed and incidental shark permit holders using PLL gear are prohibited from retaining great, smooth, and scalloped hammerhead sharks (76 FR 53652; August 29, 2011). HMS Angling and HMS Charter/Headboat permit holders also land hammerhead sharks. In the recreational fishery, only one shark, greater than 54” total length (TL) can be retained per vessel per trip. That one shark could be a scalloped, smooth, or great hammerhead shark. Typically, the most commonly caught hammerhead shark in recreational fisheries is the scalloped hammerhead (NMFS 2011).

An analysis of HMS logbook data from 2005 through 2009 indicated that on average, 25 vessels landed 181 hammerhead sharks per year on PLL gear. An additional 1,130 sharks (average) are caught and subsequently discarded on PLL gear every year; 780 of which are discarded alive and 350 discarded dead. According to NMFS POP data from 2005-2009, 55 percent of hammerhead sharks caught are alive when brought to the vessel. However, some studies in the literature note much higher at-vessel mortality rates. At-vessel fishing mortalities of 91 percent and 94 percent were respectively found for scalloped and great hammerhead in the shark BLL fisheries by Morgan and Burgess (2007) through an analysis of data collected via the Commercial Shark Fishery Observer Program (1994-2005). Hammerhead sharks are caught

incidentally to tuna and tuna-like species and constitute a small portion of the non-target species catch of the PLL HMS fishery.

1.3.2 Dusky Sharks

Dusky sharks are found between Cape Cod, Massachusetts and Georges Bank to Florida (including the Gulf of Mexico and Caribbean Sea). Dusky sharks are classified as a coastal-pelagic species, and may range from continental waters inshore to outer continental shelf and adjacent ocean waters; they are also rarely found in estuaries or regions with reduced salinity (Musick et al. 1993; Musick and Colvocoresses 1986). These animals move along the U.S. east coast in the spring and fall, likely following changes in water temperature (Musick and Colvocoresses 1986). The SEDAR 21 Data Workshop Life History working group determined that Atlantic dusky shark populations constitute one stock, and identified a triennial reproductive cycle. Fecundity was estimated at 7.13 ± 2.06 pups per litter (range of 3-12 pups) (SEDAR 2011a; Romine et al., 2009). $L\infty$ estimated for male and female sandbar shark are 373 cm FL and 349 cm FL, respectively. The age at 50 percent maturity was estimated by the SEDAR shark life history working group at just under 20 years for both sexes. One hundred percent maturation for both sexes was estimated to occur at 26 years.

NMFS has also established a Species of Concern list that identifies species that, although not actively being considered for listing under the Endangered Species Act (ESA), are of biological concern. Dusky shark were previously listed as ESA candidate species, but have since been classified as a "Species of Concern". There is no mandatory federal protection for candidate species or species of concern though voluntary protection of these species is urged. Efforts to promote the conservation of such species, if effective, may alleviate or eliminate existing threats thus perhaps avoiding a future need for listing. Prior to being classified as a prohibited species by NMFS, dusky shark were regularly landed in commercial and recreational fisheries in the United States, and are a common bycatch species in the PLL fishery for tuna and tuna-like species (Cortes et al. 2006). Demographic analysis by Romine et al. (2009) imply a decline in dusky shark populations at low levels of fishing mortality due to live history characteristics, suggesting it is one of the more vulnerable sharks in U.S. waters.

1.3.3 Sandbar Sharks

Sandbar sharks are found between Cape Cod, Massachusetts and the western Gulf of Mexico in the North Atlantic Ocean (Conrath and Musick 2007). Sandbar sharks occurring in the U.S. waters of the western North Atlantic Ocean (including the Gulf of Mexico) are considered a single stock due to a lack of genetic differentiation and tag-recapture data which suggestion a high degree of mixing between the regions. The SEDAR 21 Data Workshop life history working group identified a 2.5 year reproductive cycle, and noted that there was a positive relationship between age and average litter size. $L\infty$ estimated for male and female sandbar shark are 172.94 ± 1.30 cm FL and 181.15 ± 1.45 cm FL, respectively. The age at 50 percent maturity was estimated by the SEDAR shark life history working group at between 13-14 years for females, and between 12-13 years for males. Most (>95%) of females are mature by age 18, and most (>95%) of males are mature by age 16. Ontogenetic diet shifts occur in sandbar shark, where adults mainly eat teleost fish and elasmobranchs, whereas juvenile sandbar

sharks often eat crustaceans (Stillwell and Kohler 1993; Ellis and Musick 2007). Sandbar sharks are an example of a coastal-pelagic species, which occur both inshore and beyond the continental shelves, but have not demonstrated mid-ocean or transoceanic movements.

Prior to being prohibited from commercial harvest outside of the shark research fishery, sandbar sharks comprised the majority of LCS landings in the Atlantic region and were the second most commonly harvested species (behind blacktip sharks) in the Gulf of Mexico region. Currently, sandbar sharks may only be commercially harvested in the shark research fishery. Sandbar sharks harvested with BLL gear in the shark research fishery in 2010 totaled 4,413 sharks (NMFS 2011). Approximately 94.2 percent of these animals were harvested on trips targeting sandbar shark. The remaining 6 percent of the 2010 sandbar harvest were taken on trips targeting LCS (0.99 percent), shallow reef fish (4.7 percent), and deep water reef fish (0.1 percent). Despite bring prohibited as of July 2008, there were still a relatively large number of sandbar harvested in the recreational fishery in 2009 (n = 4,908 sharks) and 2010 (n = 6,277 sharks) (NMFS 2011).

1.3.4 Blacknose Sharks

Blacknose sharks are found in western Atlantic waters from North Carolina to Brazil, including the Gulf of Mexico and the Caribbean Sea (Garrick 1982; Bonfil 1997) Blacknose sharks have a total length of approximately 45-50 cm at birth (Branstetter 1981). The maturation schedule of blacknose sharks differs between fish in the Gulf of Mexico region and the Atlantic region. Driggers et al. (2004) found statistically significant differences in growth models of blacknose sharks in the Gulf of Mexico and Atlantic Ocean in both sexes, and higher theoretical longevities of these sharks in the Atlantic Ocean. The age at 50 percent maturity was estimated by the SEDAR 21 blacknose shark life history working group as 4.37 years for South Atlantic sharks and 5.45 years for Gulf of Mexico sharks. However, 100 percent of all blacknose sharks (both regions combined) are mature by age 7 (SEDAR, 2011). The reproductive cycle of sharks in the Atlantic region is biennial while the reproductive cycle of sharks in the Gulf of Mexico is annual (SEDAR 2011b). The maximum observed age is 20.5 years for both sexes (SEDAR, 2011). Maximum size for males and females were estimated at 97.9 cm FL and 104.3 cm FL, respectively, in both the Atlantic and Gulf of Mexico stocks (SEDAR 2011b). Median fecundity in both regions is 5 pups per litter.

Within the commercial shark fisheries, blacknose sharks are predominantly landed in the South Atlantic region. Approximately 2/3 of the blacknose sharks captured in the commercial fishery are harvested with drift gillnets. In 2010, blacknose sharks made up approximately 2 to 12 percent of all SCS recreational landings. Approximately 77 percent of the recreational fishery for blacknose sharks occurs in the Gulf of Mexico while 14 percent occurs in the South Atlantic. Shrimp trawl bycatch in the Gulf of Mexico comprises most of the catches for the Gulf of Mexico stock, and was a key source of uncertainty in the SEDAR 21 assessment.

1.4 Need for Action

Based on the stock assessments summarized above in Section 1.2, NMFS declared the following stock status determinations for scalloped hammerhead sharks on April 28, 2011 (76 FR 23794) and on October 7, 2011 (76 FR 62331) for the other species. Sandbar sharks are still overfished, but no longer experiencing overfishing. Dusky sharks are still overfished and still experiencing overfishing (i.e., their stock status has not changed). There are now two stocks of blacknose sharks. The Atlantic blacknose shark stock is overfished and experiencing overfishing, the status of the Gulf of Mexico blacknose shark stock is unknown. Scalloped hammerhead sharks are overfished and experiencing overfishing.

If an Atlantic HMS that has been declared as overfished or approaching an overfished condition, NMFS, on behalf of the Secretary, must take action to end or prevent overfishing in the fishery and to implement conservation and management measures to rebuild overfished stocks within 2 years of making this determination. This action must include implementing a rebuilding plan, through an FMP amendment or regulations, which ends overfishing immediately and provides for rebuilding of the fishery in accordance with 16 U.S.C. 1854(e)(3)-(4) as implemented by 50 CFR 600.310(j)(2)(ii). When developing rebuilding plans, in addition to rebuilding the fishery within the shortest time possible in accordance with 16 U.S.C. 1854(e)(4) and 50 CFR 600.310(j)(3), NMFS must ensure that such actions address the requirements to amend the FMP for each affected stock or stock complex to establish a mechanism for specifying and actually specify Annual Catch Limits (ACLs) and Accountability Measures (AMs) to prevent overfishing in accordance with 16 U.S.C. 1853(a)(15) and 50 CFR 600.310(j)(2)(i).

Therefore, NMFS must implement management measures to maintain rebuilding of sandbar sharks, end overfishing and rebuild dusky, scalloped hammerhead, and Atlantic blacknose sharks, and address the unknown overfished/overfishing status of Gulf of Mexico blacknose sharks.

2 Range of Potential Alternatives

In this chapter, NMFS sets out a broad range of alternatives for possible consideration in a later draft EIS and proposed rule to address the results of the SEDAR 21 stock assessment for sandbar, dusky, and blacknose sharks and the stock assessment for scalloped hammerhead sharks. The alternatives in this chapter are organized within the following sections: quotas and retention limits, time/area closures, and at vessel mortality and discard reduction.

2.1 Quotas and Retention Limits

In response to results from the latest stock assessments, adjustments to quotas and retention limits may be necessary. The latest blacknose assessments split blacknose sharks into two stocks (Atlantic and Gulf of Mexico), potentially requiring changes to the way the blacknose commercial quota currently is structured, and, a separate stock assessment for scalloped hammerhead sharks provides the option of managing scalloped hammerhead sharks separately from the LCS complex, similar to what was done with sandbar sharks in 2008. These changes

require NMFS to establish annual catch limits (ACLs) and accountability measures (AMs) for these stocks. The following sections explore possible alternatives that would address TACs, commercial quotas, and retention limits in response to recent stock status determinations for scalloped hammerhead, sandbar, dusky, and blacknose sharks.

2.1.1 Blacknose Sharks

2.1.1.1 Blacknose Shark TACs and Blacknose Shark and Non-Blacknose Shark LCS Commercial Quotas

Amendment 3 established, among other things, a rebuilding plan for blacknose sharks based on the previous stock assessment in 2007 (SEDAR 13), which assumed one overall stock occurred in the U.S. Atlantic and Gulf of Mexico. Blacknose sharks were managed as part of the SCS complex until the implementation of certain management measures in Amendment 3 in 2010, which separated blacknose sharks from the SCS complex. Amendment 3 established a blacknose shark quota of 19.9 mt dw for the entire stock, and a non-blacknose SCS quota of 221.6 mt dw, which was the average non-blacknose landings from 2004-2008. The blacknose and non-blacknose SCS quotas remain linked, however, so that both fisheries close if the landings of either blacknose or non-blacknose SCS reach, or are projected to reach, 80 percent of the quota. This was done to eliminate dead discards in the non-blacknose SCS fishery when the blacknose shark fishery is closed. Based on public comment and analyses of NMFS observer data for Amendment 3, NMFS found that gillnet fishermen could selectively target different shark species and were able to minimize mortality of blacknose sharks (as well as protected species) in gillnets by avoiding blacknose sharks. The data also indicated that elimination of gillnets would not achieve the conservation and management objectives necessary to rebuild blacknose sharks and actually could be detrimental to the stock due to higher discard rates of blacknose sharks from other gears in the fishery. Amendment 3 established a framework mechanism to provide NMFS the flexibility to increase or decrease either the blacknose or non-blacknose SCS quotas based on the ability of fishermen to avoid blacknose sharks and target non-blacknose SCS, and any subsequent change in status based on new stock assessments of these species of sharks.

The SEDAR 21 blacknose shark assessment separated Atlantic populations into two separate stocks (Gulf of Mexico and Atlantic stocks) due to differences in life history parameters between the two regions and movement patterns as interpreted from tagging studies. As a result, NMFS needs to establish ACLs and AMs for these two stocks of blacknose sharks. For the Atlantic, the stock assessment concluded that the stock is overfished and that overfishing is occurring. Projections of the base model indicated that the stock has a 70 percent probability to rebuild by 2043 with a TAC of 7,300 blacknose sharks. The rebuilding year determined from the base model in the 2010/2011 assessment was calculated as the year the stock would rebuild with no fishing pressure (i.e., F=0), or 2034, plus one generation time (the generation time for Atlantic blacknose sharks is 9 years). The target year for rebuilding ranged from 2033 to 2086 depending on the state of nature (i.e., sensitivity run) of the stock. Thus, Atlantic blacknose sharks would not be able to rebuild by the current rebuilding target of 2027 under the current fishery-wide

TAC of 19,200 blacknose sharks. NMFS determined that the Atlantic blacknose shark stock is overfished and experiencing overfishing (76 FR 62331; October 7, 2011), and in Amendment 5, NMFS is considering analyzing alternatives that would include implementing a TAC of 7,300 Atlanic blacknose sharks (38,617 mt dw), consistent with the 2006 Consolidated HMS FMP. This potential TAC would include all commercial and recreational landings and any dead discards in all fisheries that interact with Atlantic blacknose sharks.

For the Gulf of Mexico stock assessment, because the assessment model for the Gulf of Mexico stock was unable to fit the apparent trends in some of the abundance indices and there was a fundamental lack of fit of the model to some of the input data, the Review Panel of the SEDAR 21 Review Panel Workshop did not accept the stock assessment and did not provide a TAC recommendation for the Gulf of Mexico. Therefore, NMFS determined that the stock status for the Gulf of Mexico blacknose shark stock is unknown (76 FR 62331; October 7, 2011). As such, NMFS would explore alternatives on how to calculate a Gulf of Mexico blacknose shark TAC, which would include all commercial and recreational landings and any dead discards in all fisheries that interact with Gulf of Mexico blacknose sharks. Some of these preliminary alternatives use the combined blacknose shark TAC of 19,200 blacknose sharks, established in Amendment 3, in order to calculate the Gulf of Mexico blacknose shark TAC. NMFS could subtract the 7,300 Atlantic blacknose shark TAC that will be applied to the Atlantic from the previous 19,200 combined blacknose shark TAC to calculate a 11,900 blacknose shark TAC for the Gulf of Mexico (19,200 – 7,300 = 11,900). NMFS could also consider alternatives that would use the average ratio of catches (51 percent in the Gulf of Mexico and 49 percent in the Atlantic) and apply the appropriate proportion as to the current 19,200 TAC to establish a TAC for the Gulf of Mexico stock. NMFS could use this percentage approach to develop a proposed TAC of 9,792 sharks (19,200 * 0.51 = 9,792) for the Gulf of Mexico and allocate a 7,300 blacknose shark TAC to the Atlantic region based on the SEDAR 21 stock assessment. This would result in a combined TAC of 17,092 sharks, which are 2,092 fewer sharks than the 2011 blacknose shark TAC. These are a few of the TAC considerations outlined in Table 2.4, along with others, are some that could be developed and analyzed in greater detail in the DEIS.

Once TACs are established for the Atlantic and Gulf of Mexico blacknose shark stocks, NMFS will need to establish commercial quotas for each stock. The current commercial quota for blacknose sharks is 43,872 lb dw, which equates to approximately 8,293 sharks using the average individual weight calculated from the Bottom Longline Shark Observer Program in 2009 (5.29 lb dw). NMFS would have to determine how many blacknose sharks are available for commercial harvest in each region after accounting for blacknose shark mortality in the recreational fishery and other fisheries that encounter blacknose sharks before developing the commercial quotas for the Gulf of Mexico and Atlantic.

The SEDAR 21 stock assessment for Atlantic blacknose sharks recommended a TAC of 7,300 sharks, which equates to 38,617 lb dw using the average weight calculated from the Bottom Longline Shark Observer Program in 2009 (5.29 lb dw) that was used in the SEDAR 21 blacknose shark stock assessments. Data used in the Atlantic blacknose shark stock assessment showed that average annual blacknose shark discards in the Atlantic BLL fishery between 2006 and 2009 were 177 sharks (Table 2.2), and average Atlantic recreational landings between 2006 and 2009 were 1,229 sharks (Table 2.6). Accounting for these discards and recreational harvest

would leave approximately 5,894 sharks available for commercial harvest under an Atlantic blacknose TAC of 7,300 sharks. When looking at landings data (Table 2.1), average commercial landings of Atlantic blacknose shark between 2006 and 2009 were 19,874 sharks. However, according to shark dealer data, after the implementation of Amendment 3 in 2010, a total of 5,287 blacknose sharks were landed in the Atlantic region. Therefore, the estimated quota available for the commercial fishery, after HMS sources of mortality have been accounted for (BLL discards and the recreational fishery), which would result in a quota comparable to landings in the 2010 commercial fishery.

Directed commercial landings of blacknose shark were much lower in the Gulf of Mexico than in the Atlantic (Table 2.1). In the Gulf of Mexico landings decreased by 74 percent between 2006 and 2007; and after the implementation of Amendment 3 in 2010, directed commercial landings were reduced by an additional 80 percent from 2009 landings to only 795 sharks. Average Gulf of Mexico BLL discards for blacknose sharks between 2006 and 2009 were 2,661 sharks per year (Table 2.2). Average recreational landings of blacknose shark in the Gulf of Mexico between 2006 and 2009 were 5,935 sharks (Table 2.6). Accounting for BLL discards and recreational harvest would remove 8,596 sharks from a Gulf of Mexico TAC. However, both of the TAC alternatives presented above (11,900 and 9,792 sharks) would still provide enough quota for the commercial Gulf of Mexico blacknose shark fishery to operate as it did in 2010.

Another significant source of catches analyzed during SEDAR 21 included shrimp trawl bycatch; these numbers are presented in Table 2.3. All blacknose shark mortality in shrimp fisheries was accounted for in the SEDAR 21 stock assessments and in setting the blacknose shark TAC in Amendment 3. Since the Gulf of Mexico and South Atlantic Councils manage the shrimp trawl fisheries, NMFS is considering measures in this predraft that reduce landings and discards in only the Atlantic shark fisheries. NMFS will continue to work with the Gulf of Mexico and South Atlantic Councils to establish bycatch reduction methods, as appropriate, to reduce mortality in the shrimp trawl fisheries. Changes in the shrimp trawl fisheries in these regions would be done through the Council process. Discard in the shrimp trawl fishery has decreased by nearly 64 percent in 2009 compared to 2002 levels (Table 2.3).

Table 2.1 **Commercial landings of blacknose sharks (in number of sharks) by region from 2006-2010.** Source: SEDAR 21 Atlantic and Gulf of Mexico stock assessments (2006-2009); HMS Dealer Logbook (2010).

	2006	2007	2008	2009	2010
Atlantic	14,248	12,817	23,199	29,230	5,287
Gulf of Mexico	17,309	4,617	2,206	4,030	795

Table 2.2 **Bottom longline discards of blacknose sharks (in number of sharks) by region from 2006-2009.** Source: SEDAR 21 Atlantic and Gulf of Mexico stock assessments (2006-2009); HMS Dealer Logbook (2010).

	2006	2007	2008	2009
Atlantic	456	163	90	0
Gulf of Mexico	8,416	967	368	896

Table 2.3 **Estimated discards in the Atlantic and Gulf of Mexico shrimp trawl fisheries (numbers of sharks).** Source: SEDAR 21 Atlantic and Gulf of Mexico stock assessments (2006-2009)

	2002	2003	2004	2005	2006	2007	2008	2009
Atlantic	2,846	2,258	2,047	1,501	1,279	1,137	863	1,025
Gulf of Mexico	43,518	34,529	31,306	22,953	19,554	17,381	13,193	15,668
Total	**46,364**	**36,787**	**33,353**	**24,454**	**20,833**	**18,518**	**14,056**	**16,693**

Currently, the non-blacknose SCS quota is linked with the blacknose shark quota, meaning that when landings of one fishery reach, or are projected to reach, 80 percent of the quota, both fisheries close. Therefore, because there would be two blacknose shark regional quotas, the non-blacknose SCS may need to be split into Atlantic and Gulf of Mexico regional quotas in order for it to continue to be linked with blacknose shark quota. Quota linkage alternatives between the two blacknose shark regional quotas and the non-blacknose SCS quota is discussed in Section 2.1.1.2. Potential alternatives for blacknose shark TACs, blacknose shark and non-blacknose SCS quotas, and their anticipated associated ecological and socioeconomic impacts are outlined in Table 2.4.

Table 2.4 **Potential blacknose shark TAC and blacknose shark and non-blacknose SCS quota alternatives.**

Alternative	Ecological Impacts	Social/Economic Impacts
Potential Blacknose Shark TAC Alternatives		
1a. No Action: Maintain current blacknose TAC of 19,200 sharks for one overarching stock, without dividing into Regional TACs	- Continued overfishing of blacknose sharks, which would lead to adverse ecological impacts.	- Neutral socioeconomic impacts for the commercial or recreational sector.

Alternative	Ecological Impacts	Social/Economic Impacts
1b. Implement the recommended 7,300 blacknose shark TAC in the Atlantic region, and subtract that number from the current combined blacknose shark TAC of 19,200 sharks to calculate a Gulf of Mexico TAC of 11,900 sharks (19,200 total TAC-7,300 ATL TAC=11,900 GOM TAC).	- Establishing an Atlantic TAC of 7,300 sharks should end overfishing and rebuild the Atlantic blacknose stock, resulting in beneficial ecological impacts. - Establishing a TAC of 11,900 sharks for the Gulf of Mexico fishery would create a cap on blacknose shark mortality and could prevent adverse ecological impacts.	- Current mortality in the Atlantic and Gulf of Mexico stocks are below the respective proposed TACs; thus, the expected socio-economic impacts would be neutral.
1c. Implement the recommended 7,300 blacknose shark TAC in the Atlantic region, and apply the catch ratio used in the SEDAR 21 stock assessment (51%) to calculate a Gulf of Mexico TAC of 9,792 sharks (19,200 total TAC * 0.51=9,792 GOM TAC).	- Establishing an Atlantic TAC of 7,300 sharks should end overfishing and rebuild the Atlantic blacknose stock, resulting in beneficial ecological impacts. - Establishing a TAC of 9,792 sharks for the GOM fishery would create a cap on blacknose shark mortality and could result in beneficial ecological impacts.	- The combined TACs of the Atlantic and Gulf of Mexico regions would be 2,108 sharks less than the previous TAC of 19,200 sharks (19,200-7,300-9,792=2,108). However, current mortality in the Atlantic and Gulf of Mexico stocks are below the respective proposed TACs; thus, the expected socio-economic impacts would be neutral.
1d. Implement the recommended 7,300 blacknose shark TAC in the Atlantic, and use the annual directed and incidental fishing mortality of blacknose sharks since the implementation of Amendment 3 (2010) to calculate the Gulf of Mexico blacknose shark TAC.	- Establishing an Atlantic TAC of 7,300 sharks should end overfishing and rebuild the Atlantic blacknose stock, resulting in beneficial ecological impacts.- - Establishing a Gulf of Mexico TAC based on directed and incidental mortalities of blacknose sharks since the implementation of Amendment 3would create a cap on blacknose shark mortality and could result in beneficial ecological impacts.	- There is potential for adverse economic impacts because the overall commercial quota in each region will be lower than the quota in the no-action alternative; therefore, total revenue from this fishery could be expected to be reduced within the regions.
Potential Blacknose Shark Commercial Quota Alternatives		
2a. No Action: Maintain current blacknose quota of 43,872 lb dw (19.9 mt dw). Regional quotas would not be allocated. (Option available for Alternative 1a).	- Continued overfishing of blacknose sharks could occur, which could lead to adverse ecological impacts.	- Neutral socioeconomic impacts for the commercial or recreational sector in the short-term; in the long-term fisheries may face more restrictive regulations if stocks do not rebuild, creating adverse economic impacts.

Alternative	Ecological Impacts	Social/Economic Impacts
2b. Set regional blacknose shark commercial quotas for the Atlantic and Gulf of Mexico at levels below regional TACs accounting for regional HMS blacknose shark recreational landings and discards (Regional TAC-recreational landings – discards = Regional Commercial Quota) (Option available for Alternatives 1b, 1c, and 1d).	- Accounting for commercial harvest, recreational landings, and discard mortalities would account for all sources of mortality. This could contribute towards rebuilding stocks and have beneficial ecological impacts because it would provide for an overall cap on blacknose mortality.	Depending on how the regional TACs are calculated, neutral to adverse socioeconomic impacts could be realized.
2c. Establish a blacknose shark quota of 0 sharks (0.0 mt) and prohibit retention in commercial fisheries. (Option available for Alternatives 1b, 1c, and 1d).	- Prohibiting commercial retention would only minimally reduce blacknose mortality in the BLL fisheries due to high at-vessel mortality rates. These dead discards may lead to continued overfishing and adverse ecological impacts.	- Prohibiting retention in the commercial and recreational fisheries could have adverse socioeconomic impacts and increase dead discards of blacknose sharks in the commercial fishery.
Potential Non-blacknose SCS Commercial Quota Alternatives		
3a. No Action: Maintain current non-blacknose SCS quota of 693,257 lb dw. Regional quotas would not be allocated. (Option available for Alternative 1a, 1b, 1c, and 1d).	- Maintaining current quotas will place an overall cap on the SCS fishery, and result in neutral ecological impacts because non-blacknose SCS are not overfished and are not experiencing overfishing. -Maintaining linkages between the blacknose and non-blacknose SCS fisheries would help reduce discards by closing both fisheries when one reaches, or is projected to reach, 80 percent of its quota.	- Keeping the non-blacknose SCS quota the same would have neutral socioeconomic impacts, as current fishing practices for non-blacknose SCS would be anticipated to continue. - Non-blacknose SCS and blacknose quotas would remained linked, which could have negative socio-economic impacts if the blacknose fishery is closed before the entire non-blacknose SCS quota is landed.
3b. Create regional quotas for non-blacknose SCS by dividing the 693,257 lb dw quota in half (346,628.5 lb dw) between the Atlantic and Gulf of Mexico Regions. (Option available for Alternatives 1b, 1c, and 1d).	- Dividing the non-blacknose SCS quota into Atlantic and Gulf of Mexico regional quotas should have neutral ecological impacts because the total quota would remain the same for non-blacknose SCS, which are not overfished and are not experiencing overfishing.	- Implementing regional quotas for non-blacknose SCS could result in mixed socioeconomic impacts depending on future landings in the Gulf of Mexico and/or Atlantic and could lead to adverse socioeconomic impacts.

Alternative	Ecological Impacts	Social/Economic Impacts
3c. Create regional quotas for non-blacknose SCS by dividing the 693,257 lb dw quota into Atlantic and Gulf of Mexico regional quotas according to the percentage of the non-blacknose SCS quota each region has landed since the implementation of Amendment 3 (2010). (Option available for Alternatives 1b, 1c, and 1d).	- Dividing the non-blacknose SCS quota into Atlantic and Gulf of Mexico regional quotas should have neutral ecological impacts because the total quota would remain the same for non-blacknose SCS, which are not overfished and are not experiencing overfishing.	- Implementing regional quotas for non-blacknose SCS could result in mixed socioeconomic impacts depending on future landings in the Gulf of Mexico and/or Atlantic and could lead to adverse socioeconomic impacts.
4. Allow inseason regional non-blacknose SCS quota transfers between regions if landings from one non-blacknose SCS region are approaching 80 percent of the regional quota. This would be allowed because the non-blacknose SCS regional quotas would be in place to limit regional blacknose shark mortality, not regional non-blacknose SCS mortality. (Option available for Alternatives 3b and 3c).	- Ecological impacts are anticipated to be neutral because the non-sandbar SCS stock has been assessed as one stock and would be divided into regional quotas for purposes of minimizing regional blacknose shark mortality. Because of this it does not matter which region non-blacknose SCS landings come from, just as long as the combined regional for non-blacknose SCS do not exceed the combined regional quotas.	- Socioeconomic impacts are anticipated to be neutral to positive, as allowing regional non-blacknose quota to be transferred inseason would allow both regions to stay open when combined landings between the two regions are less than 80 percent of the combined regional non-blacknose SCS quota.
Potential Recreational Quota Measures		
1. Status quo. Do not establish a recreational quota. Control recreational effort through retention limits.	- Could lead to long-term adverse ecological impacts if recreational effort in the Gulf of Mexico is not capped (commercial and recreational effort in 2010 were similar). - Atlantic recreational effort on blacknose is limited, therefore, not establishing a cap is expected to have neutral ecological impacts in the Atlantic.	- Neutral socioeconomic impacts are expected in the short-term, although long-term adverse socioeconomic impacts could occur if recreational landings lead to/continue overfishing on the Gulf of Mexico/Atlantic blacknose shark stocks and recreational fishing opportunities are reduced.
2. Establish an overall recreational quota based on average annual recreational landings.	- Could lead to overall beneficial ecological impacts by creating a cap on effort.	- Socioeconomic impacts of creating regional recreational quotas are neutral to slightly adverse, especially if the quota restricts recreational fishing opportunities.
3. Establish regional recreational quotas based on annual average recreational landings within the Atlantic and Gulf of Mexico regions.	- Could lead to overall beneficial ecological impacts by creating a cap on effort.	- Expected socioeconomic effects of creating regional recreational quotas could be expected to be neutral to slightly adverse, especially if the quota restricts recreational fishing opportunities.

2.1.1.2 Linking the Blacknose Shark Quota to the Non-blacknose SCS Quota

Based on the most recent stock assessments for the non-blacknose SCS (finetooth, Atlantic sharpnose, and bonnethead sharks; SEDAR 13, 2007) NMFS determined that these species are not overfished and not experiencing overfishing. In the Amendment 3 DEIS, NMFS proposed the closure of the shark gillnet fishery in regions south of South Carolina (including the Gulf of Mexico and the Caribbean; the preferred alternative). Based on public comment and analysis of observer data that indicated that gillnet fishermen could avoid blacknose sharks while targeting other SCS species, NMFS did not finalize that alternative in the Amendment 3 FEIS. However, NMFS linked the blacknose and SCS quotas so that if the blacknose shark quota is reached, both the blacknose and the non-blacknose SCS fisheries would be closed to reduce discards of blacknose sharks in the non-blacknose SCS fishery. This was done to eliminate dead discards of blacknose sharks in the non-blacknose SCS fishery when the blacknose shark fishery was closed. In subsequent years, landings of blacknose sharks have remained low (Table 2.1). Fishermen have since reported that they are avoiding blacknose sharks to keep the SCS fishery open, and that there is peer pressure within the fishery to avoid blacknose sharks.

The quotas established in Amendment 3 require NMFS to close both the blacknose or non-blacknose SCS fisheries when the landings of either reaches, or is projected to reach, 80 percent of their respective quotas. Given that the blacknose shark quota is smaller than the non-blacknose SCS quota (19.9 mt dw vs 314.4 mt dw), linking the quotas and closing both fisheries prevents dead discards of blacknose sharks after the blacknose shark fishery closed. In 2010, the first year these two quotas were linked, both fisheries closed on November 2, 2010, when the blacknose shark quota was projected to be approaching 80 percent (75 FR 67251). In 2011, both fisheries remained open the entire fishing year, as neither the blacknose or non-blacknose SCS quotas were predicted to, or surpassed, 80 percent of the quota. This suggests that fishermen have been able to avoid landing blacknose sharks in order to keep the much larger non-blacknose SCS fishery (693,257 lb dw) open. The HMS Advisory Panel noted that by linking the quotas, NMFS provided an incentive to SCS fishermen to avoid blacknose sharks and further reduce the effort and discards of blacknose shark. During scoping Amendment 5, there were requests to keep the quotas linked and to de-link the quotas and consider time/area closures for blacknose sharks. Therefore in analyzing a full range of alternatives, NMFS is reconsidering the need to link the blacknose and non-blacknose SCS quotas and invites additional comment on this issue.

Currently, the quotas for blacknose and non-blacknose SCS are for one overall region in the Atlantic and Gulf of Mexico. However, as discussed in the previous section, the blacknose shark quota could be divided between Atlantic and Gulf of Mexico regions based on results of the 2010/2011 assessments. Therefore, NMFS may need to consider such a split in the non-blacknose SCS quota if the quotas would continue to be linked. NMFS is considering a range of alternatives regarding the linking of regional blacknose shark quotas to non-blacknose SCS quota, such as linking each blacknose regional quota to the current non-blacknose SCS quota or creating regional Atlantic and Gulf of Mexico quotas for non-blacknose SCS that are linked to corresponding regional blacknose shark quotas. These alternatives and their anticipated ecological and socioeconomic impacts are outlined in Table 2.5.

Table 2.5 Potential blacknose shark commercial quota linkage alternatives

Alternative	Ecological Impacts	Social/Economic Impacts
Potential Commercial Quota Linkage		
1. No Action: Keep an overarching commercial blacknose quota linked to the non-blacknose SCS fishery-wide quota. This would allow the closure of the entire non-blacknose SCS fishery if the overall blacknose quota reaches 80%	- Adverse ecological impacts could occur if blacknose shark mortality exceeds the SEDAR 21 TAC recommendation of 7,300 sharks in the Atlantic.	-Commercial quotas are currently linked, and therefore the no action alternative would have neutral socioeconomic effects as it does not induce additional hardships or provide additional economic gain to fishery participants.
2. Keep commercial quotas for both blacknose sharks and non-blacknose SCS separate and independent from each other. Blacknose regional quotas would not be linked to one overarching non-blacknose SCS quota.	- Prohibiting retention of blacknose sharks while the non-blacknose SCS fishery is still open could result in dead discards of blacknose sharks which could have adverse ecological impacts.	- Not linking the quotas could result in beneficial economic impacts, maximizing the number of fishing opportunities.
3. Link the regional non-blacknose SCS quota to the appropriate regional blacknose quota. When regional blacknose landings reach 80% of their quota the associated non-blacknose SCS fishery would close and vice-versa.	- By linking regional quotas, regional blacknose and non-blacknose mortality would be reduced resulting in beneficial ecological impacts.	- Linking the quotas would result in an overall reduction of potential available fishing opportunities in either region, which may lead to minor adverse socioeconomic impacts. - Linking the quotas would regionalize any closures that occurred, minimizing adverse socioeconomic impacts occurring in one region as a result of activities within the other region.
4. Do not link the blacknose quota with the non-blacknose SCS quota.	- Could lead to adverse ecological impacts through additional dead discards of blacknose sharks after the blacknose shark fishery closes.	- Beneficial economic impacts could occur if the closure of one fishery does not force the closure of another fishery that still has available quota.

2.1.1.3 Blacknose Shark Retention Limits in Commercial and Recreational Fisheries

Currently, the commercial shark fishery is regulated under a limited access permit program. Within this program, there are directed and incidental commercial shark permits that have different trip limits associated with each type of permit. A directed shark permit currently has a 33 non-sandbar LCS per vessel per trip limit, with no limits on the number of SCS or pelagic sharks that can be landed on a given trip. Starting in 2013, the directed shark permit limit will increase to 36 non-sandbar LCS per vessel per trip. The incidental shark permit has a 3 non-sandbar LCS per vessel per trip limit, with a limit of 16 SCS and pelagic sharks (combined)

that can be landed on a given trip. Currently, recreational fishermen can land one blacknose shark greater than 54 inches (137 cm) fork length (FL) per trip.

There are a number of alternatives that NMFS could consider to rebuild blacknose sharks with respect to commercial and recreational retention limits for SCS. These alternatives could range from maintaining the current commercial (directed commercial – no retention limit; incidental commercial – 16 SCS) and recreational (1 shark/vessel/trip >54" FL) blacknose shark retention limits, to prohibiting commercial and/or recreational retention of blacknose sharks. Implementing a commercial retention limit for directed permit holders is also an option, which would allow some incidental retention of blacknose sharks while reducing the incentive to target them. According to the SEDAR 21 stock assessments for Atlantic and Gulf of Mexico blacknose sharks, the majority of commercial landings from 2006-2009 came from the Atlantic region (Table 2.1), and the majority of recreational blacknose shark landings came from the Gulf of Mexico over that same time period (Table 2.6).

Table 2.6 **Recreational harvest of blacknose sharks, in number of fish: 2006-2009.** Sources: SEDAR 21 stock assessments for Atlantic and Gulf of Mexico blacknose sharks

	2006	2007	2008	2009
Atlantic Region	476	3,368	2	1,070
Gulf of Mexico Region	9,438	5,809	3,716	4,755

Alternatives for blacknose shark retention limits in the commercial and recreational fisheries, and their anticipated ecological and socioeconomic impacts, are outlined in Table 2.7.

Table 2.7 **Potential blacknose shark retention limit alternatives**

Alternative	Ecological Impacts	Social/Economic Impacts
Potential Commercial Retention Limits		
1. No Action: Maintain current commercial (directed commercial – no retention limit; incidental commercial – 16 SCS in combination with pelagic sharks) blacknose shark retention limits	- No retention limit on the commercial fishery, combined with a reduced Atlantic TAC of 7,300 sharks, could create a situation whereby the TAC is quickly reached and additional sharks interacting with the gear would have to be discarded dead. Thus, there is potential for minor adverse ecological impacts if the pace of the fishery is uncontrolled.	- Neutral socioeconomic impacts in the short-term; in the long-term, fisheries may face more restrictive regulations if stocks do not rebuild, creating adverse socioeconomic impacts.

Alternative	Ecological Impacts	Social/Economic Impacts
2. Apply the current incidental SCS retention limit (16) to directed and incidental shark permit holders for blacknose sharks.	- Commercial shark permit holders would still be allowed to incidentally retain up to 16 blacknose sharks. The limit is small enough to discourage directed fishing on blacknose sharks, but allows for some retention to minimize dead discards and could have beneficial ecological impacts.	- Adverse socioeconomic impacts are likely to occur on directed shark permit holders that target and land blacknose shark, due to implementing a retention limit for blacknose sharks. - Positive socioeconomic effects are expected for fishermen that target non-blacknose SCS; this measure would slow down fishing on blacknose and would likely reduce the probability of a non-blacknose SCS closure if quotas remain linked.
3. Prohibit retention of blacknose sharks in commercial fisheries.	- Prohibiting commercial retention would only minimally reduce blacknose mortality in the BLL fisheries due to high at-vessel mortality rates. These dead discards may lead to continued overfishing and adverse ecological impacts.	- Prohibiting retention in commercial fisheries would have adverse socioeconomic impacts.
Potential Recreational Retention Limits		
1. No Action: Maintain current recreational (1 shark/vessel/trip >54") blacknose shark retention limits	- Continued overfishing of blacknose shark stock could occur, as mortality could exceed the recommended rebuilding target of 7,300 sharks per year in the Atlantic, which could lead to adverse ecological impacts	- Neutral socioeconomic impacts in the short-term; in the long-term, fisheries may face more restrictive regulations if stocks do not rebuild, creating adverse economic impacts.
2. Modify current recreational blacknose retention limits to 1 blacknose shark/vessel/**day**; other restrictions would be trip-level restrictions (1 non-blacknose shark greater than 54"/person/trip, 1 Atlantic sharpnose /person/trip, and 1 bonnethead /person/trip).	-Restricting the recreational harvest of one blacknose shark per vessel per day could reduce blacknose shark mortality and have beneficial ecological impacts. Additional effects would be neutral because retention limits of non-blacknose sharks would remain the same. The size limit of 54" acts as a *de facto* prohibition because blacknose rarely reach sizes greater than 54".	- Adverse effects on recreational fishermen would be minimal and limited only to those individuals making more than one trip in a day. Additional effects would be expected to be neutral because retention limits of non-blacknose sharks would remain the same. The size limit of 54" would act as a *de facto* prohibition because blacknose rarely reach sizes greater than 54". Therefore, socioeconomic effects are expected to be neutral.

Alternative	Ecological Impacts	Social/Economic Impacts
3. Prohibit recreational retention of blacknose sharks.	- Prohibiting retention of blacknose sharks in recreational fisheries could reduce mortality and have a beneficial ecological impact on the stock. However, overall effects are likely neutral because the size limit of 54" acts as a *de facto* prohibition because blacknose rarely reach sizes greater than 54".	- Adverse socioeconomic impacts could occur for recreational fishermen (including charter/headboats) that target and land extremely large blacknose sharks. However, retention limits of non-blacknose sharks would remain the same. The size limit of 54" acts as a *de facto* prohibition because blacknose rarely reach sizes greater than 54". Therefore, socioeconomic effects are expected to be neutral.

Modifying size limits in the recreational fishery could also be considered to help in reducing mortality of blacknose sharks. Recreational landings for blacknose sharks are generally much higher in the Gulf of Mexico compared to the Atlantic (Table 2.6). Currently, blacknose sharks must be greater than 54 inches FL to be retained recreationally. The species generally does not grow to be that large, so the 54 inch FL acts as a *de facto* recreational prohibition on blacknose sharks. However, recently there have been anecdotal reports of recreational landings of blacknose sharks greater than the 54 inch FL minimum size limit. Along with the few allowable recreational landings of blacknose sharks in the federal fishery some states have smaller (or no) recreational minimum sizes for blacknose sharks, and these state water landings might have a greater contribution to blacknose shark recreational landings than the federal landings. In these areas, state water fishermen could catch and retain blacknose sharks smaller than the federal 54 inch FL size limit as long as they do not possess a federal shark permit. Increasing the federal minimum size for blacknose sharks may not be appropriate at this time, because the current federal recreational size limit of 54 inch FL is substantially greater than the 39.8 inch FL (101.2 cm) size at 50 percent maturity used in the SEDAR 21 stock assessments for Atlantic and Gulf of Mexico blacknose sharks. Therefore, increasing the federal recreational minimum size for blacknose sharks was considered but not further analyzed.

2.1.2 Scalloped Hammerhead Sharks

2.1.2.1 Commercial Quotas for Scalloped Hammerhead Sharks

Scalloped hammerhead sharks are currently a part of the non-sandbar LCS complex. Based on the Hayes et al., 2009 stock assessment, NMFS determined that the scalloped hammerhead stock in the Atlantic is overfished with overfishing occurring. The Hayes et al. (2009) stock assessment estimated that a TAC of 2,853 scalloped hammerhead sharks (approximately 79.6 mt, calculated using an average dressed weight of 61.5 lb per shark) would allow for a greater than 70 percent probability to rebuild the stock within 10 years. Thus, NMFS will establish a separate ACL and AMs for the scalloped hammerhead shark stock, and establish an annual TAC of 2,853 scalloped hammerhead sharks to allow rebuilding of the stock. This

TAC includes landings and discards of scalloped hammerhead sharks in all fisheries that interact with scalloped hammerhead sharks. Table 2.8 outlines recent landings and discards of scalloped hammerhead sharks from 2006-2010 (NMFS, 2011), and compares these landings with the scalloped hammerhead estimates used in the Hayes et al. (2009) stock assessment, including the TAC estimated in Hayes et al. (2009).

Table 2.8 Comparison of commercial and recreational landings of scalloped hammerhead sharks from 2006-2010 to the TAC recommendation in the Hayes et al. (2009) scalloped hammerhead stock assessment. (2011 SAFE Report; Hayes et al., 2009)

	2006	2007	2008	2009	2010	Average
A. Recreational landings*	458	1,726	119	1,667	199	834
B. Commercial landings**	1353	626	536	1534	918	993
C. Discard Estimate***	431	431	431	431	431	431
D. Total Estimated Harvest (A+B+C)	2242	2783	1086	3632	1548	2258
E. Hayes et al. TAC estimate	2,853	2,853	2,853	2,853	2,853	2,853
F. Difference between the total estimated harvest and the Hayes et al. TAC estimate (D-E)	-611	-70	-1767	779	-1305	-595
G. Additional scalloped hammerhead sharks from unclassified hammerhead sharks recreational estimate	1,011	742	0	0	0	351
H. Total including recreational unclassified hammerhead sharks****(D+G)	3253	3525	1086	3632	1548	2609
I. Hayes et al. TAC estimate	2,853	2,853	2,853	2,853	2,853	2,853
J. Difference between the total estimated harvest including recreational unclassified landings and the Hayes et al. TAC estimate (H-I)	400	672	-1767	779	-1305	-244

*Recreational numbers do not include unclassified hammerhead sharks (1,099 in 2006 and 807 in 2007, 0 in 2008-2010).
**Commercial landings calculated from pounds dressed weight (lb dw) by using the average mean weight for the hammerhead complex from 2000 to 2005 (61.5 lb) and the percentage estimate of scalloped hammerhead sharks in the Unclassified hammerhead shark category from 2000-2005 (59%).
***Discard estimate is the same as the estimate used in Hayes et al. (2009).

****The percentage estimate of scalloped hammerhead sharks used in the unclassified recreational hammerhead shark category is the average percentage estimate from 2000-2005 (92%).

From 2006-2010, the sum of recreational landings, commercial landings, and the discard estimate was lower than the recommended TAC from Hayes et al. (2009) in four out of the five years, and on average was 595 sharks less per year. It should be noted that this does not include unclassified hammerhead sharks that were landed recreationally, which totaled 1,099 sharks in 2006 and 807 sharks in 2007. If the average scalloped hammerhead percentage estimate for recreationally landed unclassified sharks used in Hayes et al. (2009) (92 percent) is applied to these years, an additional 1,011 and 742 sharks would be added to the 2006 and 2007 total, respectively. With the addition of these unclassified sharks, only two of the five years totaled less than the 2,853 shark recommendation, but the average total scalloped hammerhead mortality from 2006-2010 was still less than the 2,853 shark TAC recommendation by 244 sharks.

NMFS is considering analyzing a range of commercial quota alternatives for scalloped hammerhead shark to address the stock status determination of overfished with overfishing occurring (76 FR 23794; April 28, 2011). These alternatives could consist of maintaining the status quo, which would keep scalloped hammerhead sharks under the non-sandbar LCS quota, a number of alternatives that would create a separate scalloped hammerhead quota, based on the Hayes et al. (2009) recommendation, , and setting a quota of 0 mt for scalloped hammerhead sharks (i.e., prohibiting retention). These alternatives are outlined in Table 2.9, along with their associated anticipated ecological and socioeconomic impacts.

Table 2.9 Potential commercial quota alternatives for scalloped hammerhead sharks and non-sandbar LCS

Alternative	Ecological Impacts	Social/Economic Impacts
1. No Action: Maintain current commercial non-sandbar LCS quota.	-Adverse ecological impacts could occur if scalloped hammerhead shark mortality from commercial landings exceeds the TAC recommended in the rebuilding plan (2,853 scalloped hammerhead sharks).	- Neutral socioeconomic impacts for the commercial or recreational sector in the short-term; in the long-term fisheries may face more restrictive regulations if overfishing of scalloped hammerhead sharks continues, creating adverse socioeconomic impacts.
Potential quota alternatives for scalloped hammerhead sharks		

Alternative	Ecological Impacts	Social/Economic Impacts
2a. Establish scalloped hammerhead shark quota below the TAC accounting for scalloped hammerhead recreational landings and discards (TAC - Recreational Landings – Discards = Quota)	-Creating a scalloped hammerhead quota should keep scalloped hammerhead shark mortality under the TAC recommendation, and result in beneficial ecological impacts. Beneficial impacts may be minimized if scalloped hammerhead shark dead discards are prevalent in the non-sandbar LCS fishery after the scalloped hammerhead shark quota is reached.	- Socioeconomic impacts could range from neutral to adverse depending on how much commercial quota is available after accounting for recreational landings and discards of scalloped hammerhead sharks. Adverse impacts would be expected if the scalloped hammerhead shark commercial quota is less than current scalloped hammerhead shark landings. - Having a specific commercial quota for scalloped hammerhead sharks could result in decreased opportunities to retain scalloped hammerhead sharks if the quota is reached and could have adverse economic impacts.
2b. Establish scalloped hammerhead shark quota below the TAC accounting for scalloped hammerhead recreational landings and discards (TAC - Recreational Landings – Discards = Quota) equal to the highest annual commercial scalloped hammerhead shark landings since the implementation of Amendment 2 to the Consolidated HMS FMP (2008).	-Creating a scalloped hammerhead quota should keep scalloped hammerhead shark mortality under the TAC recommendation, which should result in beneficial ecological impacts. Beneficial impacts may be minimized if scalloped hammerhead shark dead discards are prevalent in the non-sandbar LCS fishery after the scalloped hammerhead shark quota is reached.	- Socioeconomic impacts could range from neutral to adverse depending on how much commercial quota is available. Although, adverse impacts could be minimized by setting the scalloped hammerhead shark quota equal to the highest annual commercial scalloped hammerhead shark landings since the implementation of Amendment 2 - Having a specific commercial quota for scalloped hammerhead sharks could result in decreased opportunities to retain scalloped hammerhead sharks if the quota is reached and could have adverse socioeconomic impacts. .
2c. Establish scalloped hammerhead shark quota below the TAC accounting for scalloped hammerhead recreational landings and discards (TAC - Recreational Landings – Discards = Quota) equal to the average annual commercial scalloped hammerhead shark landings since the implementation of Amendment 2 to the Consolidated HMS FMP (2008).	- Creating a scalloped hammerhead quota set at the average landings since Amendment 2 should keep scalloped hammerhead shark mortality under the TAC recommendation, and result in beneficial ecological impacts. Beneficial impacts may be minimized if scalloped hammerhead shark dead discards are prevalent in the non-sandbar LCS fishery after the scalloped hammerhead shark quota is reached.	-Similar socioeconomic impacts as Alternative 2b, although adverse socioeconomic impacts may be greater because the commercial quota would be lower.

Alternative	Ecological Impacts	Social/Economic Impacts
2d. Set the commercial scalloped hammerhead shark quota equal to average scalloped hammerhead shark landings in the shark research fishery and allow commercial retention only on shark research fishery trips.	- Adverse ecological impacts could occur because prohibiting commercial retention only in the shark research fishery would increase dead discards of scalloped hammerhead sharks by fishermen who are not participating in the shark research fishery, which could lead to continued overfishing on the stock. -Prohibiting commercial retention outside the research fishery may only minimally reduce scalloped hammerhead shark mortality in the BLL and gillnet shark fisheries, because scalloped hammerhead dead discards would continue due to their high at-vessel mortality rates on these fishing gears, and could have adverse ecological impacts.	-Allocating scalloped hammerhead shark quota only to the shark research fishery would have adverse socioeconomic impacts for commercial non-sandbar LCS fishermen not participating in the shark research fishery who could no longer land scalloped hammerhead sharks.
2e. Set the commercial scalloped hammerhead quota at 0 mt, which would prohibit the retention of scalloped hammerhead sharks in the commercial fishery.	-Prohibiting commercial retention may only minimally reduce scalloped hammerhead shark mortality in the BLL and gillnet shark fisheries, because scalloped hammerhead dead discards would continue due to their high at-vessel mortality rates on these fishing gears, and could have adverse ecological impacts.	-Not allocating any scalloped hammerhead shark quota to the commercial fishery would have adverse socioeconomic impacts.
Potential Alternatives for Adjusting Non-sandbar LCS Quota		
3a. Deduct the scalloped hammerhead shark quota from the Gulf of Mexico, Atlantic and Shark Research Fishery non-sandbar LCS quotas according to the percentage of scalloped hammerhead landings that came from each fishery since the implementation of Amendment 2 to the Consolidated HMS FMP (2008). (Option available for Alternatives 2a, 2b, 2c, and 2e)	- Reductions in non-sandbar LCS quota would be representative of current scalloped hammerhead shark fishery landings in each region, therefore, ecological impacts would be neutral.	- Deductions in non-sandbar LCS quota would be representative of current scalloped hammerhead shark landings in each region, therefore, socioeconomic impacts would be neutral.

Alternative	Ecological Impacts	Social/Economic Impacts
3b. Deduct the scalloped hammerhead shark quota evenly from the Gulf of Mexico, Atlantic and Shark Research Fishery non-sandbar LCS. (Option available for Alternatives 2a, 2b, 2c, and 2e)	- Deducting the scalloped hammerhead shark quota evenly from the three non-sandbar LCS quotas may not accurately reflect where scalloped hammerhead landings currently come from. Therefore, ecological impacts could range from adverse in areas where non-sandbar LCS and/or scalloped hammerhead shark quotas were adjusted to be higher than current landings, to beneficial in areas where reductions in non-sandbar LCS and/or scalloped hammerhead shark quota were adjusted to be lower than current landings.	- Regional socioeconomic impacts could range from adverse to beneficial depending on if adjustments in non-sandbar LCS and/or scalloped hammerhead shark quotas are higher or lower than current landings in the region.
3c. Deduct the scalloped hammerhead shark quota from the non-sandbar LCS Shark Research Fishery Quota (Option available for Alternative 2d)	- Adverse ecological impacts could occur from allowing commercial retention of scalloped hammerhead sharks only in the shark research fishery. This would increase dead discards of scalloped hammerhead sharks by fishermen who are not participating in the shark research fishery, which could lead to continued overfishing on the stock.	-Allocating scalloped hammerhead shark quota only to the shark research fishery could have adverse socioeconomic impacts for commercial non-sandbar LCS fishermen not participating in the shark research fishery who could no longer land scalloped hammerhead sharks.
Potential Recreational Quota Measures		
1. Status quo. Do not establish a recreational quota. Control recreational effort through retention limits.	- Currently, recreational landings estimates are within the TAC estimate, although adverse ecological impacts could occur if they exceed the TAC in the future and overfishing continues.	- Neutral socioeconomic impacts are expected in the short-term, although long-term adverse socioeconomic impacts could occur if recreational landings continue overfishing on the scalloped hammerhead sharks and recreational fishing opportunities are reduced.
2. Establish a recreational quota based for scalloped hammerhead sharks.	- Could result in beneficial ecological impacts if the recreational quota helps to keep scalloped hammerhead shark mortality below the scalloped hammerhead shark TAC.	- A recreational scalloped hammerhead shark quota could limit recreational fishing opportunities and could result in adverse socioeconomic impacts. Establishing a recreational quota may also involve additional costs to monitor the quota.

2.1.2.2 Linking Commercial Scalloped Hammerhead Shark Quota with the Commercial Non-sandbar LCS Quota

If a new scalloped hammerhead shark quota is established, NMFS would have to determine how that quota should interact with other established shark quotas. Currently, commercial scalloped hammerhead shark landings are counted against the non-sandbar LCS quota. The non-sandbar LCS quota is split between two regions, the Gulf of Mexico and Atlantic. There is also a non-sandbar LCS quota for non-sandbar LCS, including scalloped hammerhead sharks that are caught during a shark research fishery trip. In the past following species-specific stock assessments, NMFS has created species-specific quotas and removed these

species from the quota complexes they were previously part of. Amendment 2 resulted in sandbar sharks being separated from the LCS quota complex, and the creation of Atlantic, Gulf of Mexico and research fishery non-sandbar LCS commercial quotas and a sandbar shark research fishery quota. These quotas were not linked because of the relatively low at-vessel mortality rate of sandbar sharks in BLL fisheries (Table 2.14). Therefore, many of the sandbar sharks caught incidentally while fishing for non-sandbar LCS would be released alive. Amendment 3 resulted in blacknose sharks being separated from the SCS quota complex, and created a non-blacknose SCS and a blacknose shark quota. In this case the blacknose shark quota was linked to the non-blacknose SCS quota, mainly because of the high at-vessel mortality rate of blacknose sharks on BLL gear (Table 2.14). By linking the blacknose shark and non-blacknose SCS quotas and closing both when landings of one reaches or approaches 80 percent of the quota, dead discards of blacknose sharks should be minimized. At-vessel mortality rates of scalloped hammerhead sharks are discussed in greater detail in Section 0, but are generally high on commercial fishing gear.

Scalloped hammerhead sharks are not generally targeted in the Atlantic and Gulf of Mexico commercial shark fisheries, and generally do not make up the majority of the catch on a commercial trip targeting sharks. According to Coastal Fishery Logbook (CFL) data from 2008 – July 2011, approximately 16 percent of the total shark catch reported was made up of all hammerhead sharks with scalloped hammerhead sharks making up a portion, but not all of those hammerhead shark landings. Over the same time period, approximately 65 percent of total shark landings were comprised of blacktip (~42 percent) and bull (~23 percent) sharks. These landings mainly come from fishing trips using BLL and gillnet gear, and suggest that hammerhead sharks are retained more as bycatch rather than as a directly targeted shark species in those fisheries. PLL vessels fishing for swordfish and tunas from 2005-2009 caught, on average, 1,311 hammerhead sharks per year according to HMS logbook data. On average, 181 of these hammerhead sharks were retained, but, because of a retention prohibition of hammerhead sharks by PLL vessels that became effective on September 28, 2011 (76 FR 53652; August 29, 2011), the PLL fleet should no longer be a source of any hammerhead shark landings although estimated dead discards of 431 hammerhead sharks per year may continue.

If NMFS were to choose to analyze and establish an individual scalloped hammerhead shark quota, NMFS could choose to not link the new scalloped hammerhead shark quota with any of the non-sandbar LCS quotas, or could link the scalloped hammerhead shark quota to the non-sandbar LCS quotas in a variety of ways. Linking the quotas may be a way to limit scalloped hammerhead mortality because this species is mainly caught incidentally in BLL and gillnet shark fisheries, and at-vessel mortality rates of scalloped hammerhead sharks in both of these fisheries are high. Data from the shark BLL and gillnet observer programs from 2009-2010 show an average at-vessel mortality rate of 90 and 75 percent, respectively. Therefore, closing the non-sandbar LCS fisheries when the scalloped hammerhead shark quota reaches, or is projected to reach, 80 percent would limit additional mortality of scalloped hammerhead sharks that are caught incidentally and would, most likely, have to be discarded dead. **Error! Reference source not found.** contains alternatives for scalloped hammerhead shark quota linkage and briefly summarizes their anticipated ecologic and socioeconomic impacts.

Table 2.10 Potential commercial quota alternatives for scalloped hammerhead sharks and non-sandbar LCS

Alternative	Ecological Impacts	Social/Economic Impacts
1. No Action: Maintain current commercial non-sandbar LCS quota.	-Adverse ecological impacts could occur if scalloped hammerhead shark mortality from commercial landings exceeds the TAC recommended in the rebuilding plan (2,853 scalloped hammerhead sharks).	- Neutral socioeconomic impacts for the commercial or recreational sector in the short-term; in the long-term fisheries may face more restrictive regulations if overfishing of scalloped hammerhead sharks continues, creating adverse socioeconomic impacts.
Potential quota alternatives for scalloped hammerhead sharks		
2a. Establish scalloped hammerhead shark quota below the TAC accounting for scalloped hammerhead recreational landings and discards (TAC - Recreational Landings – Discards = Quota)	-Creating a scalloped hammerhead quota should keep scalloped hammerhead shark mortality under the TAC recommendation, and result in beneficial ecological impacts. Beneficial impacts may be minimized if scalloped hammerhead shark dead discards are prevalent in the non-sandbar LCS fishery after the scalloped hammerhead shark quota is reached.	- Socioeconomic impacts could range from neutral to adverse depending on how much commercial quota is available after accounting for recreational landings and discards of scalloped hammerhead sharks. Adverse impacts would be expected if the scalloped hammerhead shark commercial quota is less than current scalloped hammerhead shark landings. - Having a specific commercial quota for scalloped hammerhead sharks could result in decreased opportunities to retain scalloped hammerhead sharks if the quota is reached and could have adverse economic impacts.
2b. Establish scalloped hammerhead shark quota below the TAC accounting for scalloped hammerhead recreational landings and discards (TAC - Recreational Landings – Discards = Quota) equal to the highest annual commercial scalloped hammerhead shark landings since the implementation of Amendment 2 to the Consolidated HMS FMP (2008).	-Creating a scalloped hammerhead quota should keep scalloped hammerhead shark mortality under the TAC recommendation, which should result in beneficial ecological impacts. Beneficial impacts may be minimized if scalloped hammerhead shark dead discards are prevalent in the non-sandbar LCS fishery after the scalloped hammerhead shark quota is reached.	- Socioeconomic impacts could range from neutral to adverse depending on how much commercial quota is available. Although, adverse impacts could be minimized by setting the scalloped hammerhead shark quota equal to the highest annual commercial scalloped hammerhead shark landings since the implementation of Amendment 2 - Having a specific commercial quota for scalloped hammerhead sharks could result in decreased opportunities to retain scalloped hammerhead sharks if the quota is reached and could have adverse socioeconomic impacts. .

Alternative	Ecological Impacts	Social/Economic Impacts
2c. Establish scalloped hammerhead shark quota below the TAC accounting for scalloped hammerhead recreational landings and discards (TAC - Recreational Landings – Discards = Quota) equal to the average annual commercial scalloped hammerhead shark landings since the implementation of Amendment 2 to the Consolidated HMS FMP (2008).	- Creating a scalloped hammerhead quota set at the average landings since Amendment 2 should keep scalloped hammerhead shark mortality under the TAC recommendation, and result in beneficial ecological impacts. Beneficial impacts may be minimized if scalloped hammerhead shark dead discards are prevalent in the non-sandbar LCS fishery after the scalloped hammerhead shark quota is reached.	-Similar socioeconomic impacts as Alternative 2b, although adverse socioeconomic impacts may be greater because the commercial quota would be lower.
2d. Set the commercial scalloped hammerhead shark quota equal to average scalloped hammerhead shark landings in the shark research fishery and allow commercial retention only on shark research fishery trips.	- Adverse ecological impacts could occur because prohibiting commercial retention only in the shark research fishery would increase dead discards of scalloped hammerhead sharks by fishermen who are not participating in the shark research fishery, which could lead to continued overfishing on the stock. -Prohibiting commercial retention outside the research fishery may only minimally reduce scalloped hammerhead shark mortality in the BLL and gillnet shark fisheries, because scalloped hammerhead dead discards would continue due to their high at-vessel mortality rates on these fishing gears, and could have adverse ecological impacts.	-Allocating scalloped hammerhead shark quota only to the shark research fishery would have adverse socioeconomic impacts for commercial non-sandbar LCS fishermen not participating in the shark research fishery who could no longer land scalloped hammerhead sharks.
2e. Set the commercial scalloped hammerhead quota at 0 mt, which would prohibit the retention of scalloped hammerhead sharks in the commercial fishery.	-Prohibiting commercial retention may only minimally reduce scalloped hammerhead shark mortality in the BLL and gillnet shark fisheries, because scalloped hammerhead dead discards would continue due to their high at-vessel mortality rates on these fishing gears, and could have adverse ecological impacts.	-Not allocating any scalloped hammerhead shark quota to the commercial fishery would have adverse socioeconomic impacts.
Potential Alternatives for Adjusting Non-sandbar LCS Quota		

Alternative	Ecological Impacts	Social/Economic Impacts
3a. Deduct the scalloped hammerhead shark quota from the Gulf of Mexico, Atlantic and Shark Research Fishery non-sandbar LCS quotas according to the percentage of scalloped hammerhead landings that came from each fishery since the implementation of Amendment 2 to the Consolidated HMS FMP (2008). (Option available for Alternatives 2a, 2b, 2c, and 2e)	- Reductions in non-sandbar LCS quota would be representative of current scalloped hammerhead shark fishery landings in each region, therefore, ecological impacts would be neutral.	- Deductions in non-sandbar LCS quota would be representative of current scalloped hammerhead shark landings in each region, therefore, socioeconomic impacts would be neutral.
3b. Deduct the scalloped hammerhead shark quota evenly from the Gulf of Mexico, Atlantic and Shark Research Fishery non-sandbar LCS. (Option available for Alternatives 2a, 2b, 2c, and 2e)	- Deducting the scalloped hammerhead shark quota evenly from the three non-sandbar LCS quotas may not accurately reflect where scalloped hammerhead landings currently come from. Therefore, ecological impacts could range from adverse in areas where non-sandbar LCS and/or scalloped hammerhead shark quotas were adjusted to be higher than current landings, to beneficial in areas where reductions in non-sandbar LCS and/or scalloped hammerhead shark quota were adjusted to be lower than current landings.	- Regional socioeconomic impacts could range from adverse to beneficial depending on if adjustments in non-sandbar LCS and/or scalloped hammerhead shark quotas are higher or lower than current landings in the region.
3c. Deduct the scalloped hammerhead shark quota from the non-sandbar LCS Shark Research Fishery Quota (Option available for Alternative 2d)	- Adverse ecological impacts could occur from allowing commercial retention of scalloped hammerhead sharks only in the shark research fishery. This would increase dead discards of scalloped hammerhead sharks by fishermen who are not participating in the shark research fishery, which could lead to continued overfishing on the stock.	-Allocating scalloped hammerhead shark quota only to the shark research fishery could have adverse socioeconomic impacts for commercial non-sandbar LCS fishermen not participating in the shark research fishery who could no longer land scalloped hammerhead sharks.
Potential Recreational Quota Measures		
1. Status quo. Do not establish a recreational quota. Control recreational effort through retention limits.	- Currently, recreational landings estimates are within the TAC estimate, although adverse ecological impacts could occur if they exceed the TAC in the future and overfishing continues.	- Neutral socioeconomic impacts are expected in the short-term, although long-term adverse socioeconomic impacts could occur if recreational landings continue overfishing on the scalloped hammerhead sharks and recreational fishing opportunities are reduced.
2. Establish a recreational quota based for scalloped hammerhead sharks.	- Could result in beneficial ecological impacts if the recreational quota helps to keep scalloped hammerhead shark mortality below the scalloped hammerhead shark TAC.	- A recreational scalloped hammerhead shark quota could limit recreational fishing opportunities and could result in adverse socioeconomic impacts. Establishing a recreational quota may also involve additional costs to monitor the quota.

2.1.2.3 Recreational and Commercial Retention Limits for Scalloped Hammerhead Sharks

Currently, there are retention limits in both the commercial and recreational shark fisheries that could be modified to apply specifically to scalloped hammerhead sharks. Commercial landings of scalloped hammerhead sharks are attributed to the non-sandbar LCS quota and are subject to the 33 non-sandbar LCS per trip retention limit for directed shark permit holders, which was implemented with Amendment 2. Therefore, up to 33 scalloped hammerhead sharks could be landed per trip by a vessel with a directed shark permit. Shark incidental permit holders are authorized to land 3 non-sandbar LCS per trip, which would allow retention of a maximum of 3 scalloped hammerhead sharks per trip. In the recreational fishery, scalloped hammerhead sharks fall under the retention limit of 1 shark greater than 54 inch FL per trip.

Recreational landings estimates of scalloped hammerhead sharks from 2006-2010 have exceeded commercial landings in some years and if unclassified hammerhead shark recreational landings estimates are considered recreational landings of scalloped hammerhead sharks exceeded commercial landings every year (Table 2.8). Therefore, modifications to recreational retention limits may be needed to adequately reduce mortality of scalloped hammerhead sharks. NMFS conducted a study in September 2008 to characterize HMS recreational fisheries in the South Atlantic and Gulf of Mexico. This consisted of a phone survey of HMS Angling, HMS Charter/Headboat, and Atlantic Tunas General category and permit holders from North Carolina to Texas (excluding Florida) regarding their HMS recreational fishing activities over the previous 12 months. The study found that for all shark species reported, the large majority were caught and released alive, and that most recreationally caught sharks by Angling category vessels in the Gulf and South Atlantic were not caught on directed trips but rather incidentally on trips targeting other species (MRIP 2010). Eight hammerhead sharks were reported as kept and 522 were reported as released alive in the September 2008 study. The HMS For-Hire pilot study (MRIP 2011) surveyed for-hire vessels in Florida and HMS Charter/Headboat permitted vessels in South Florida. The study noted that from 2000-2009, 80.8 percent of positive intercepts for hammerhead shark catches (excluding bonnethead) from the Marine Recreational Fisheries Statistics Survey (MRFFS) came from Florida. The surveys used in this study (Field Intercept Survey and Combined Telephone Survey) indicated significantly higher landing rates for hammerhead sharks than all other shark species, and that taxidermy mounts accounted for all of the hammerhead shark landings. The study also recommended that the monitoring of HMS landings for some shark species should be primarily conducted by a census program due to the limitations of any survey to accurately estimate such rare event landings, and that extending the HMS recreational non-tournament reporting requirement to great, smooth, and scalloped hammerhead sharks could help increase the reporting rate. Recreational retention of hammerhead sharks is already prohibited on recreational trips that also possess a tuna, swordfish, or billfish (76 FR 53652; August 29, 2011), but extending that prohibition to all HMS fisheries could reduce mortality of scalloped hammerhead sharks, if necessary.

Another way to possibly reduce recreational mortality of scalloped hammerhead sharks could be to increase the recreational minimum size of scalloped hammerhead sharks. The current recreational minimum size for sharks (excluding Atlantic sharpnose and bonnethead sharks) is 54 inches FL, which is lower than the estimated size at maturity for female scalloped

hammerhead sharks (240cm, 94 inches total length; Hazin et al., 2001). Establishing a larger minimum size for scalloped hammerhead sharks could reduce the number of immature scalloped hammerhead sharks that are landed, which may have positive impacts on the stock status. This alternative could also be extended to include all hammerhead sharks (excluding bonnethead sharks), which could further reduce scalloped hammerhead shark mortality due to mistakes in species identification.

There have not been many at-vessel mortality rate studies for sharks caught on recreational fishing gear, and NMFS does not have an at-vessel mortality rate estimate for scalloped hammerhead sharks caught in the recreational fishery at this time. Campana et al. (2006) compared at-vessel mortality rates for blue sharks (*Prionace glauca*) in commercial and recreational fisheries and found at-vessel mortality rates of 10-20 percent on commercial PLL vessels and at-vessel mortality rate of 0 percent for blue sharks caught on recreational fishing gear. They found these results understandable, as at-vessel mortality is associated with the amount of time spent on the hook, and generally time on the hook is less on recreational fishing gear. While scalloped hammerhead at-vessel mortality rates are currently unavailable, it is reasonable to assume that they are less than at-vessel mortality rates of scalloped hammerhead sharks caught on PLL gear.

There are a number of factors to consider in determining if the current commercial retention limits for scalloped hammerhead sharks would allow for rebuilding, such as the number of scalloped hammerhead sharks landed on a per-trip basis. A commercial trip limit specific to scalloped hammerhead sharks could be developed based on landings data since the implementation of Amendment 2. For example, NMFS could set a scalloped hammerhead shark trip limit based on the average number of hammerheads retained per trip from trips that landed hammerhead sharks, and may be an appropriate way to discourage any future attempts at targeting of scalloped hammerhead sharks without causing a large increase in discards. Another option may be to require mandatory retention of scalloped hammerhead sharks in BLL and gillnet fisheries given their high at-vessel mortality rate. This would allow for all scalloped hammerhead sharks caught in these fisheries to be counted against the scalloped hammerhead shark quota, and would account for a small increase in scalloped hammerhead shark mortality because their at-vessel mortality rates are extremely high on both gear types. Retention limit alternatives for scalloped hammerhead sharks are outlined in Table 2.11, along with their anticipated associated ecologic and socioeconomic impacts.

Table 2.11 Potential scalloped hammerhead and non-sandbar LCS commercial and recreational retention limit alternatives

Alternative	Ecological Impacts	Social/Economic Impacts
Potential Commercial Retention Limits		
1. No Action: Maintain current commercial non-sandbar LCS retention limits. All hammerhead shark landings are counted against the current 33 non-sandbar LCS per trip limit.	- Recent commercial landings of scalloped hammerhead sharks suggest that they, along with recreational landings and discards, are near the recommended rebuilding target of 2,853. Therefore ecological impacts of the no action alternative may be neutral.	- No adverse socioeconomic impacts in the short-term; in the long-term fisheries may face more restrictive regulations if stocks do not rebuild, creating adverse economic impacts.

Alternative	Ecological Impacts	Social/Economic Impacts
2a. Create a hammerhead shark trip limit equal to the average number of hammerhead sharks landed on trips that landed hammerhead sharks from 2008-2011. (Alternative connected with either Alternative 3a or 3b)	-Establishing a scalloped hammerhead shark trip limit should limit incentives to target scalloped hammerhead sharks. This could have beneficial ecological impacts if combined with other alternatives that reduce the incentive to discard (allowing retention of scalloped hammerhead shark on top of the 33 non-sandbar LCS trip limit) and target (linking scalloped hammerhead quota with non-sandbar LCS quota) scalloped hammerhead sharks. Although, setting the quota at average landings may lead to some dead discards.	- Having a specific commercial trip limit for scalloped hammerhead sharks less than the 33 non-sandbar LCS trip limit could reduce the number of scalloped hammerhead sharks that fishermen could land and could have adverse socioeconomic impacts.
2b. Create a hammerhead shark trip limit equal to the maximum number of hammerhead sharks landed on trips that landed hammerhead sharks from 2008-2011. (Alternative connected with either Alternative 3a or 3b)	-Similar impacts as Alternative 2a, although beneficial impacts may be greater because setting the retention limit equal to maximum landings should minimize dead discards.	-Similar impacts as Alternative 2a, but adverse impacts would be lessened as the chance of reaching the scalloped hammerhead trip limit would be minimized.
3a. Keep the current non-sandbar LCS trip limit, and exclude scalloped hammerhead sharks from counting against the non-sandbar LCS trip limit. (Alternative connected with either Alternative 2a, or 2b)	- Could have beneficial impacts on the scalloped hammerhead and non-sandbar LCS stocks if separating the scalloped hammerhead shark retention limit leads to decreased dead discards.	- Beneficial socioeconomic impacts as fishermen could potentially land more sharks per trip.
3b. Keep the current non-sandbar LCS trip limit, and count scalloped hammerhead sharks against the non-sandbar LCS trip limit. (Alternative connected with either Alternative 2a or2b)	- Adverse ecological impacts may occur if the current non-sandbar LCS retention limit of 33 sharks (36 starting in 2013), results in dead discards of scalloped hammerhead sharks.	- Neutral socioeconomic impacts may occur because LCS retention would continue to be 33 sharks (36 starting in 2013).
Potential Recreational retention limits		
1. No Action: Maintain current recreational shark retention limits.	- Recent recreational landings of scalloped hammerhead sharks suggest that they, along with commercial landings and discards, are near the recommended rebuilding target of 2,853. Therefore ecological impacts of the no action alternative may be neutral.	- No adverse socioeconomic impacts in the short-term; in the long-term fisheries may face more restrictive regulations if stocks do not rebuild, creating adverse economic impacts.

Alternative	Ecological Impacts	Social/Economic Impacts
2. Establish a size limit for recreationally-caught scalloped hammerhead sharks that corresponds with female scalloped hammerhead shark minimum size at maturity.	- Establishing a scalloped hammerhead shark minimum size would reduce scalloped hammerhead shark mortality and allow more individuals the opportunity to mature and reproduce, which could have beneficial ecological impacts	- Adverse socioeconomic impacts could occur, as recreational opportunities to land scalloped hammerhead sharks would be reduced.
3. Establish a size limit for recreationally-caught hammerhead sharks (excluding bonnethead sharks) that corresponds with female scalloped hammerhead shark minimum size at maturity.	- Establishing a scalloped hammerhead shark minimum size would reduce all hammerhead shark mortality and allow more individuals the opportunity to mature and reproduce, which could have beneficial ecological impacts	- Adverse socioeconomic impacts could occur, as recreational opportunities to land hammerhead sharks would be reduced.
5. Prohibit recreational retention of scalloped hammerhead sharks.	- Beneficial ecological impacts as recreational scalloped hammerhead mortality would be reduced.	- Adverse socioeconomic impacts could occur, as recreational opportunities to land scalloped hammerhead sharks would be eliminated.
Potential Recreational Reporting of Scalloped Hammerhead Sharks		
1. No Action: Maintain current recreational reporting requirements for hammerhead sharks. (No requirements unless selected for tournament reporting or contacted by the Large Pelagic Survey or Marine Recreational Information Program)	- Neutral ecological impacts, as the current protocol for estimating recreational scalloped hammerhead landings would continue.	- Recreational reporting requirements would not change, therefore, neutral socioeconomic impacts are anticipated.
2. Require reporting of all recreationally landed hammerhead sharks (excluding bonnethead sharks) to NMFS through the non-tournament landing system within 24 hours of landing.	- Recreational reporting of scalloped hammerhead sharks through the non-tournament landings system may provide more accurate recreational landings data, which, if applied to the scalloped hammerhead TAC, could have beneficial impacts on the stock.	- Additional recreational reporting for hammerhead sharks involves some level of burden on recreational anglers, likely resulting in minimal adverse socioeconomic impact.

2.1.3 Dusky Sharks

2.1.3.1 Options for Reducing Commercial and Recreational Dusky Shark Mortality beyond Quotas and Retention Limits

Currently, dusky sharks are prohibited from recreational and commercial retention, and there is no associated commercial quota for dusky sharks. Therefore, alternatives to directly modify dusky shark quotas and retention limits are not appropriate for reducing fishing mortality of dusky sharks and are not further discussed in this section. Quota alternatives for scalloped

hammerhead sharks and non-sandbar LCS (Table 2.10) may have residual impacts on dusky shark mortality if they reduce overall effort in the BLL and gillnet shark fisheries. Because dusky shark retention is prohibited in commercial and recreational fisheries, dusky shark rebuilding may be realized through the implementation of time/area closures (Section 2.3) and reducing at-vessel mortality (Section 2.2).

Alternatives such as bycatch caps or reducing the non-sandbar LCS trip limit could be explored if it is determined that measures to reduce time/area closures and at-vessel mortality would not reduce fishing mortality on dusky sharks by approximately 2/3 (see Section 2.3) in order to reach rebuilding goals. A bycatch cap would allow a specific number of dusky shark mortalities in specific commercial and recreational HMS fisheries and would close those fisheries one their associated dusky shark bycatch cap was reached. Bycatch caps would need to be associated with something other than landings (e.g., dusky shark catch or dead discard rates based on observer data, recreational survey data), if landings of dusky sharks continued to be prohibited. Dusky shark fishing mortality rates could be calculated for different fisheries and when the rate exceeded the bycatch cap rate for a particular fishery (e.g., BLL non-sandbar LCS fishery, PLL tunas and/or swordfish fishery, recreational HMS) that fishery would close. NMFS could also increase outreach to the recreational fishery, as landings have been attributed to the recreational fishery even though dusky sharks are prohibited from recreational retention. Increasing awareness of current recreational shark regulations and shark identification, specifically for dusky sharks, may help reduce dusky shark mortality in the recreational fishery, which averaged 10,652.5 lb dw according to data from the SEDAR 21 stock assessment. Potential alternatives to reduce dusky shark mortality through time/area closures and reducing at-vessel mortality are outlined and described in Sections 2.3 and 2.2, respectively. Other alternatives beyond quotas and retention limits for reducing dusky shark mortality, and their associated anticipated ecological and socioeconomic impacts, are outlined in Table 2.12.

Table 2.12 Potential alternatives beyond quotas and retention limits to reduce dusky shark mortality.

Alternative	Ecological Impacts	Social/Economic Impacts
1. Create bycatch caps for dusky sharks in commercial and recreational HMS fisheries.	-Beneficial ecological impacts could be realized if bycatch caps reduce fishing mortality of dusky sharks.	-Adverse economic impacts could occur if a bycatch cap for dusky sharks was reached and the associated commercial or recreational fishery is closed.
2. Increase dusky shark outreach efforts to the recreational shark fishing community.	-Beneficial ecological impacts could be realized if increased outreach efforts to the recreational community reduce fishing mortality of dusky sharks.	-Neutral socioeconomic impacts are anticipated because dusky sharks are already prohibited from recreational retention.

2.1.4 Sandbar Sharks

2.1.4.1 TAC Alternatives for Sandbar Sharks

The SEDAR 21 assessment found that while sandbar are still considered to be overfished (SSF2009/SSFMSY = 0.51-0.72), overfishing is no longer occurring. Current management

measures, implemented in Amendment 2 to the Consolidated HMS FMP in 2008, may have stopped overfishing on sandbar sharks. There is also a greater than 70 percent probability of rebuilding by 2070, the current rebuilding timeframe, with the 2008 TAC of 220 mt ww. Maintaining current sandbar prohibitions in the commercial and recreational fisheries, and current TAC (220 mt ww) would allow for rebuilding of the stock and limited commercial harvest of sandbar sharks within the shark research fishery, after accounting for recreational landings and all other sources of sandbar shark mortality. The stock assessment also found that if the TAC were modified to be 178 mt ww, then the rebuilding timeframe could be shortened by 4 years to 2066 and still maintain a 70 percent chance of rebuilding. A 44 mt dw reduction in the sandbar shark TAC could result in a reduction in the commercial shark research fishery sandbar shark quota. Currently, the only fishery that can land sandbar sharks is the commercial shark research fishery, which has a sandbar shark quota of 87.9 mt dw, and is limited to only a few boats. This sandbar shark quota will increase to 116 mt dw in 2013. TAC alternatives, and their anticipated associated ecological and socioeconomic impacts, are outlined in Table 2.13.

Table 2.13 Potential sandbar shark TAC alternatives.

Alternative	Ecological Impacts	Social/Economic Impacts
1. No Action: Maintain current sandbar shark management measures and current TAC (220 mt ww).	- Stock assessment indicates that the sandbar stock is on schedule to rebuild by 2070 under the current TAC and management measures. - Maintaining current prohibitions and restrictions would allow the continued rebuilding of this stock and could result in beneficial ecological impacts.	- Socioeconomic impacts in the short-term could be neutral, as the status quo does not induce any new/additional hardships. Beneficial impacts may be seen if the stock rebuilds and fishing opportunities increase in the future.
2. Reduce the sandbar shark TAC to 178 mt ww.	- Stock assessment indicates that the sandbar stock could rebuild by 2066 by reducing the current TAC to 178 mt ww. - Reducing the TAC would have similar beneficial ecological impacts as alternative 1, and could rebuild the sandbar shark stock by the year 2066 instead of 2070.	- Reduction of the TAC could result in adverse socioeconomic impacts on commercial fishermen, as the shark research fishery sandbar shark quota may have to be reduced with a lower TAC.

2.2 Commercial At-vessel Mortality and Discard Reduction

Currently, dusky, sandbar, and scalloped hammerhead sharks all have certain restrictions that prohibit their harvest in commercial and recreational fisheries. Dusky sharks are on the prohibited sharks list and cannot be retained in commercial and recreational fisheries. Sandbar sharks are only authorized to be retained by commercial shark vessels that have a shark research permit and are on a shark research fishery trip with a NMFS-approved observer onboard. Retention of sandbar sharks in commercial and recreational fisheries is otherwise prohibited.

Scalloped hammerhead sharks are prohibited from retention by commercial vessels using PLL gear and by recreational vessels that also are retaining tuna, swordfish, or billfish.

Time/Area closures (see Section 2.3) could reduce mortality on these species by avoiding interactions with fishing gear, but additional measures that minimize mortality when these species interact with fishing gear may also prove effective at reaching rebuilding goals. Minimizing at-vessel mortality of sharks (sharks captured by fishing gear that arrive at the vessel dead) could also reduce discards of species that are undesirable or prohibited for commercial retention. This section explores management alternatives that could reduce at-vessel mortality of sharks captured in directed shark fisheries and as bycatch in other commercial fisheries by considering potential alternatives related to managing soak time, tending fishing gear, and modifying the current fishing hooks used in the BLL fishery.

2.2.1 Managing Soak Time of Fishing Gear

At-vessel mortality rates of sharks are highly variable from species to species and between gear types (e.g., gillnet vs. BLL). Soak time, meaning the time the fishing gear is in the water, has been shown to be correlated with at-vessel mortality on a variety of species of sharks (Morgan and Burgess 2007). Morgan and Burgess (2007) examined BLL observer data from 1994-2005 to assess at-vessel mortality rates of five species of sharks, which included scalloped hammerhead, dusky, and sandbar sharks. For all five of these species, the longer the soak time the higher the at-vessel mortality rate. Overall, scalloped hammerhead, dusky, and sandbar sharks had at-vessel mortality rates on BLL gear of 91.4, 81.1, and 36.1 percent, respectively (Morgan and Burgess 2007). This means that over 90 percent of all scalloped hammerhead sharks and over 80 percent of dusky sharks that were observed caught by BLL gear from 1994-2005 were dead before they got to the vessel. Morgan et al. (2009) looked at the same BLL observer data from 1994-2003 and blacknose sharks had an at-vessel mortality rate of approximately 70 percent. Morgan et al. (2009) also examined the effect of soak time on at-vessel mortality of shark species commonly caught in the BLL shark fishery, including dusky, sandbar, scalloped hammerhead, and blacknose sharks. To do this, soak time was binned in four hour increments, and the at-vessel mortality rate for each soak time period was calculated (Table 2.14). At-vessel mortality rates generally increased as soak times increased for all four species, and tended to increase in sets that soaked longer than eight hours (Table 2.14). In the gillnet fishery, scalloped hammerhead sharks had an observed at-vessel mortality rate of almost 77 percent from 2009-2010. Currently, the NMFS Southeast Fishery Science Center (SEFSC) Panama City Laboratory is conducting research on the effect of BLL soak time on the at-vessel mortality rate of scalloped hammerhead sharks. By using hook timers, which will account for the actual time that each shark is on the hook, they will be able to better quantify the length of time that scalloped hammerhead sharks can tolerate capture stress and survive. This information could be used to help determine if soak time restrictions are an effective means of minimizing scalloped hammerhead at-vessel mortality rates.

Table 2.14 At-vessel mortality rates (numbers in percent dead) of blacknose, dusky, sandbar, and scalloped hammerhead sharks observed caught in the shark BLL fishery from 1994-2003. Source: Morgan et al. 2009.

Soak Time (hours)	Blacknose	Dusky	Sandbar	Scalloped Hammerhead
0-4	11.3	50.0	6.5	60.0
4-8	34.8	15.4	12.7	67.9
8-12	84.9	65.8	18.9	85.0
12-16	84.4	68.1	21.8	92.6
16-20	78.3	81.8	38.5	96.1
20-24	75.0	75.0	51.3	98.0
24+	100	70.0	47.1	100

*Contradictory patterns where at-vessel mortality decreased as soak time increased is believed to be the result of low sample sizes in certain soak time bins (Morgan et. al., 2009).

NMFS BLL observers also collect gear characteristic data with regard to the number and types of hooks used, the length of the mainline, the depth of water fished, and the soak time of BLL sets. These data are collected on non-sandbar LCS fishing trips that are observed, as well as on observed sandbar shark research fishery trips, which generally target sandbar sharks. According to the 2010 observer report, mainline length, mean number of hooks, and soak time were all higher, on average, on non-sandbar LCS trips taken outside of the research fishery, and gear was fished in deeper water during shark research fishery trips (Table 2.15).

Table 2.15 Gear characteristics of sets observed by the NMFS BLL observer program from 2005-2010.

Fishing Year	Region and Target species (in parenthesis)	Mainline Length (km)	Depth (m)	Mean # of Hooks	Soak Time (hours)
2005 and 2006	Atlantic (Sandbar Shark)	14.9	56.4	559	11.9
2005 and 2006	Gulf of Mexico (Sandbar Shark)	13.5	39.4	507	9.2
2007	Atlantic (Sandbar Shark)	21.1	40.2	587	11.9
2007	Gulf of Mexico (Sandbar Shark)	18.1	25.4	603	10.9

Implementation of Amendment 2 to the HMS FMP					
2008	Atlantic (Non-sandbar LCS)	16.0	16.2	385	11.5
2008	Gulf of Mexico (Non-sandbar LCS)	15.2	37.9	552	11.3
2009	GOM/Atl (Sandbar Shark Research Fishery)	20.3	62.5	403	20.3
2009	GOM/Atl (Non-sandbar LCS)	13.7	20.1	367	13.7
2010	GOM/Atl (Sandbar Shark Research Fishery)	4.8	40	312	12.8
2010	GOM/Atl (Non-sandbar LCS)	6.4	26.5	421	16

Modifications to the LCS shark trip limit (from 4,000 lbs to 33 non-sandbar LCS per trip) and prohibiting the retention of sandbar sharks outside the shark research fishery implemented by Amendment 2 to the Consolidated HMS FMP, has had some impact on how the commercial BLL shark fishery is prosecuted. The average number of hooks and mainline length per set seems to have decreased (Table 2.15, Figure 2.1, and Figure 2.2) since 2008. Prior to Amendment 2, the annual average number of hooks per set from 2005-2007 was 564 on observed BLL trips targeting sharks. After the implementation of Amendment 2, the annual average of hooks per set from 2008-2010 was 407 on observed BLL trips targeting sharks. Annual average mainline length has also decreased over the same time period, from 16.9 km prior to Amendment 2 to 12.7 km miles post Amendment 2. While both the number of hooks and mainline length has decreased since the implementation of Amendment 2, the soak time of BLL gear has increased, from 11 hours prior to Amendment 2 to 14.3 hours post Amendment 2 (Table 2.15 and Figure 2.3). This suggests that reductions in fishing effort as a result of Amendment 2 are not as pronounced as the reduction in hooks per set because the time that hooks are fished has increased.

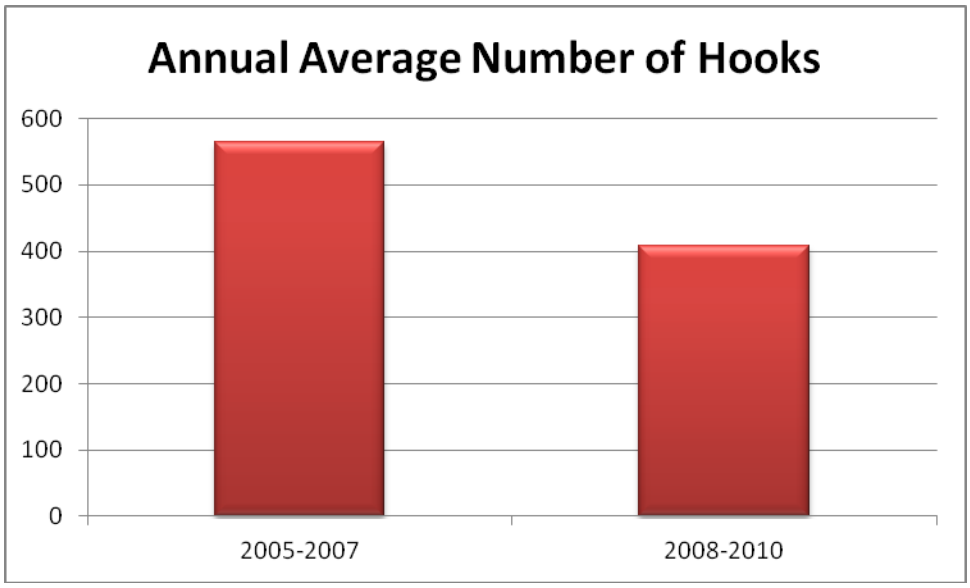

Figure 2.1 **Annual average number of hooks used per BLL set observed from 2005-2010.**

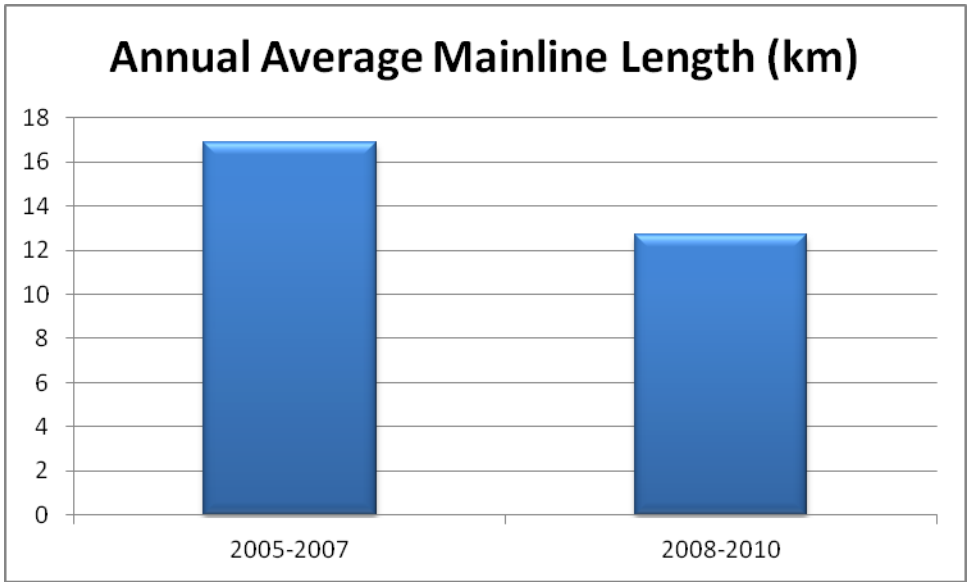

Figure 2.2 **Annual average mainline length per BLL set observed from 2005-2010.**

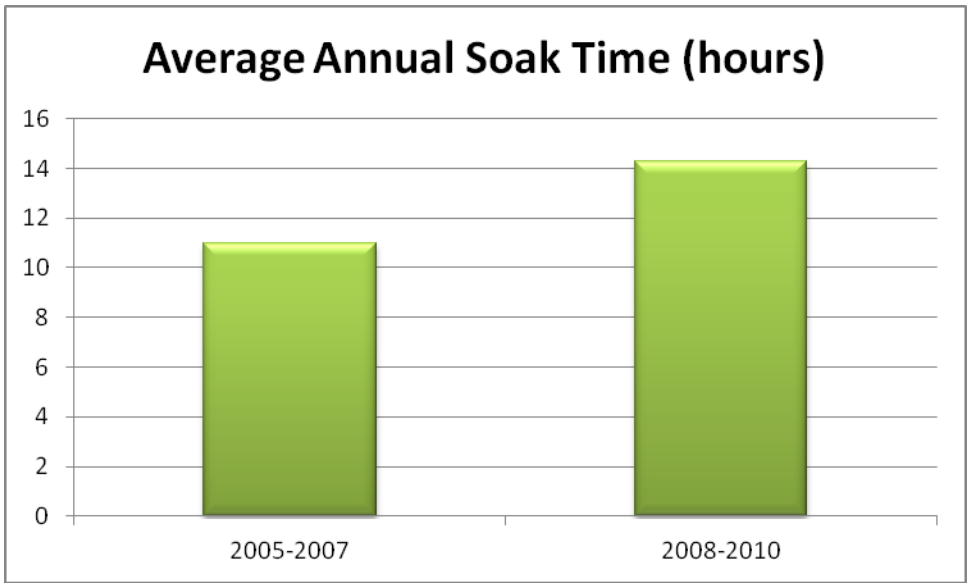

Figure 2.3 **Annual average soak time per BLL set observed from 2005-2010.**

Observed gillnet set processing time (the time the gear is initially put in the water until the time all of the gear is removed from the water) and percentage of sharks caught in observed gillnet fisheries since 2005 has decreased since the implementation of Amendment 2 (Figure 2.4, Figure 2.5, and Figure 2.6). The data suggests that there has been a shift away from gillnets targeting sharks to targeting teleost fish. Because of the shift away from targeting sharks and generally short set processing times for gillnet gear, alternatives for restricting soak time in gillnet gear may not be effective in reducing shark mortality.

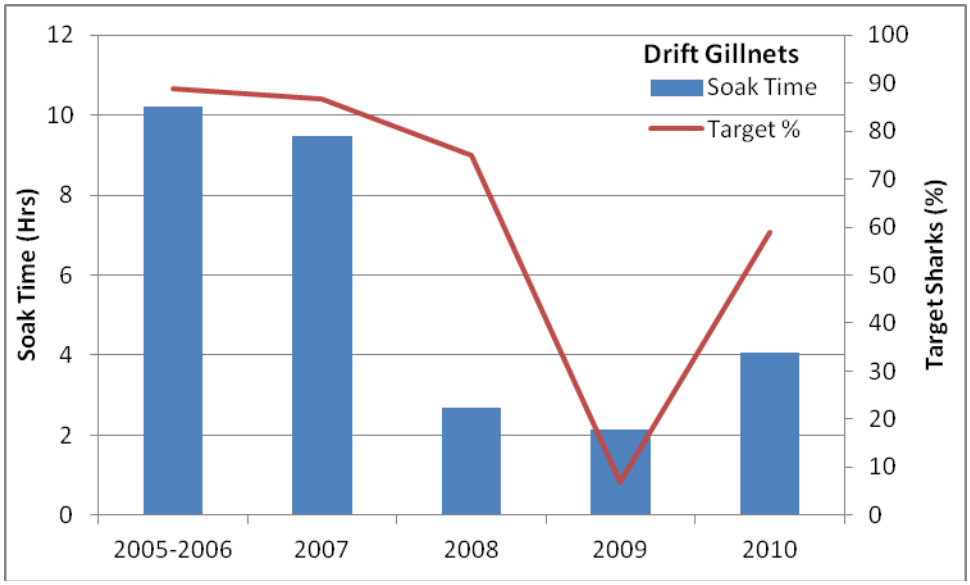

Figure 2.4 **Observed drift gillnet average soak times and percentage of shark catch from 2005-2010.**

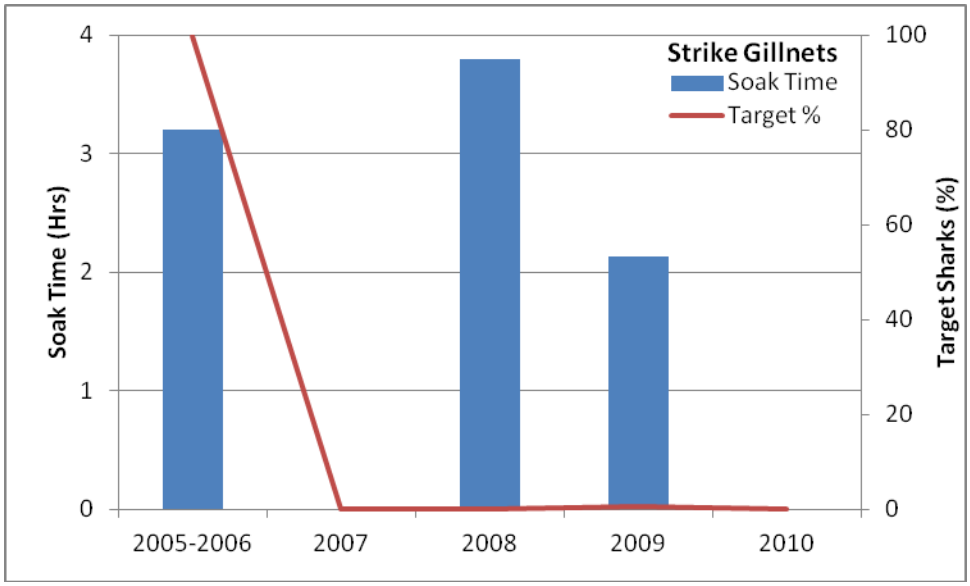

Figure 2.5 **Observed strike gillnet average soak times and percentage of shark catch from 2005-2010. No trips were observed in 2007.**

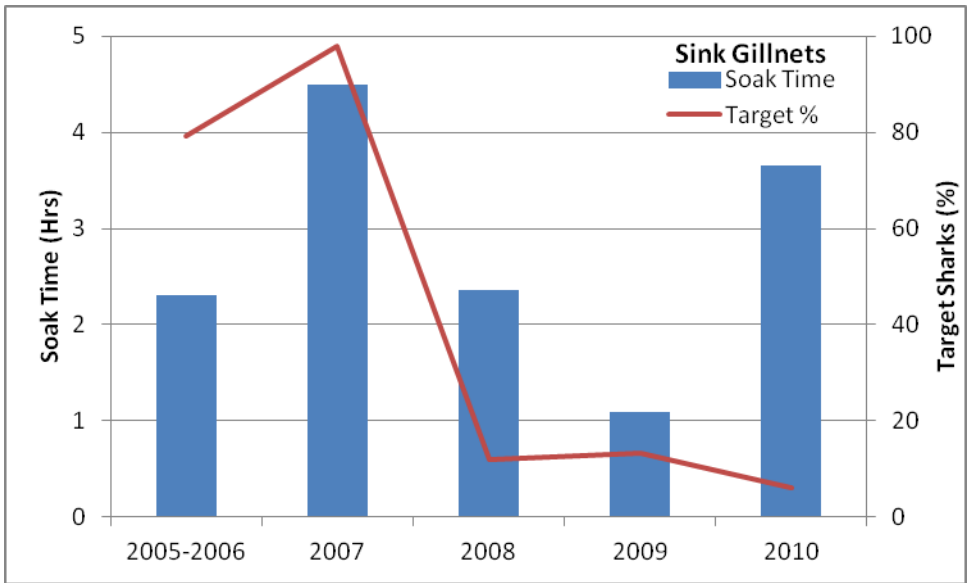

Figure 2.6 **Observed sink gillnet average soak times and percentage of shark catch from 2005-2010.**

Potential alternatives to reduce soak time in the BLL shark fishery in order to decrease at-vessel mortality and reduce waste are outlined below in Table 2.16. Soak time is the total elapsed time that the gear is in the water and fishing. It may be difficult to enforce and monitor a soak time restriction setting a certain amount of time for setting gear. Furthermore, unforeseeable issues may occur while setting or hauling back the gear (e.g., mainline breaks,

gear becomes entangled) which can affect soak time. Thus, the soak time restriction alternatives that NMFS is considering analyzed currently would be limited to time-of-day restrictions rather than actual soak time (number of hours) restrictions, due to difficulties in enforcing an actual soak time restriction. Although, if ways are found to adequately enforce an actual soak time restriction and/or address the safety issues, these options may be explored in the DEIS alternatives. Restricting the number of hooks on board BLL vessels targeting sharks may also be a way to reduce shark at-vessel mortality, especially for species that are prohibited and not directly targeted, and potential alternatives are discussed in Section 2.2.3. Restricting the length of the mainline for BLL sets is also considered in this predraft, but because enforcement difficulties with determining mainline length on the water and that because limiting mainline length is essentially a de facto hook restriction, this management option will not be further analyzed at this time, although comment is invited.

Table 2.16 Potential alternatives for regulating soak time in the commercial shark BLL fishery

Alternative	Ecological Impacts	Social/Economic Impacts
1. No Action. Do not implement gear soak time restrictions.	- No incentive to reduce soak time and increase chances of live release of sharks, resulting in adverse ecological impacts in the short term and long-term.	- The no action alternative would continue to provide more flexibility in fishing technique and allows fishermen to continue to set gear for long periods of time. If at-vessel mortality of sharks caught as bycatch continues to be high, adverse socioeconomic impacts could occur in the long-term if further restrictions are necessary to rebuild already overfished shark stocks (e.g., scalloped hammerhead, dusky).
2. BLL gear used in the directed shark fishery may only be in the water at night, from 7 pm to 7am local time.	- Shortens possible soak times leading to reduced catch of target and non-target species, and maximizing the probability of live-release of non-target species, which could lead to beneficial ecological impacts.	- Adverse socioeconomic impacts may occur due to reduced flexibility in fishing technique and if shortened soak times reduces catch levels. -Limiting the time of day that fishing gear could be in the water could have safety at-sea implications. - Would require VMS in order to declare that vessel was participating in a directed shark BLL trip.
3. BLL gear used in the directed shark fishery may only be in the water during the day, from 7 am to 7 pm local time.	- Shortens possible soak times leading to reduced catch of target and non-target species, and maximizing the probability of live-release of non-target species, which could lead to beneficial ecological impacts.	- Adverse socioeconomic impacts may occur due to reduced flexibility in fishing technique and if shortened soak times reduces catch levels. -Limiting the time of day that fishing gear could be in the water could have safety at-sea implications. - Would require VMS in order to declare that vessel was participating in a directed shark BLL trip.

2.2.2 Gear Tending Measures

Gear tending measures would require vessel operators to leave fishing gear attached to their vessels or remain in the vicinity (i.e., 1 nautical mile) of their gear during fishing activities. The intent of these measures is to minimize the time that fishing gear, specifically BLL gear being used to target sharks, remains in the water. Furthermore, they would also ensure that

operators are near their fishing gear when it is actively fishing. Anecdotal evidence from participants in the shark fishery indicates that fishermen will often haul their gear until they have brought one retention limit of non-sandbar LCS (33 fish) on the vessel, cease hauling the gear and redeploy, leaving any remaining gear unattended until they have landed the first limit. While it is likely that this has been occurring for some time, the practice has become more prevalent since implementation of a more restrictive retention limit that does not allow sandbar sharks to be landed outside the shark research fishery in 2008. Vessels then return to their gear after landing and resume haulback until all of the gear has been retrieved. Leaving gear unattended and actively fishing for extended periods diminishes the likelihood that any sharks are still alive at haulback, may increase interactions with protected resources, and may also compromise safety at sea by leaving gear unattended. Leaving sharks on the line for extended periods also decreases the quality of the product, potentially reducing revenues from shark meat. In Table 2.17, NMFS considers gear tending potential alternatives, and their anticipated associated ecological and socioeconomic impacts.

Table 2.17 Potential gear tending requirement alternatives

Alternative	Ecological Impacts	Social/Economic Impacts
1. No Action. Do not require BLL gear to be tended.	- Gear that is temporally unattended and soaking for long periods of time may result in regulatory discards and minimize chances for live release of sharks and bycatch. Gear may be lost and could continue to catch fish and/or protected resources. This could have adverse ecological impacts to shark stocks that are already overfished.	- Neutral economic impacts. While fishermen can make multiple trips from one set of gear (efficient use of fishing gear), they need to use additional fuel to steam back and forth to the fishing grounds. -Extended soak times may reduce the quality of product and decrease the ex-vessel price. Fishermen would not need to spend time tending gear, allowing continued flexibility in fishing technique resulting in neutral economic impacts.
2. Require that BLL gear used by vessels with a shark permit remain attached to the vessel at all times.	- Beneficial ecological impacts could result because gear could not be temporally unattended during fishing activities. This could reduce target catch and bycatch, and allow for catch can be more quickly retrieved, maximizing the potential for live release of unwanted sharks, other bycatch or protected resources.	- May result in negative socioeconomic impacts by reducing fishermen's flexibility in fishing technique - Might create safety at sea issues if keeping the gear attached comprises vessel maneuverability.
3. Require that vessels with a shark permit that are using BLL gear remain within 1 nautical mile of the gear	- Same as Alternative 2	- Same as Alternative 2, except vessels would not experience the same safety at sea issues that may arise from being continually attached to the gear.

2.2.3 Modifying Bottom Longline Hook Requirements

Potential alternatives that would affect fishing methods, including quantity and type of hooks deployed may be an effective method for reducing fishing mortality and contribute to rebuilding of overfished stocks. Logbook and observer data indicate that fishermen have not made significant modifications to the quantity of BLL fishing gear (mainline length and number of hooks) deployed since 2008 despite significant reductions (approximately 70 percent) to the retention limit for large coastal sharks and removing sandbar sharks from the list of authorized LCS species outside the research fishery. In other words, fishermen appear to be setting their gear in a manner that could result in exceeding the LCS retention limit. Observer data indicated that in the years preceding implementation of Amendment 2 (2005-2007) vessels were deploying between 13.5–21.1 miles of mainline, and setting between 507-602 hooks/set, and setting the gear for 9.2-11.9 hours on average (Table 2.15; Figure 2.3). Between 2008 and 2010, following implementation of Amendment 2, vessels deployed between 4.8-16 miles of mainline, between 312-552 hooks/set, and are setting gear between 11.3-20.3 hours on average (Table 2.15; Figure 2.3). Longer soak times can result in increased levels of bycatch, increased dead discards, more interactions with protected resources, and diminished post release survival for target and non-target species. The intent of these alternatives would be to reduce total hook hours in the BLL fishery by limiting the number of hooks deployed per set in order to minimize the number of potential interactions with sharks caught on BLL gear. Reducing the number of interactions may also lead to reduced numbers of dead discards, increased post release survival, and reduced fishing mortality of blacknose, dusky, sandbar, and scalloped hammerhead sharks. Potential alternatives for BLL hook requirements, and their anticipated associated ecological and socioeconomic impacts, can be found in Table 2.18.

Table 2.18 Potential bottom longline hook requirement alternatives

Alternative	Ecological Impacts	Social/Economic Impacts
1. No Action: Maintain existing measures (unlimited number of corrodible hooks on BLL vessels targeting sharks).	- Potentially negative ecological impacts by allowing an unlimited number of hooks to be deployed and not implementing gear restrictions that may result in reduced interactions with sandbar, dusky, blacknose, and scalloped hammerhead sharks.	- Neutral economic impacts as current gear practices would not change.

2. Restrict the number of hooks that can be deployed per set and the total number of hooks that can be possessed onboard bottom longline vessels with directed shark permits.	- Potentially beneficial ecological impacts expected by reducing the quantity of hooks that can be deployed, which could reduce interactions with protected resources/prohibited species and minimize highgrading/dead discards.	- Some adverse economic impacts to BLL fishermen targeting sharks if reducing the number of hooks results in reduced catch of sharks and bycatch of other marketable Council managed species. Although, there may be some beneficial economic impacts form improvements in product quality. - Socioeconomic impacts of restricting the number of hooks is also related to selection of other measures in this section (i.e., soak time). - VMS or a call in requirement may be necessary to implement this alternative because fishermen may need to declare a shark fishing trip which would have additional adverse socioeconomic impacts. Alternatively, they may need to declare out of the shark fishery to go fishing for a different species.

2.2.4 Potential Alternatives Considered but Not Further Analyzed in Predraft

2.2.4.1 Require the Use of Modified or Alternative Hooks in Commercial Shark Fisheries

An alternative that would require commercial shark permit holders to use weak hooks in longline fisheries targeting sharks is considered in this document but not further analyzed in the predraft. NMFS invites comments on that approach. This alternative would require commercial shark permit holders to use weak hooks, similar to those required in the PLL fishery in the Gulf of Mexico, which are of a smaller gauge thickness than hooks generally used in the fishery, to allow large bluefin tuna to "straighten" hooks and increase post hooking survival as a result. Ecological benefits may result by protecting some species of subadult sharks until they have had a chance to reproduce, however, because of the range in size at maturity among shark species it may be difficult discerning which gauge hook to use to ensure these benefits. Compared to spawning bluefin tuna, which are substantially larger than other species being targeted on PLL gear, shark species vary extensively in size and weight relative to target species, making selection of one particular weak hook size challenging. Furthermore, sharks may interact with the hook and bait differently than bluefin tuna which hit the hook at a higher rate of speed increasing the likelihood that a larger fish will straighten the hook more quickly. Also, precise location and seasons of pupping for many shark species is not known, and the use of weak hooks may not have a direct impact on large, pregnant females if fishing effort is not taking place in pupping areas during the pupping season.

There has also been some research on the use of Selective Magnetic and Repellant Treated (SMART) hooks. Results indicate that these hooks may result in a reduction in the number of shark interactions with some species in both commercial and recreational fisheries. An alternative that require the use of these types of hooks may be more appropriate for recreational vessels that are targeting billfish, swordfish, or tunas because of the reduced costs compared to commercial vessels. This alternative is considered but not further analyzed at this time because of the potential economic impacts to the BLL and PLL fisheries and because the positive ecological benefits for blacknose, sandbar, dusky, or scalloped hammerhead sharks have not been demonstrated. NMFS invites comments on that potential approach.

Some studies have shown that the use of circle hooks in some other commercial and recreational fisheries has resulted in positive ecological impacts for target species, incidental catch, and protected resources. For example, research has shown that the use of large circle hooks (18/0 or larger) in combination with finfish bait on PLL gear is an effective mitigation measure for sea turtle (Cheloenidae) bycatch (Watson et al. 2005). These studies have shown that circle hooks are less likely to be ingested by various fish species than J-hooks. Rather, circle hooks typically lodge in the jaw area where they can be more easily removed and are less likely to result in ingestion, bleeding, and elevated levels of post-hooking mortality. Mouth-hooking has been indicated as resulting in a higher post-release survival compared to deep-hooking (Grover et al. 2002; Lukacovic and Uhhoff 2002; Skomal et al. 2002). However, the effect of circle hooks is not the same for all species. Some studies have indicated increased shark catch rates due to circle hook use whereas other studies have indicated decreased shark catch rates; therefore, their conservation benefit for some species, such as pelagic sharks, may be mixed (Curran and Bigelow 2001; Swimmer et al. 2011; Afonso et al. 2007). While the proportion of circle hooks used on observed BLL trips targeting sharks varies from year, on average, between 31 and 56 percent of sets used either 18/0 or 20/0 circle hooks (2008-2010). NMFS is interested in collecting additional information on the use of circle hooks in recreational fisheries targeting sharks. Ecological benefits of requiring circle hooks in recreational fisheries may be more pronounced because of the fact fish caught on circle hooks may be less likely to ingest the hook which may facilitate expedited release and reduce physical damage to prohibited or undersized sharks caught. This alternative is considered but not further analyzed because the Agency is not aware of any shark specific research demonstrating the performance of circle hooks in reducing shark mortality in BLL fisheries. NMFS invites comments on that potential approach. This research should be completed and indicate positive ecological impacts prior to implementing a circle hook requirement for the BLL shark fishery.

2.2.4.2 Bottom Longline Gangion Length

At-vessel mortality rates for dusky, sandbar, and scalloped hammerhead sharks tend to be lower on PLL gear than BLL gear, according to data collected from the NMFS Pelagic Observer Program (POP). When comparing scalloped hammerhead, dusky, and sandbar sharks, using POP data from 1992-2004 (Keene et al. 2007), scalloped hammerhead sharks still had the highest at-vessel mortality rate, but their PLL at-vessel mortality rate of 58.3 percent was lower than their at-vessel mortality rate of over 90 percent on BLL gear. The same was true for dusky (39.2 percent at-vessel mortality rate, compared to over 80 percent on BLL) and sandbar (18.3 percent

PLL at-vessel mortality rate, compared to over 30 percent for BLL). One difference between PLL and BLL gear is the gangions in the PLL fishery are generally longer than the gangions in the BLL fishery. Longer gangions may provide sharks that are ram ventilators a greater area of mobility when hooked and may be beneficial for these species as they are required to continually swim to pump water over their gills. Dusky, sandbar, and scalloped hammerhead sharks are all ram ventilators, and all experience a reduction in at-vessel mortality on PLL gear compared to BLL gear, although there may be a variety of other factors that may be responsible for the lower PLL at-vessel mortality rate. Because of an unknown causal effect of longer gangions on shark at-vessel mortality, alternatives for gangion length were not further analyzed for the purposes of the pre-draft, although NMFS invites comments on that approach.

2.3 Time/Area Closures

Alternatives exploring additional time/area closures may be an effective means of achieving Agency objectives specific to this rulemaking, including reducing fishing mortality to prevent overfishing in the short-term thereby allowing overfished stocks to rebuild. Time/area closures are one type management method that prevents fish from interacting with fishing gear, thus reducing bycatch mortality and discards. These closures can be designed to prevent interactions in an area important to the species (e.g., nursery area) or could be designed to mitigate hotspot areas. However, time/area closures can also result in fishing pressure moving to other areas, which could potentially compromise these objectives. In HMS fisheries, time/area closures have typically been implemented on a gear specific basis (i.e., PLL, BLL, and/or gillnet) due to elevated interactions with target or incidental catch of during a specific time in a particular region. The first time/area closure for HMS was implemented in the 1999 FMP with the Northeastern U.S. closure off New Jersey in June 1999 to reduce bluefin tuna discards. Since then, additional closures have been implemented in the DeSoto Canyon (2000), Florida East Coast (2001), Charleston Bump (2001), and Northeast Distant (2001). These time/area closures are all specific to PLL gear. BLL gear closures have also been implemented off of the Mid-Atlantic (2005), the Caribbean (2007), and in the South Atlantic and Gulf of Mexico (Madison Swanson, Steamboat Lumps, and the Edges) to complement closures implemented by the respective regional fishery management councils for Council-managed species (2006, 2008). There are also specific gillnet restrictions, including areas where use of gillnet gear is restricted or prohibited to reduce interactions with whales in conjunction with the Atlantic Large Whale Take Reduction Plan. Existing time/area closures have reduced bycatch, minimized interactions with protected resources, and reduced fishing mortality of target species.

Despite existing closures, dusky sharks, which have been a prohibited species since 2000, continue to experience fishing mortality rates approximately three times that which correspond to F_{MSY} and are overfished. Sandbar sharks remain overfished, although overfishing is no longer occurring. Blacknose and scalloped hammerhead sharks are also overfished and experiencing overfishing. The Agency is analyzing logbook, observer, and other fisheries data to determine where, when, and with which types of gear, interactions with these species are occurring in order to assess the ecological, social, and economic impacts of time/area closures that could be included in the proposed rule and DEIS.

Modifications could be could be made to the timing, duration, and size of current closed areas, such as the Mid-Atlantic Shark Closed Area, that would expand ecological benefits or minimize economic impacts. NMFS could also explore adopting closure areas in other fisheries which could provide shark mortality reductions. For example, the Gulf of Mexico Fishery Management Council (GOMFMC) in 2010, as part of Amendment 31 to the Reef Fish FMP, implemented a closure for BLL gear in the Eastern Gulf of Mexico (east of 85°30' W) shoreward of 35 fathoms between June and August. Backstopping this time/area closure would prevent shark directed permit holders with BLL gear onboard from retaining sharks shoreward of the 35 fathom (210 feet) contour line between Cape San Blas (85°30' W) and the Dry Tortugas between June and August of every year. This closure was implemented by the GOMFMC to reduce loggerhead sea turtle bycatch with BLL gear in the Gulf of Mexico reef fish fishery, but might also provide reductions in shark mortality if implemented in the BLL shark fishery. These potential closure modifications, along with other alternatives regarding time/area closures, and their ecological and socioeconomic impacts are summarized in Table 2.19.

The Agency is evaluating potential modifications to existing time/area closures in addition to complementing time/area closures that have already been implemented. The following figures and tables provide additional information on interactions with blacknose, sandbar, scalloped hammerhead, and dusky sharks using fishery dependant and fishery independent data sources. Fishery dependant data are compiled from the HMS and Coastal Fisheries Logbook, which are the primary means of reporting employed by commercial shark permit holders fishing with PLL and BLL gear, respectively. Data from the BLL and Pelagic Observer programs are also included. Data from observed trips also correspond to trips documented in logbooks, therefore, figures that include both observer and logbook data include duplicative interactions. Fishery independent data is derived from two ongoing research surveys conducted by NMFS scientists from the Northeast and Southeast Fisheries Science Centers. These surveys employ standardized techniques for collecting fishery independent data and can provide additional information on areas where dusky shark interactions occur outside of the seasons and areas traditionally utilized by the commercial shark fishery. Sampling effort for the survey conducted by the Mississippi Laboratory of the Southeast Fisheries Science Center is concentrated on the Gulf of Mexico and South Atlantic regions. The APEX predator laboratory of the Northeast Fisheries Science Center includes sampling stations in the North Atlantic and South Atlantic regions.

While the figures and tables included in this section provide additional data concerning interactions with scalloped hammerhead, sandbar, blacknose, and dusky sharks, the Agency is particularly interested in getting stakeholder feedback on the utility of time/area closures to reduce fishing mortality of dusky sharks in longline fisheries. The recent stock assessment indicates that fishing mortality needs to be reduced by approximately 2/3 and elevated interactions and elevated post-hooking mortality rates are hastening recovery of the stock. Interactions with dusky sharks from observed and non-observed trip fishing trips with PLL and BLL gear and two NOAA BLL shark surveys are displayed in Appendix 1 through 5. These figures attempt to provide additional information concerning areas of elevated interactions with dusky sharks in the directed commercial shark fishery on BLL gear, in the PLL fishery (where sharks are typically caught incidentally to tunas and/or swordfish), and on two NOAA research surveys employing bottom longline gear that focus on different spatial areas. Maps created using

GIS software display the latitude and longitude of BLL and PLL sets that interacted with at least one dusky shark. Furthermore, the number of dusky shark interactions by quarter and year are also included. Preliminary observations of fishery independent and dependent data indicate that there are areas of elevated interaction rates off of the mid-Atlantic bight area on both BLL and PLL gears and in the North Atlantic bight on PLL gear.

Table 2.19 Potential time/area closure alternatives

Alternative	Ecological Impacts	Social/Economic Impacts
1. No Action: Maintain existing closures (Atlantic Large Whale Take Reduction Team measures, mid-Atlantic closure, SAFMC/Caribbean Council closures, HMS PLL closures).	- Maintains current fishing mortality levels for sandbar, dusky, blacknose, or scalloped hammerhead sharks which would result in mixed ecological impacts depending on the species.	- Long term impacts may be negative if dusky sharks continue to experience overfishing and remain in an overfished condition.
2. Modify mid-Atlantic BLL time/area closure (could change timing, change size, or include other gears such as PLL) to reduce interactions with dusky, sandbar, scalloped hammerhead, and Atlantic blacknose sharks.	- Reductions in interactions could result in beneficial ecological impacts. -Depending on timing of shark season opening dates, could increase fishing pressure in other areas and/or with other gear types which could increase shark interactions.	- Socioeconomic impacts could range from adverse to beneficial for BLL and PLL fishermen due to reduced or increased fishing opportunities (depending on how area modified). - VMS use might need to be expanded to effectively monitor the closed area resulting in additional adverse economic impacts; alternatively, if area is reduced or the timing is reduced VMS use might be reduced resulting in some positive economic impacts.
3. Modify the Charleston Bump PLL time/area closure (could change timing, size, or include other gears) to reduce interactions with dusky, sandbar, scalloped hammerhead, and Atlantic blacknose sharks.	- Reductions in shark interactions could result in beneficial ecological impacts. -Could increase fishing pressure on sharks in other areas.	- Negative socioeconomic impacts to PLL and/or BLL fishermen due to reduced fishing opportunities (depending on how area is modified). -VMS use might need to be expanded to effectively monitor the closed area resulting in additional adverse economic impacts.

Alternative	Ecological Impacts	Social/Economic Impacts
4. Implement a Closure for BLL gear in the Eastern GOM (east of 85°30' W) shoreward of 35 fathoms between June and August to reduce interactions with dusky, sandbar, scalloped hammerhead, and Gulf of Mexico blacknose sharks.	- Reductions in shark interactions could result in beneficial ecological impacts. - Could increase fishing pressure on sharks caught in other areas.	- Adverse economic impacts to BLL fishermen who hold a shark permit and fish with BLL gear (depending on timing of commercial shark fishing seasons). - VMS may be required to effectively monitor the closed area resulting in additional adverse economic impacts if the vessel does not already have a VMS unit that is approved for use in HMS fisheries.
5. Expand the ASMFC time/area closure in state waters off of Virginia, Maryland, Delaware, and New Jersey to Federal Waters between May 15 and July 15. These areas have been identified as nursery areas for various shark species and expanding the closure into Federal waters may reduce interactions with juvenile sharks and/or female sharks with pups.	- Reductions in dusky, sandbar, and scalloped hammerhead and shark interactions could occur, resulting in beneficial ecological impacts.	- Adverse economic impacts to shark directed fishermen targeting LCS in this region (depends on the timing of commercial shark fishing seasons). - VMS may be required to effectively monitor the closed area resulting in additional adverse economic impacts.

2.4 References

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APPENDIX 1 SOUTHEAST FISHERIES SCIENCE CENTER GULF OF MEXICO BOTTOM LONGLINE SURVEY MAPS AND DATA

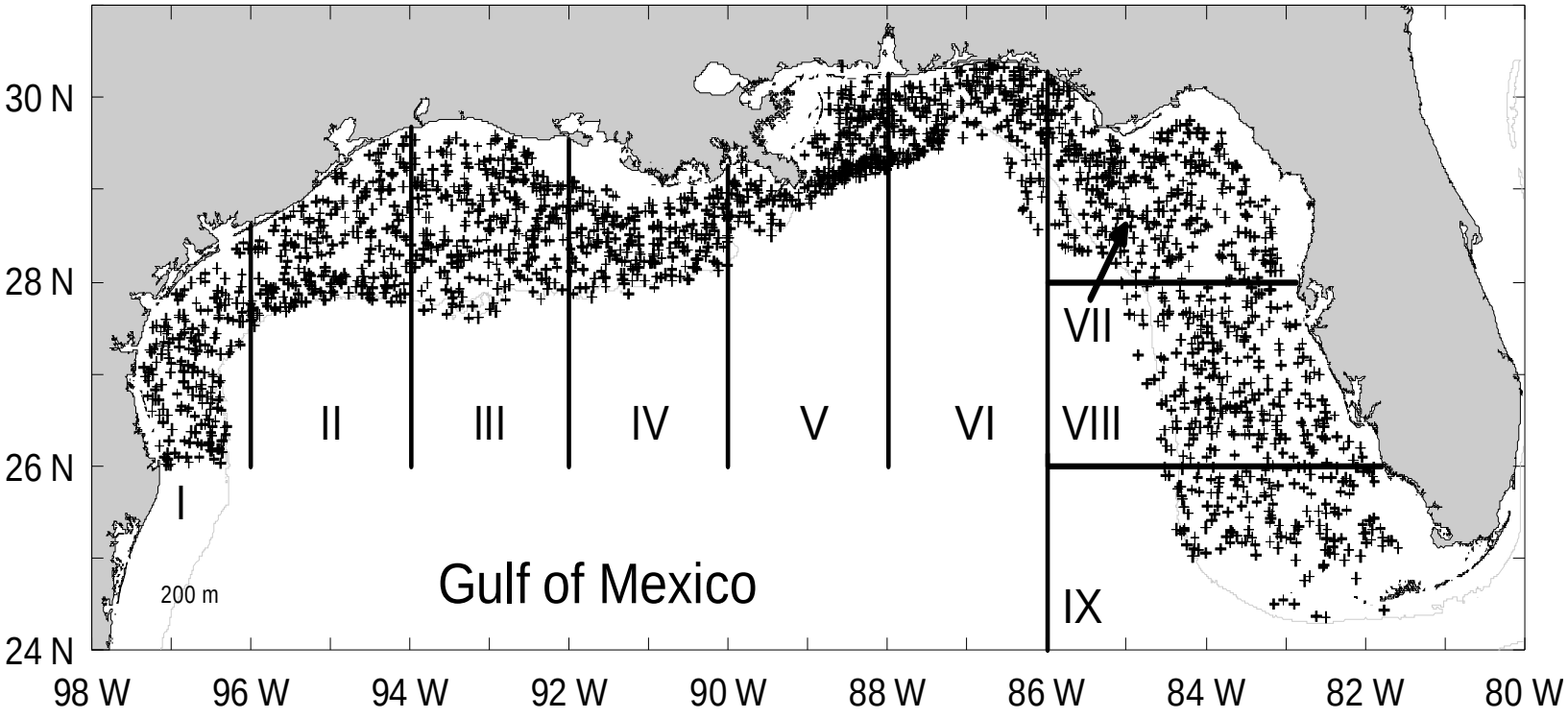

Figure 2.7 **Study area and zones (Roman numerals) used to analyze the spatial distribution of sharks caught during Southeast Fisheries Science Center Mississippi Laboratory Bottom Longline Survey. Plus signs (+) denote location of sampling stations where longline gear was deployed between 1995-2006. The 200 m isobath is shown.**

Table 2.20 **Percent species composition by zone (depicted in Figure 2.7 above) for juvenile and adult life stages combined. For example, in Zone I, western Gulf of Mexico, 81.83% of the sharks caught on the bottom longline survey were Atlantic sharpnose sharks.**

	Zone								
Species	I	II	III	IV	V	VI	VII	VIII	IX
Atlantic sharpnose shark	81.83	70.58	72.62	72.95	73.56	67.01	30.09	51.38	52.15
Blacknose shark	4.13	13.09	8.82	4.54	5.67	16.34	40.20	37.44	37.80
Blacktip shark	7.67	9.46	7.76	12.63	12.27	1.93	6.62	8.99	6.38
Bull shark	0.59	3.37	1.66	0.25	0.83	0.00	1.31	0.29	0.17
Sandbar shark	2.35	1.89	0.65	1.03	1.92	12.41	20.41	0.74	2.65
Spinner shark	3.43	1.60	8.50	8.61	5.75	2.31	1.37	1.15	0.84

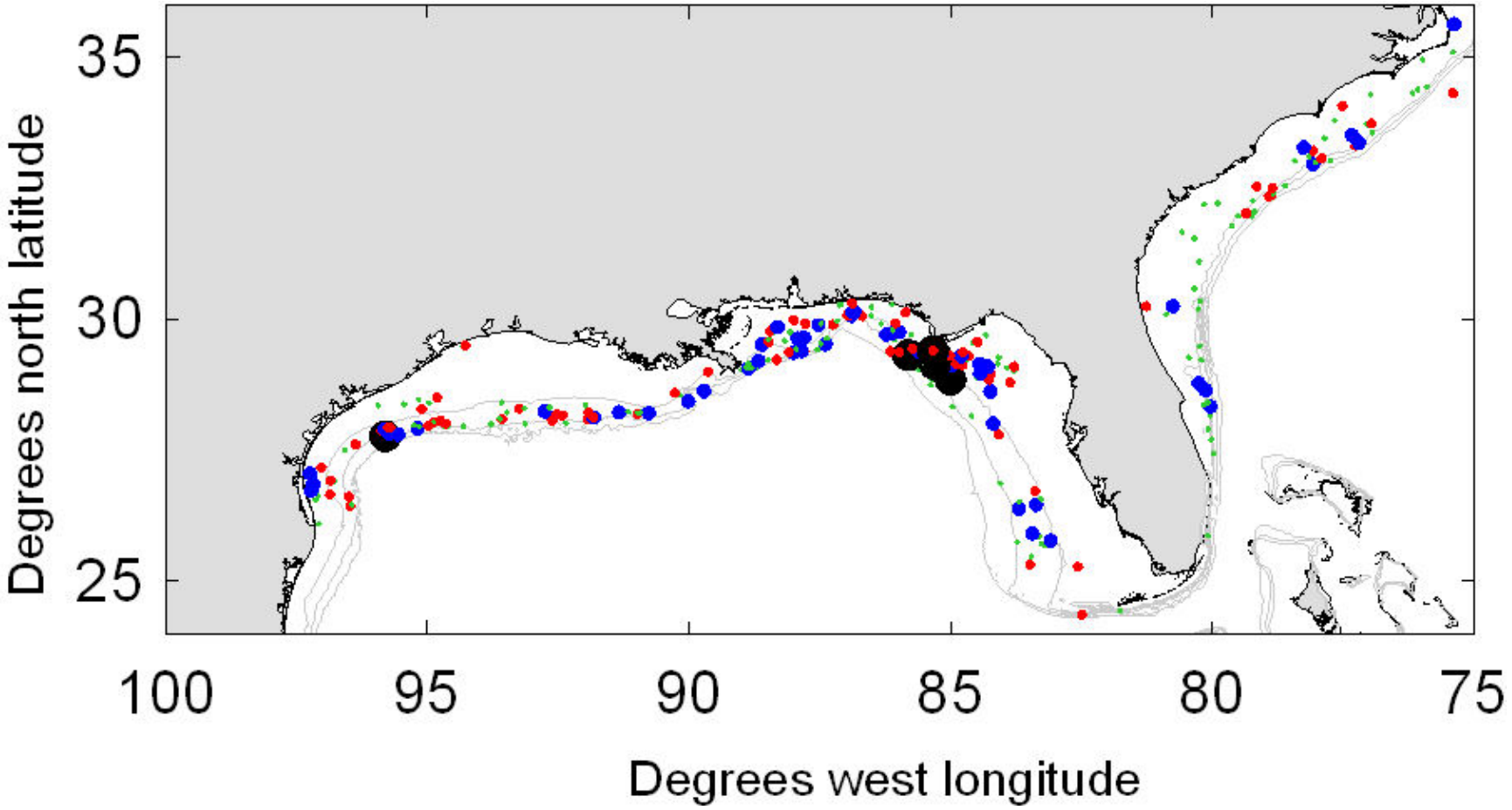

Figure 2.8 **CPUE data for sandbar shark from 3,045 bottom longline sets from 1995 through 2009 conducted by the Southeast Fisheries Science Center Mississippi Laboratory Bottom Longline Survey. Each symbol represents CPUE (number of individuals caught per 100 hook hours) at stations with a positive sandbar catch; Green: 0.1-1, Red: 1-2, Blue: 2-5, Black: 5-14.**

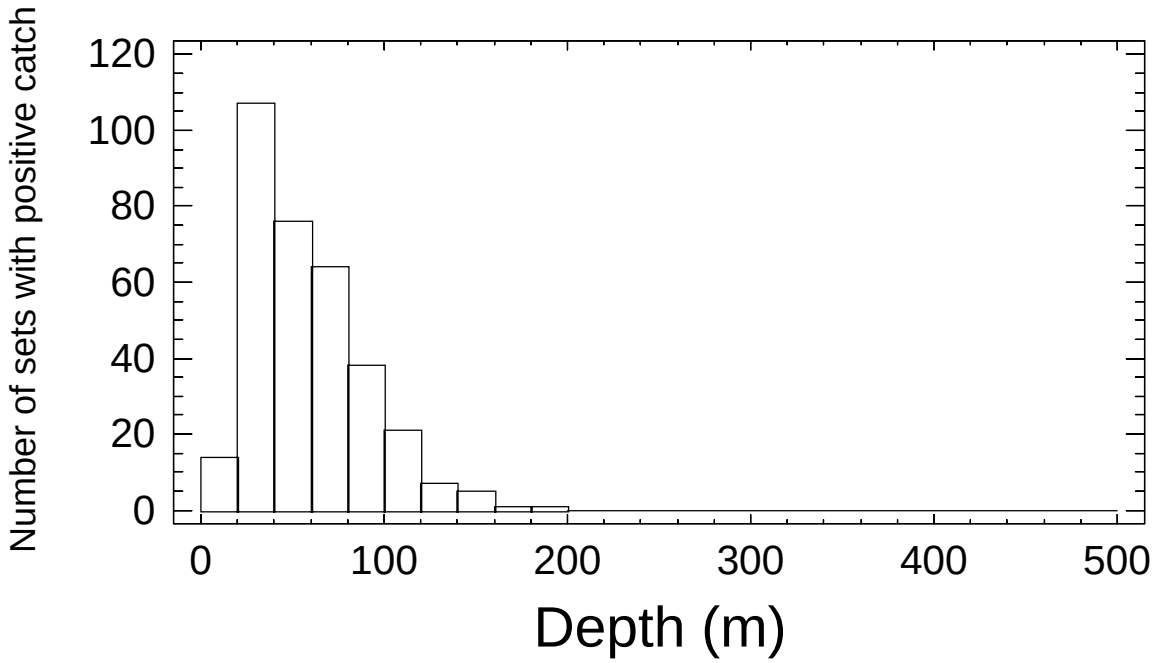

Figure 2.9 **Number of sets with positive sandbar shark catch by depth from 3,045 bottom longline sets in the Gulf of Mexico and Atlantic Ocean from 1995 through 2009 from the Southeast Fisheries Science Center Mississippi Laboratory Bottom Longline Survey.** Figure 2.8 **(above) denotes the location of sets included in the table.**

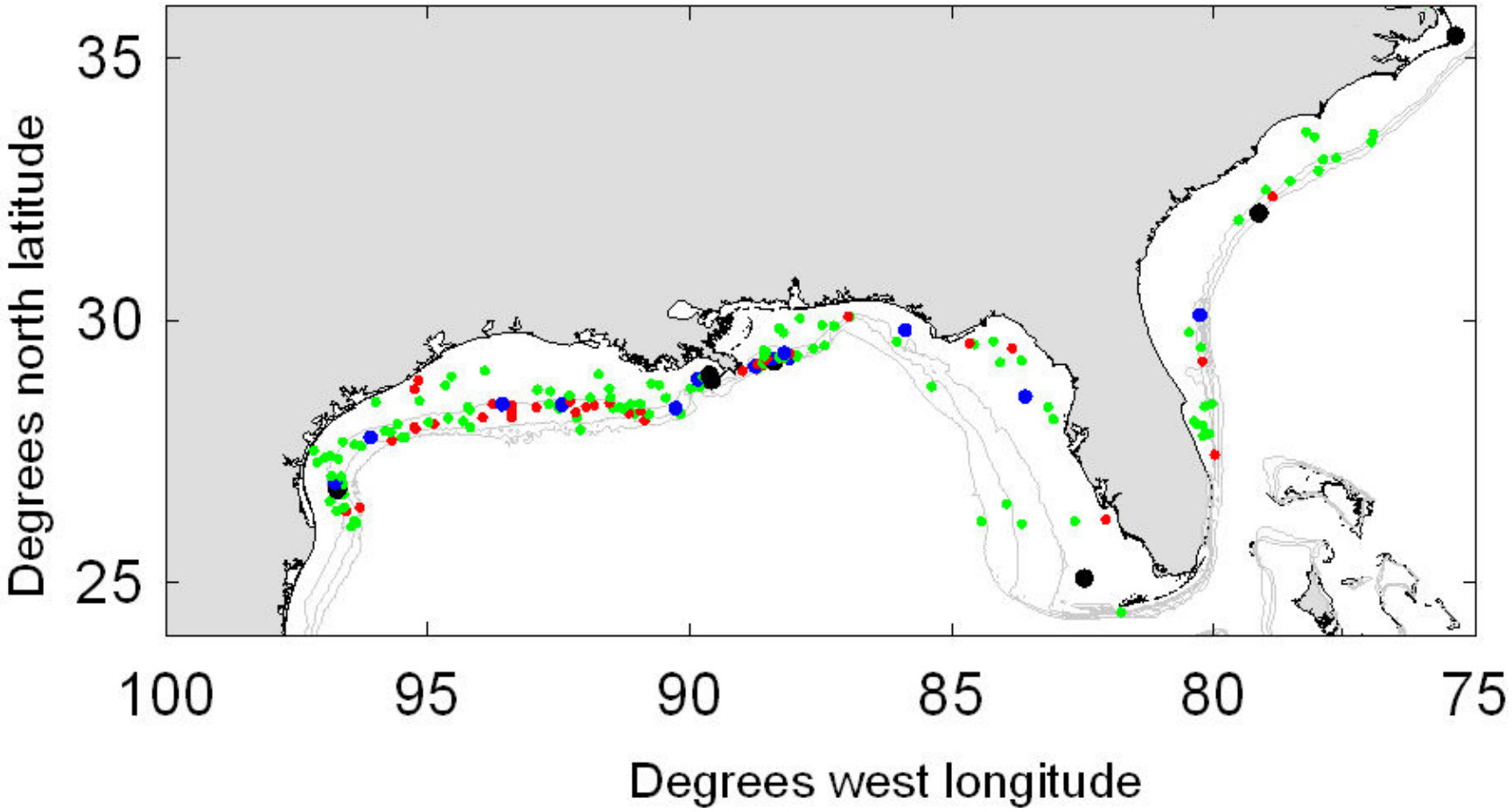

Figure 2.10 **CPUE data for scalloped hammerhead shark from 3,045 bottom longline sets from 1995 through 2009 from the Southeast Fisheries Science Center Mississippi Laboratory Bottom Longline Survey. Each symbol represents CPUE (number of individuals caught per 100 hook hours) at stations with a positive scalloped hammerhead catch; Green: 0.1-1, Red: 1-2, Blue: 2-3, Black: 3-5.**

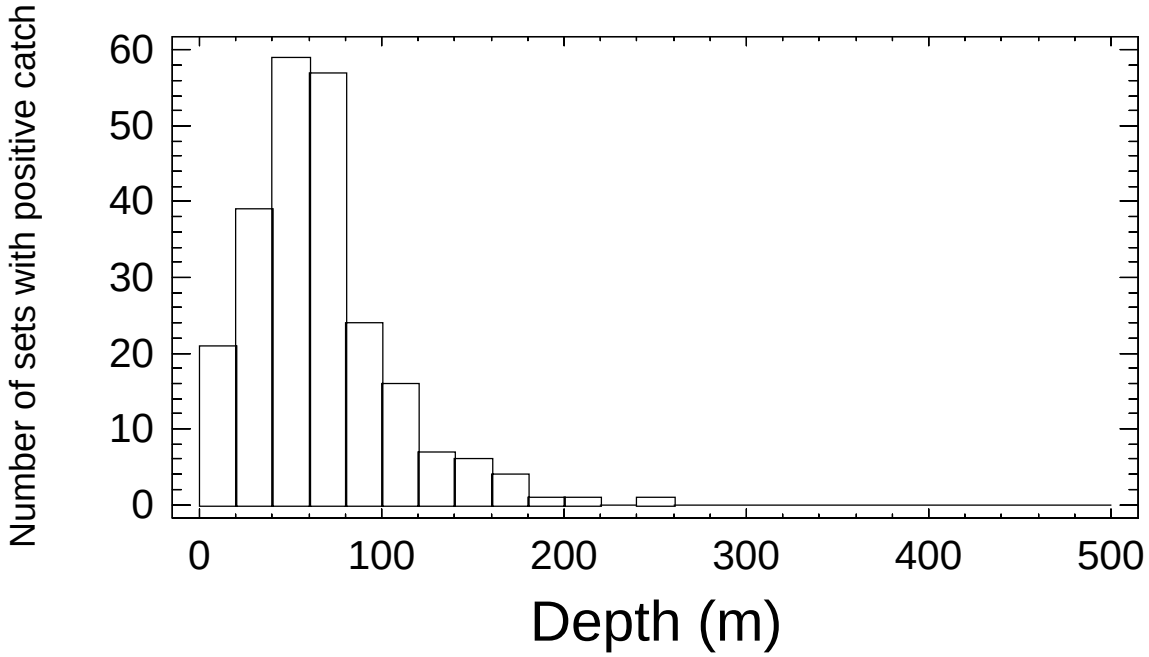

Figure 2.11 **Number of sets with positive scalloped hammerhead catch by depth from 3,045 bottom longline sets in the Gulf of Mexico and Atlantic Ocean from 1995 through 2009 from the Southeast Fisheries Science Center Mississippi Laboratory Bottom Longline Survey. Figure 2.10 (above) denotes the location of sets included in the table.**

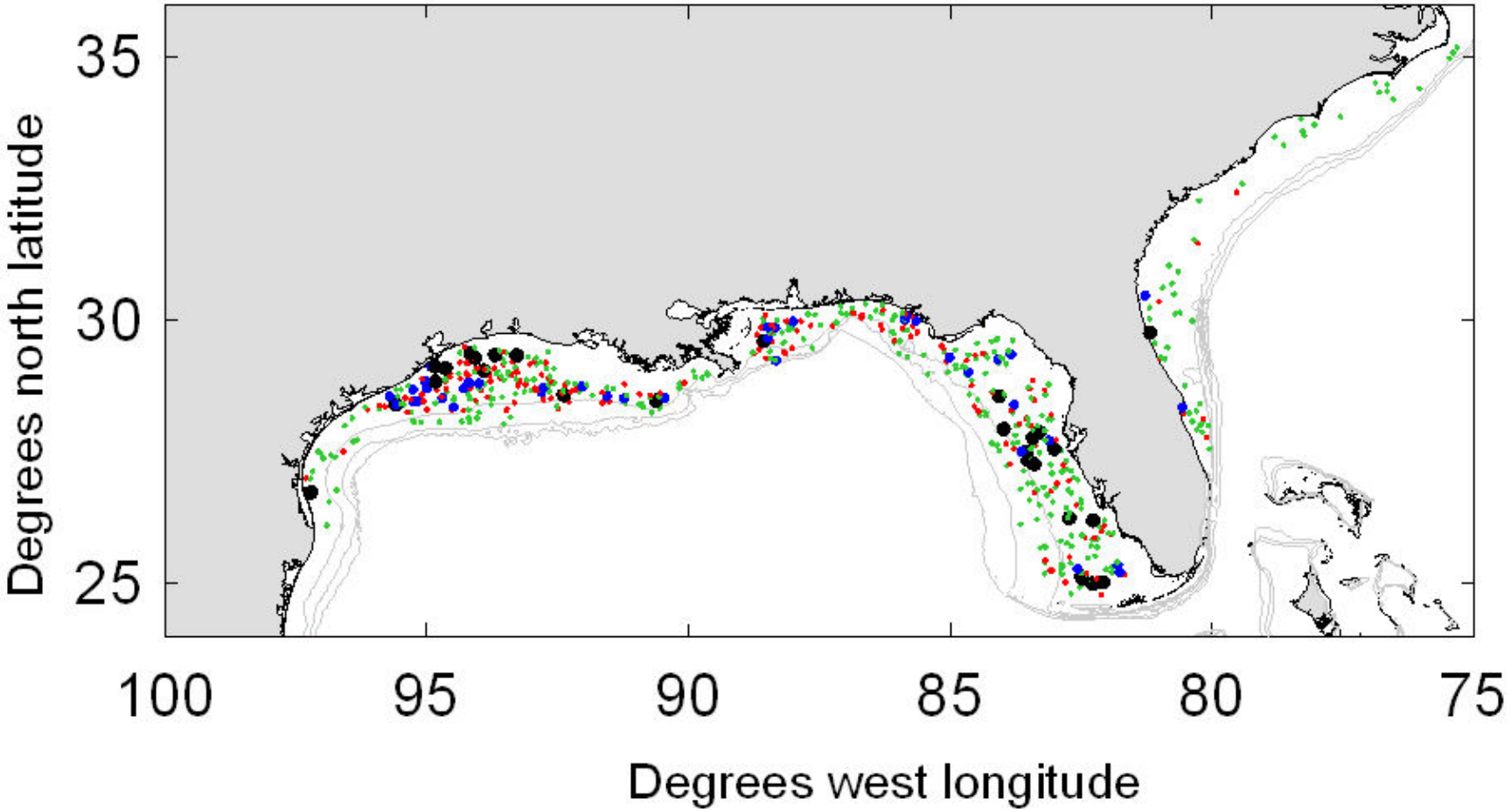

Figure 2.12 **CPUE data for blacknose sharks from 3,045 bottom longline setsfrom 1995 through 2009 from the Southeast Fisheries Science Center Mississippi Laboratory Bottom Longline Survey. Each symbol represents CPUE (number of individuals caught per 100 hook hours) at stations with a positive blacknose shark catch; Green: 0.1-2 , Red: 2-6 , Blue: 6-10, Black: 10-40.**

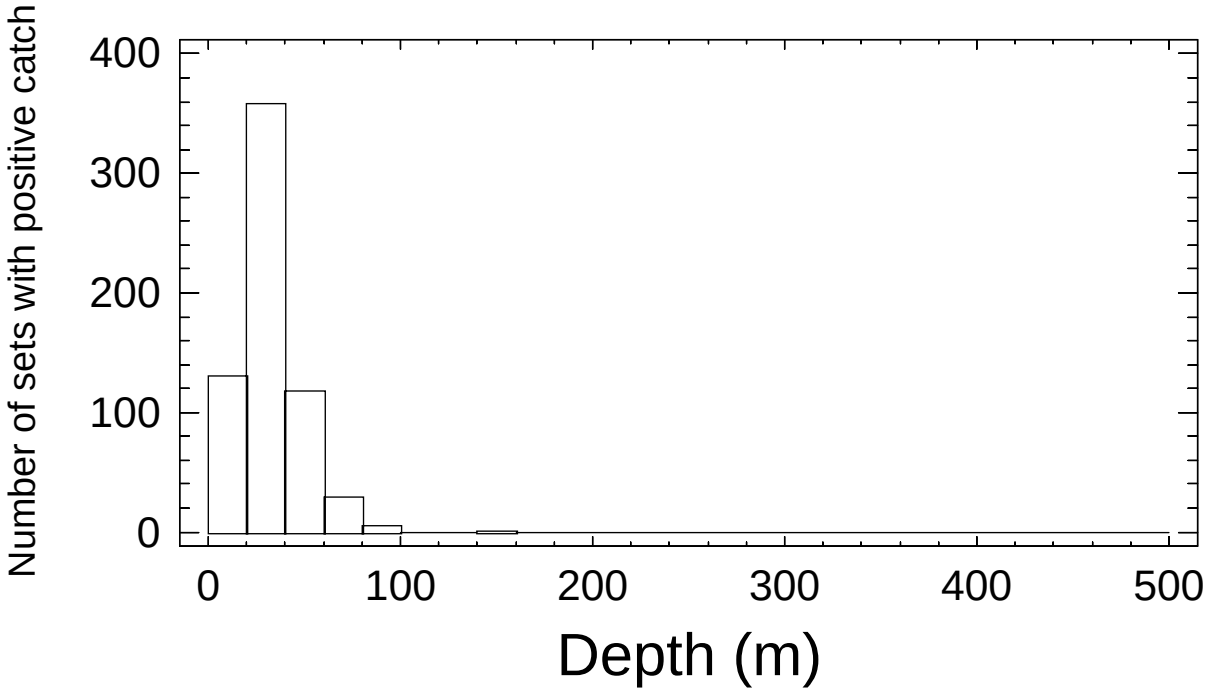

Figure 2.13 **Number of sets with positive blacknose shark catch by depth from 3,045 bottom longline sets in the Gulf of Mexico and Atlantic Ocean from 1995 through 2009 from the Southeast Fisheries Science Center Mississippi Laboratory Bottom Longline Survey. Figure 2.12 (above) denotes the location of sets included in the table.**

APPENDIX 2 NORTHEAST FISHERIES SCIENCE CENTER APEX PREDATORS BOTTOM LONGLINE SURVEY MAPS

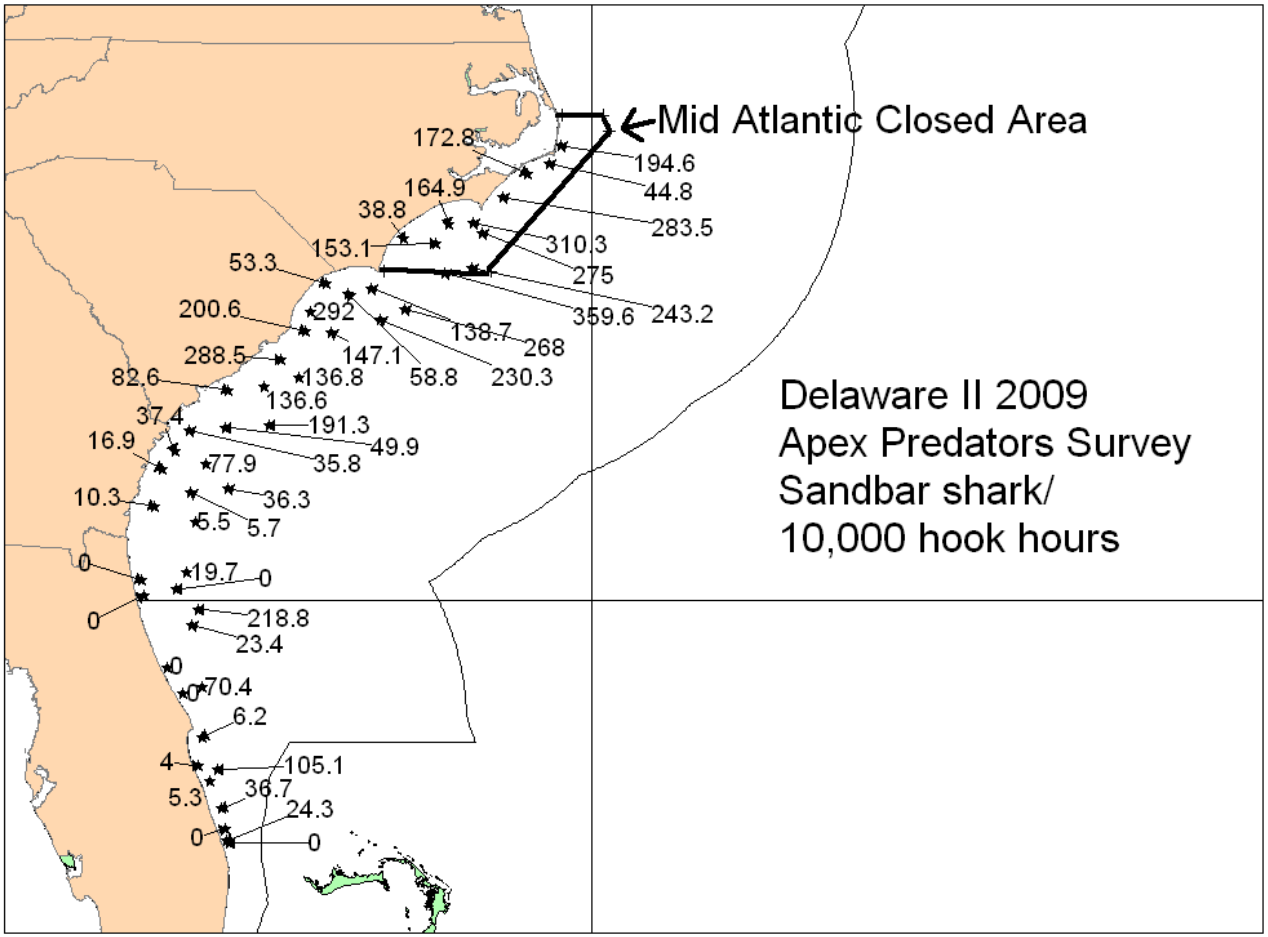

Figure 2.14 Sandbar shark CPUE (number of sandbar/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009).

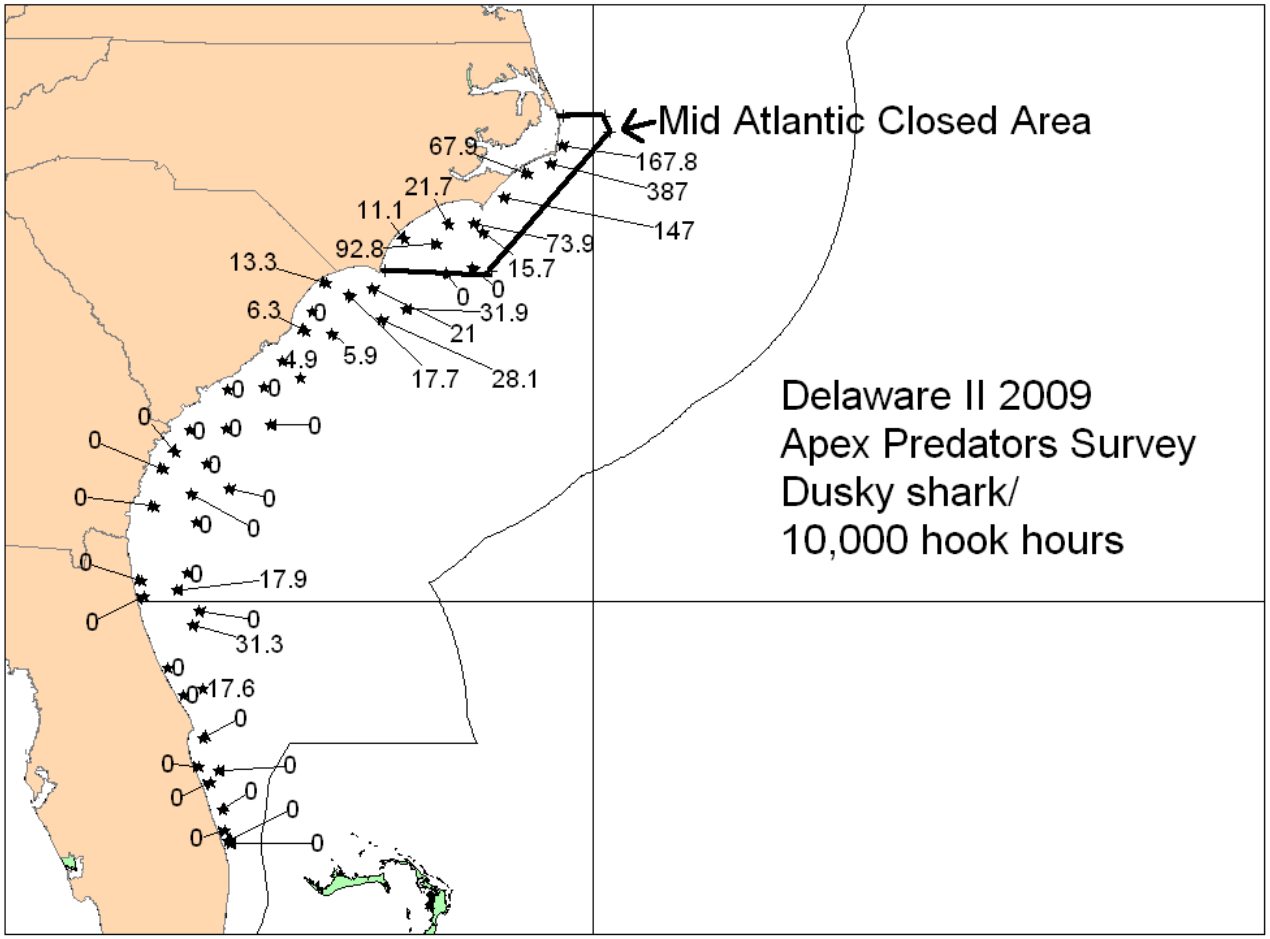

Figure 2.15 **Dusky shark CPUE (number of dusky/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009).**

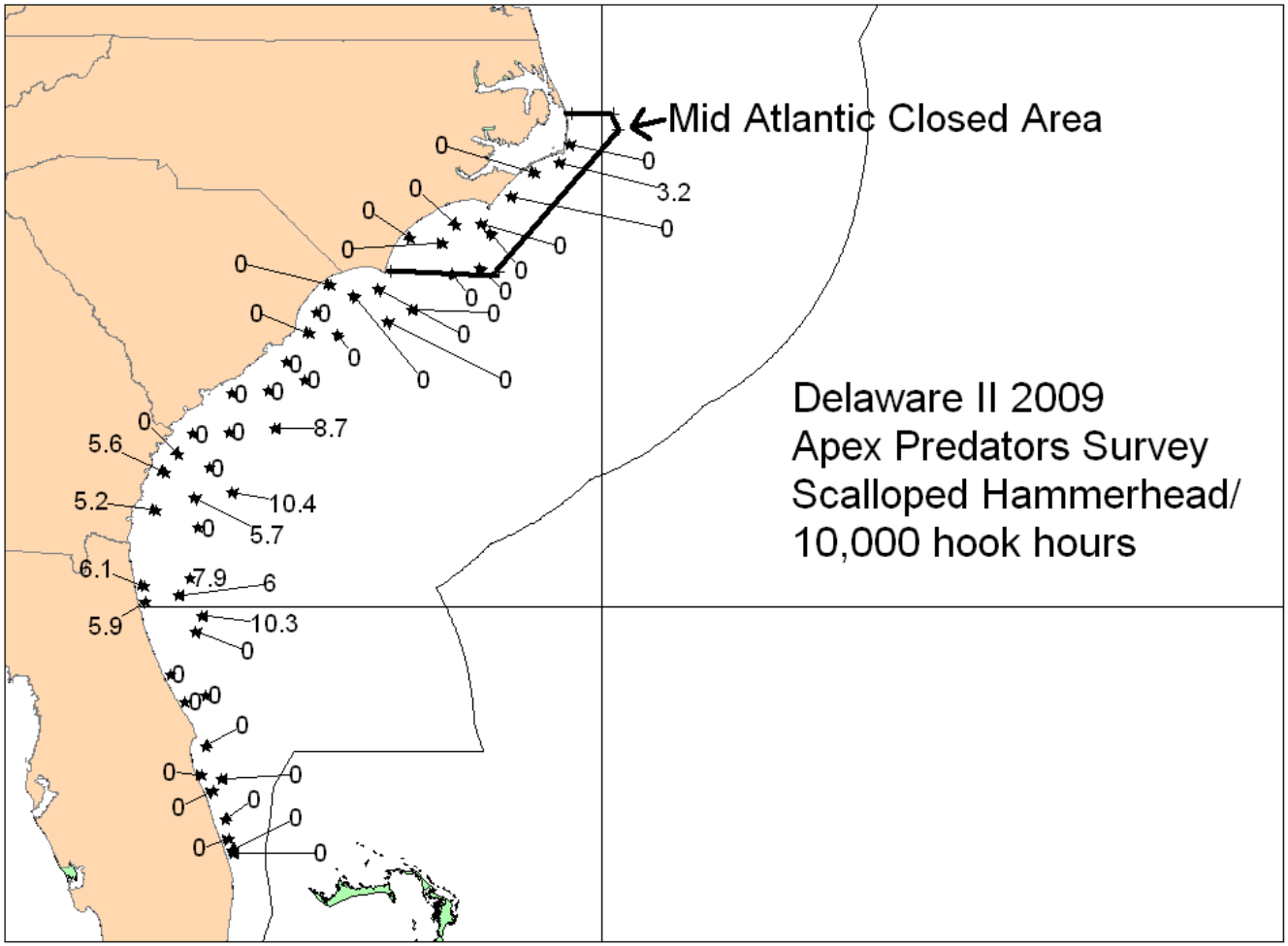

Figure 2.16 **Scalloped hammerhead shark CPUE (number of scalloped hammerhead/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009).**

APPENDIX 3: DUSKY SHARK INTERACTION MAPS AND DATA

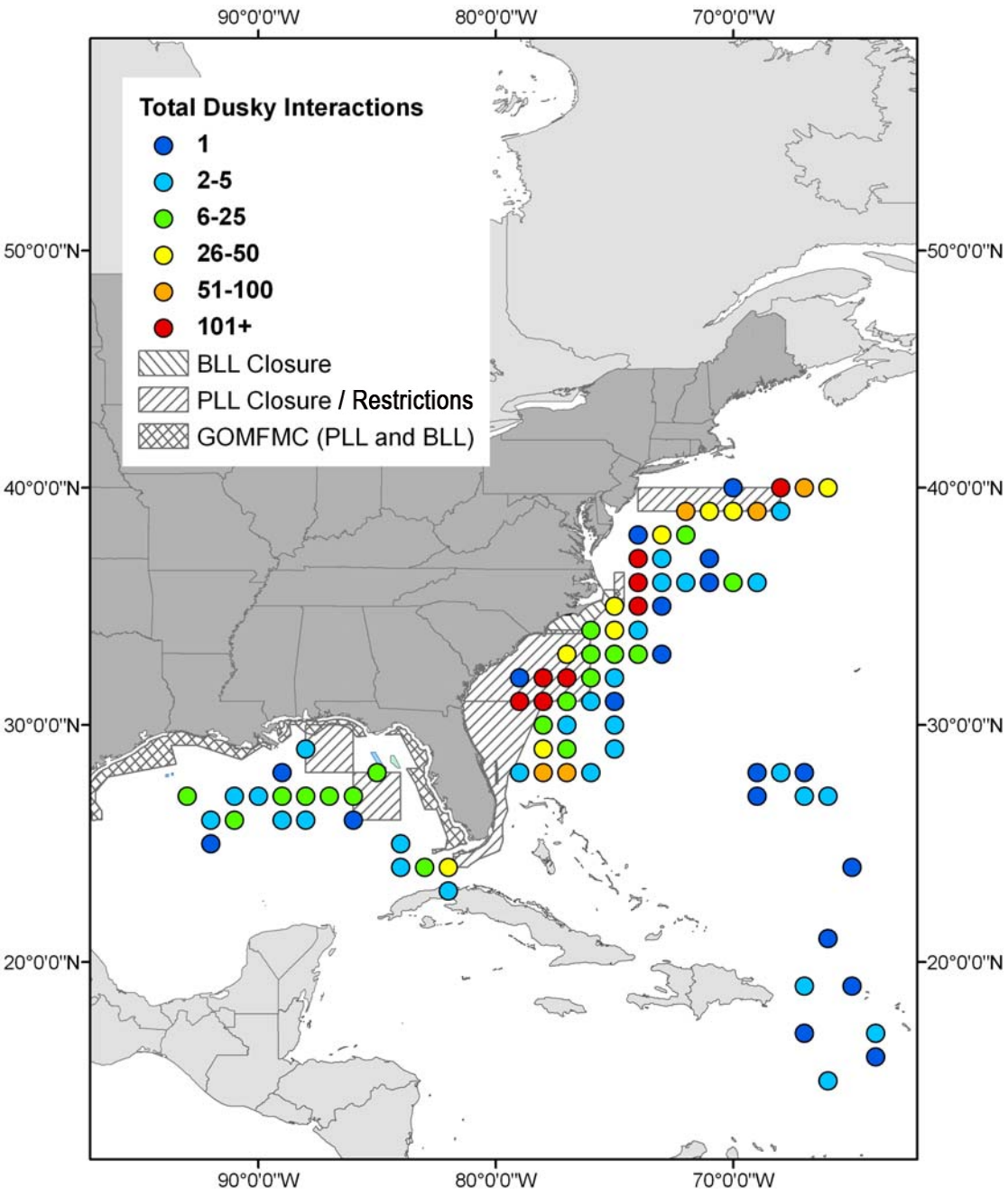

Figure 2.17 **Dusky shark interactions on PLL gear from the HMS Logbook, 2006-2010. Points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

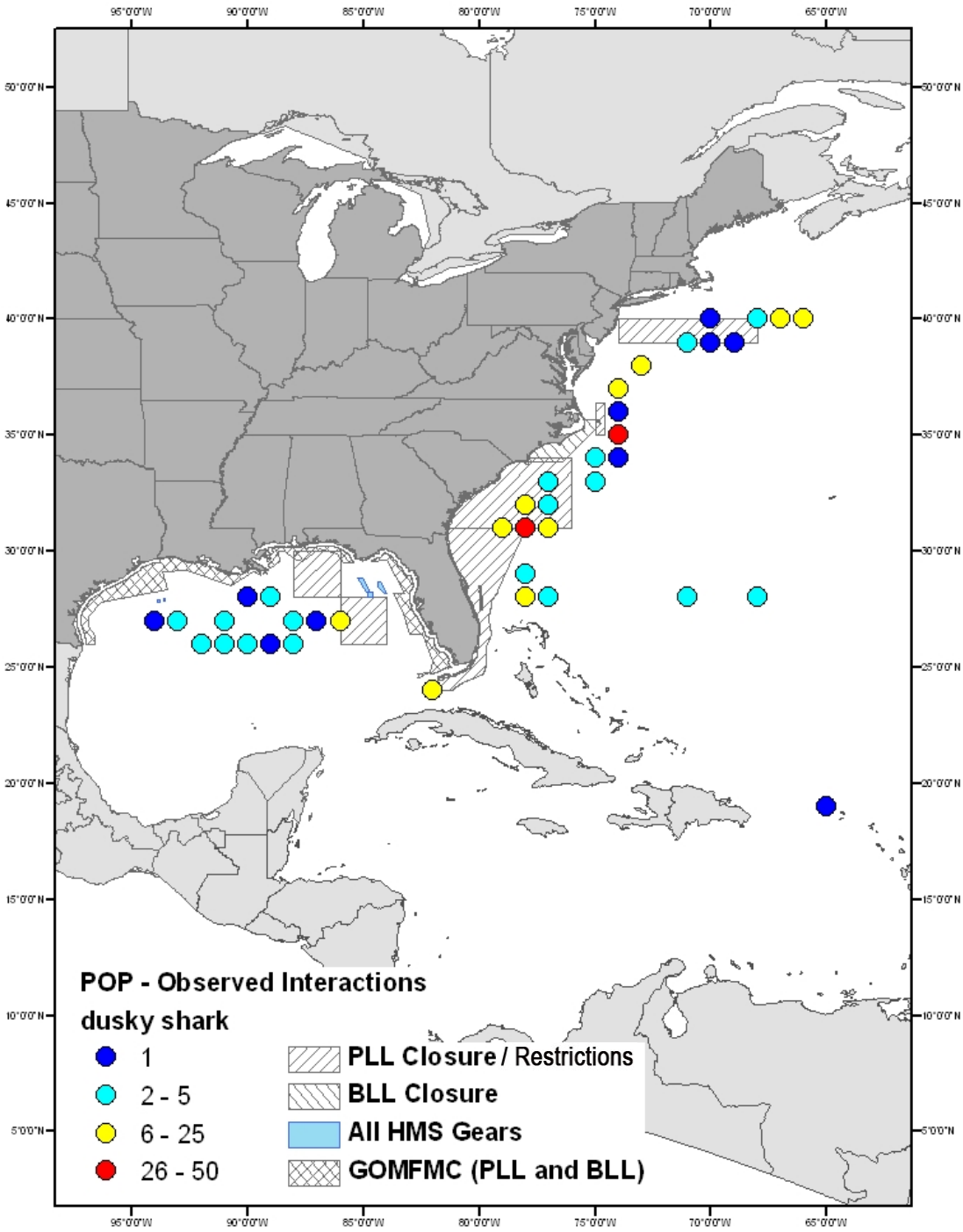

Figure 2.18 **Dusky shark interactions where at least one dusky shark was observed on PLL sets in by the Pelagic Observer Program, 2006-2009. Points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent.**

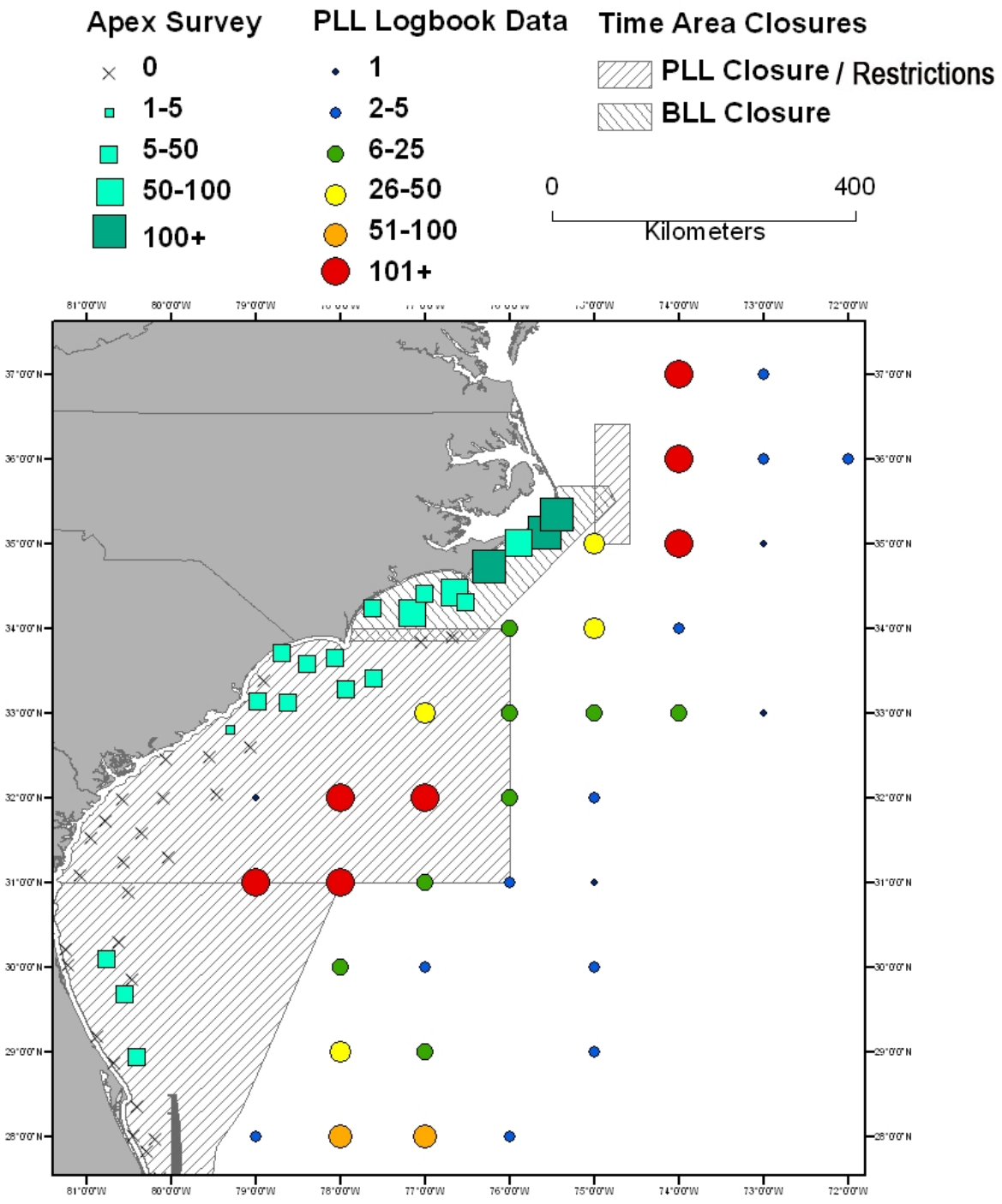

Figure 2.19 **PLL sets with dusky shark interactions from 2006-2010 in the vicinity of the Mid-Atlantic Shark Closed Area and the Florida East Coast Closed Area based on HMS Logbook data and dusky shark CPUE (number of dusky/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). HMS Logbook points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent.**

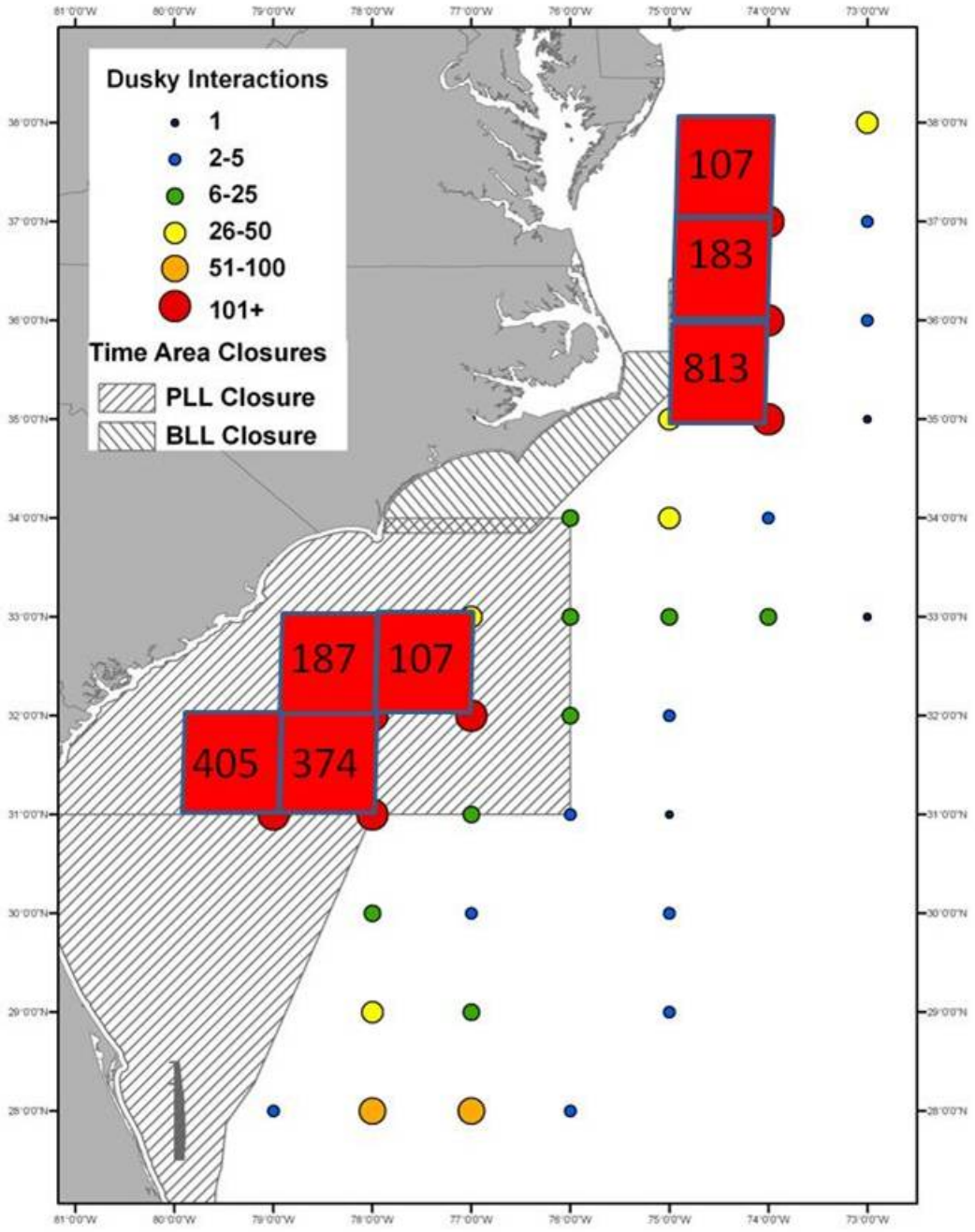

Figure 2.20 **PLL sets with dusky shark interactions in the vicinity of the Mid-Atlantic Shark Closed Area and the Florida East Coast Closed Area based on HMS Logbook data. HMS Logbook points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent. High interaction grid cells are labeled with the number of interactions that occurred within.**

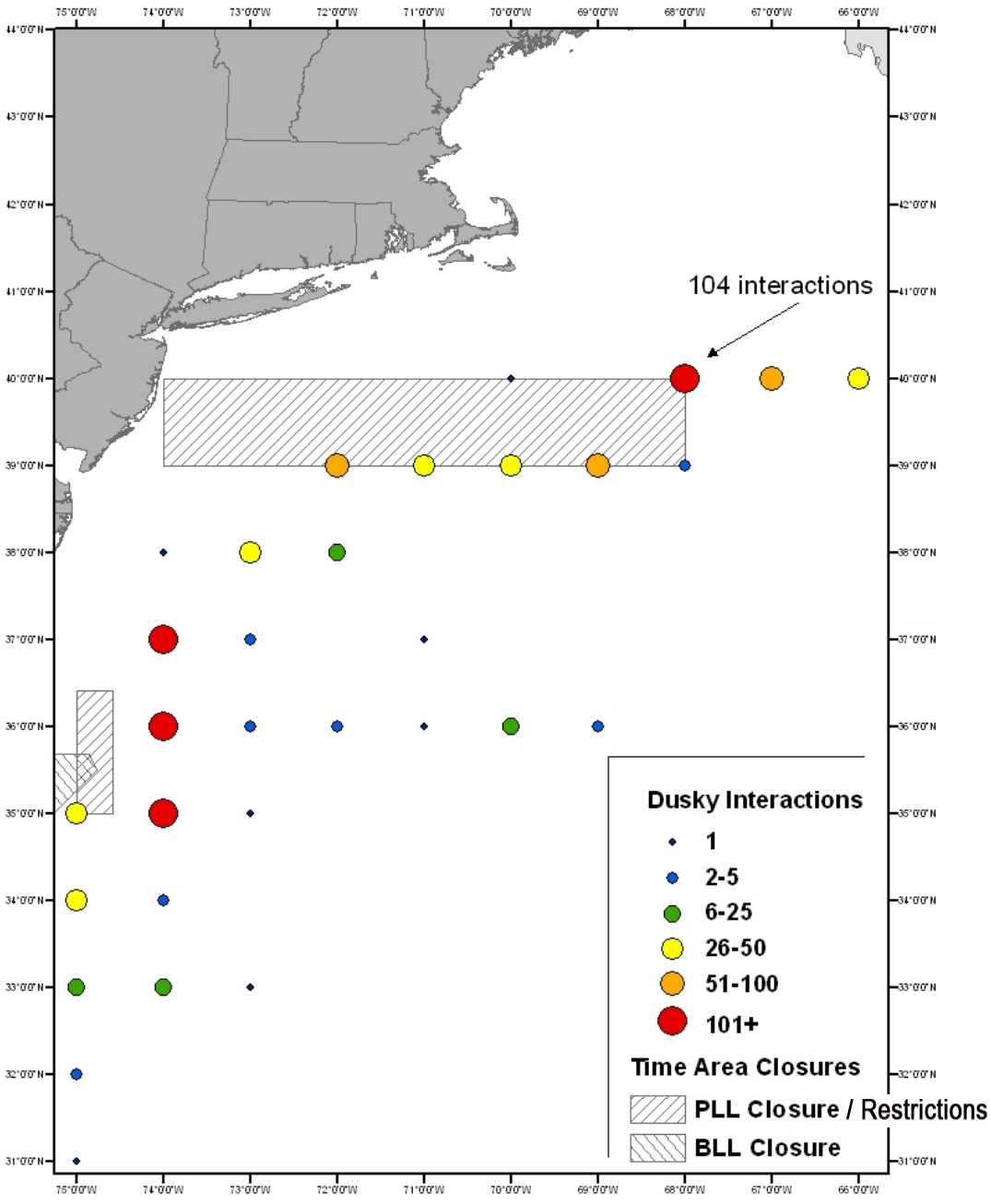

Figure 2.21 **PLL sets with dusky shark interactions in the North Atlantic region, 2006-2010, based on HMS Logbook data. HMS Logbook points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

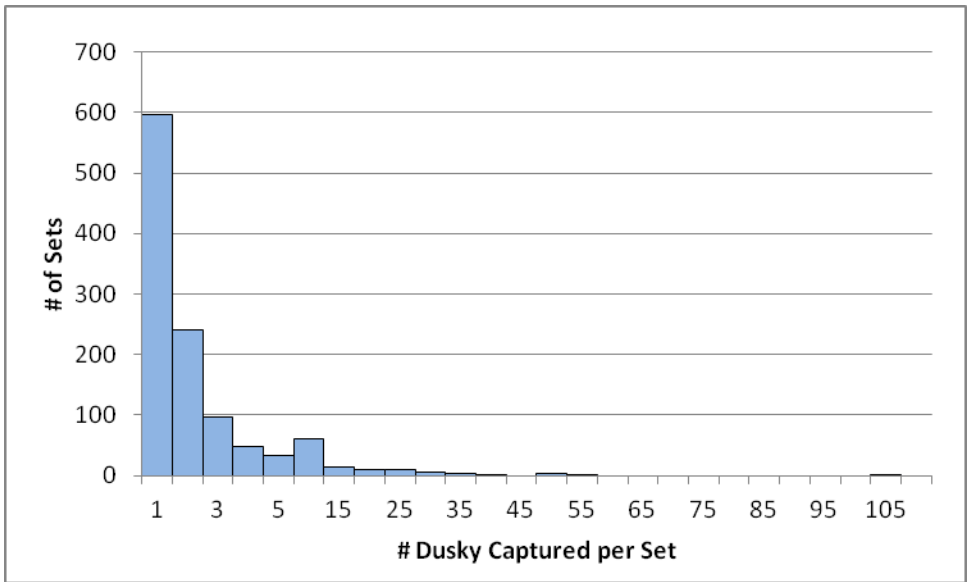

Figure 2.22 **The number of dusky sharks captured on PLL sets with a dusky shark interaction as reported in HMS logbook data, 2006-2010. Total number of sets = 1,121**

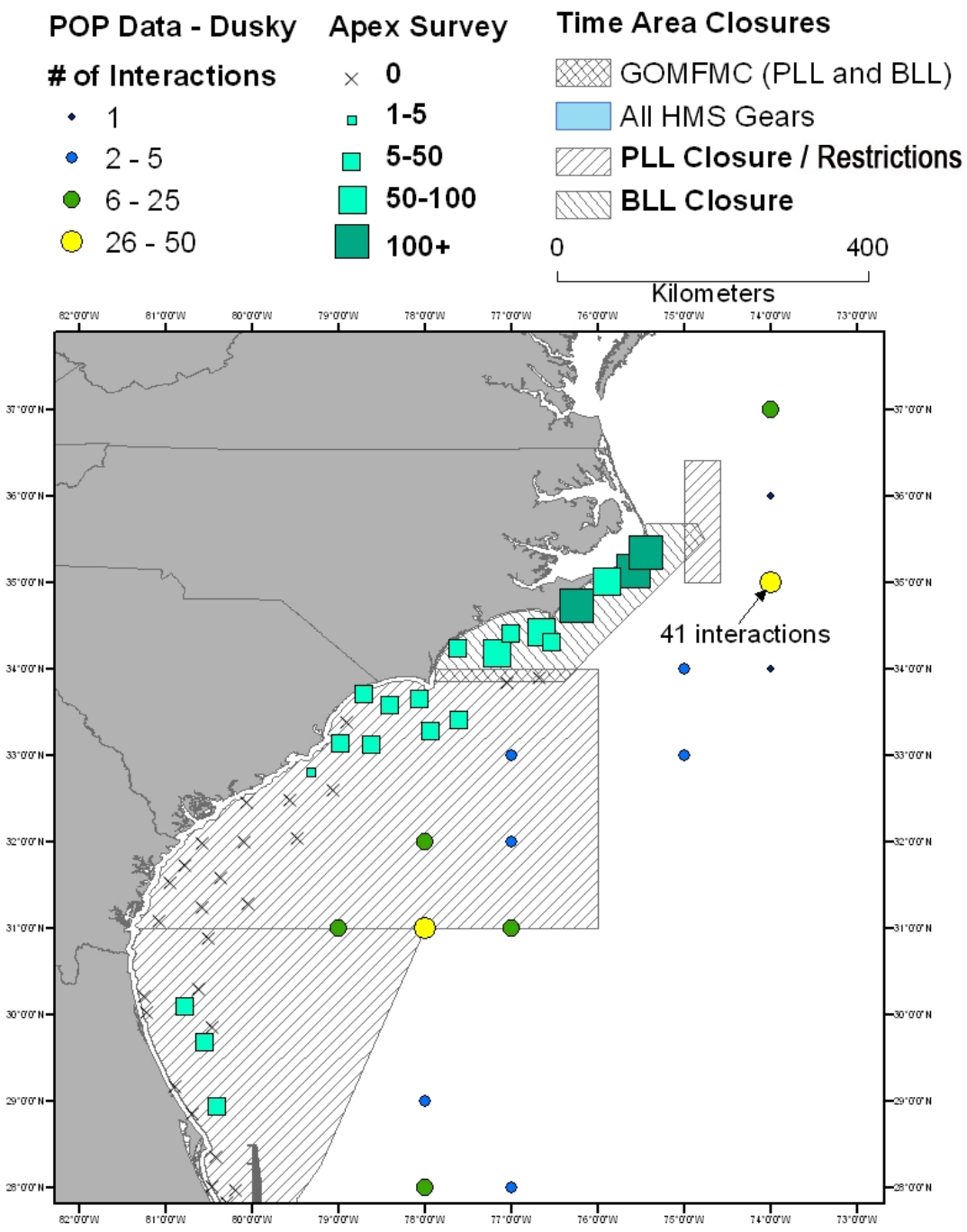

Figure 2.23 **Dusky shark interactions observed on PLL sets in by the Pelagic Observer Program (POP), 2006-2009 in the vicinity of the Mid-Atlantic Shark Closed Area and the Florida East Coast Closed Area, and dusky shark CPUE (number of dusky/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). POP points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

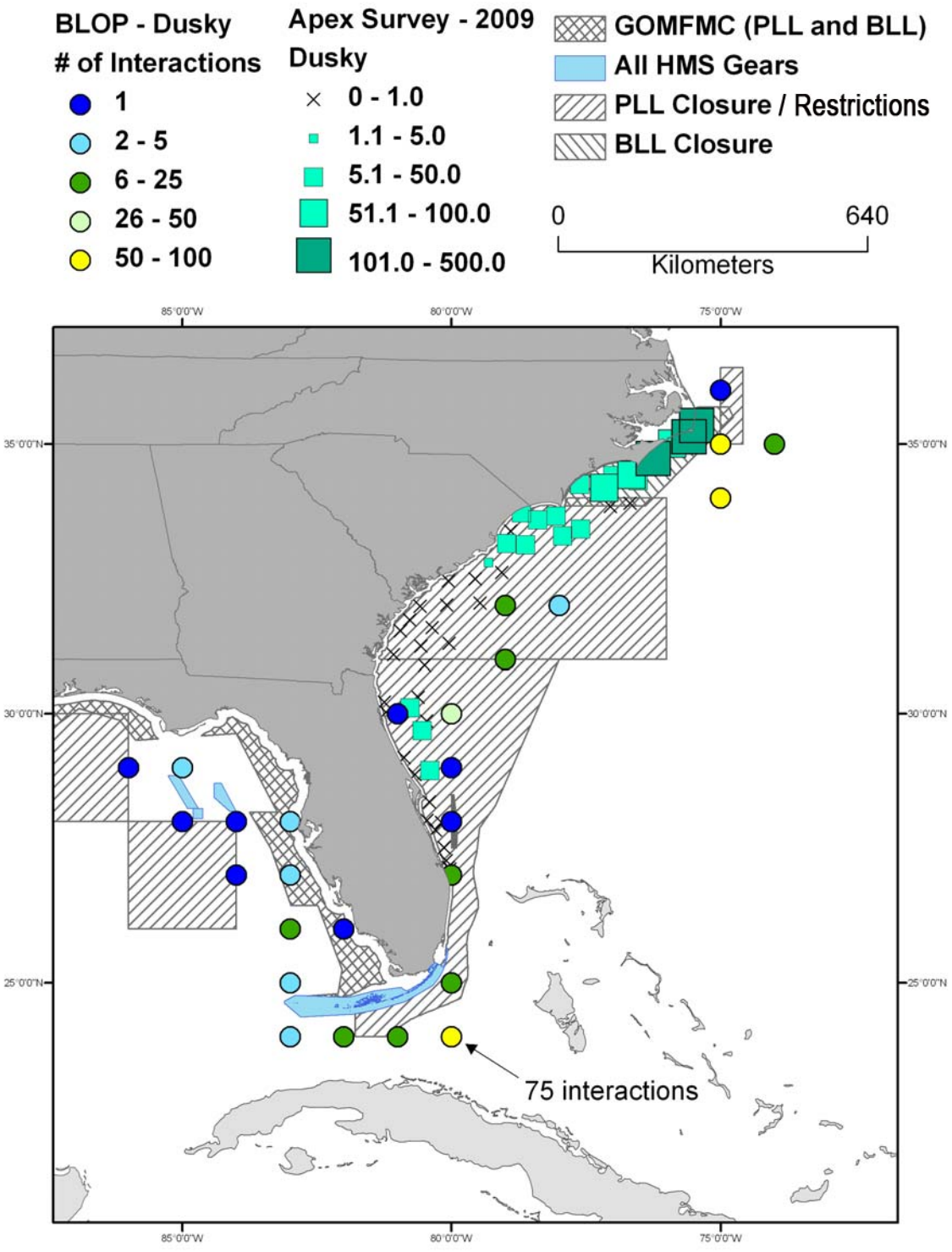

Figure 2.24 **Dusky shark interactions observed on BLL sets in by the Bottom Longline Observer Program (BLLOP), 2006-2010 and dusky shark CPUE (number of dusky/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). BLLOP points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

APPENDIX 4 SCALLOPED HAMMERHEAD SHARK INTERACTION MAPS AND DATA

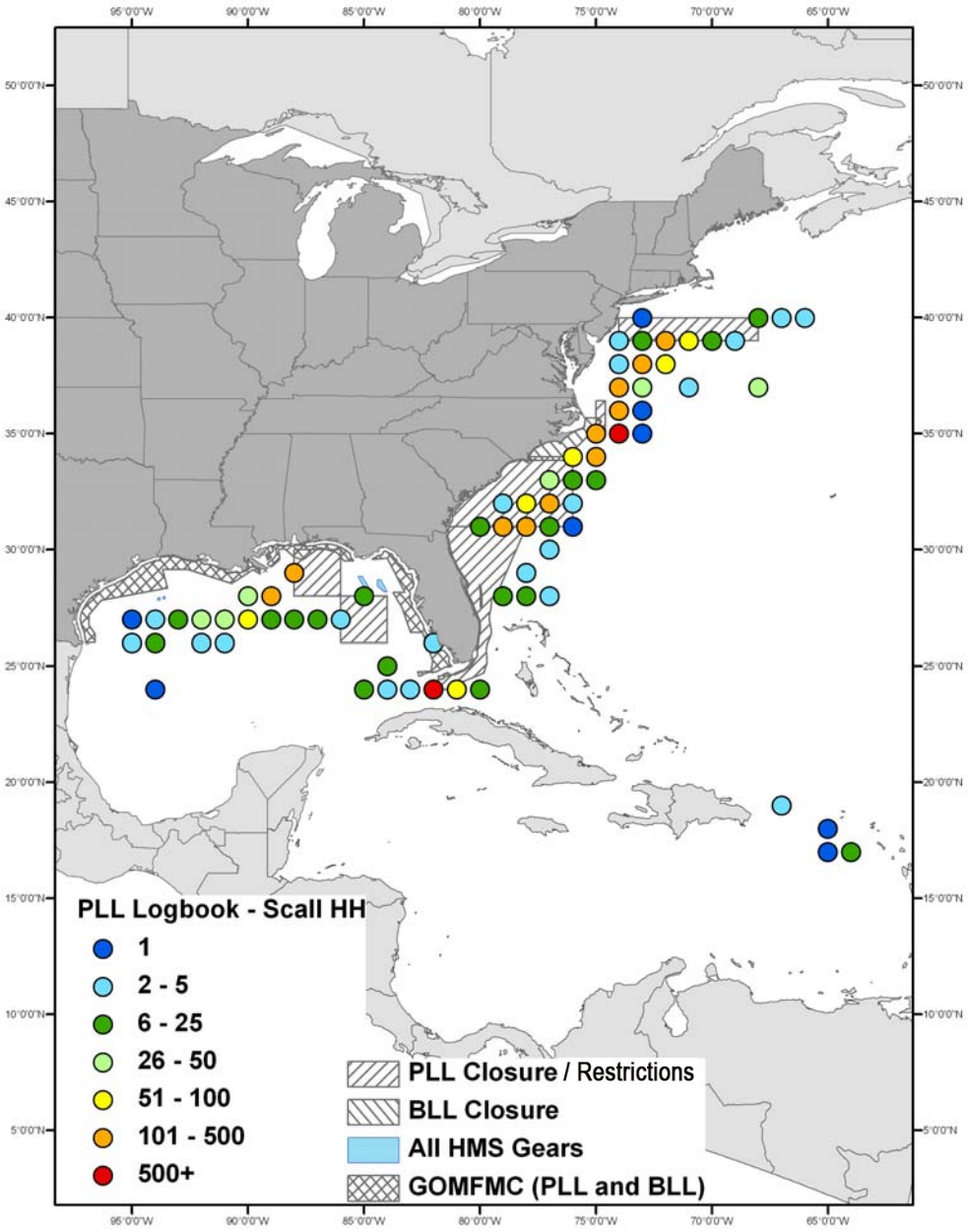

Figure 2.25 **Scalloped hammerhead shark interactions on PLL gear from the HMS logbook, 2006-2010. Points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

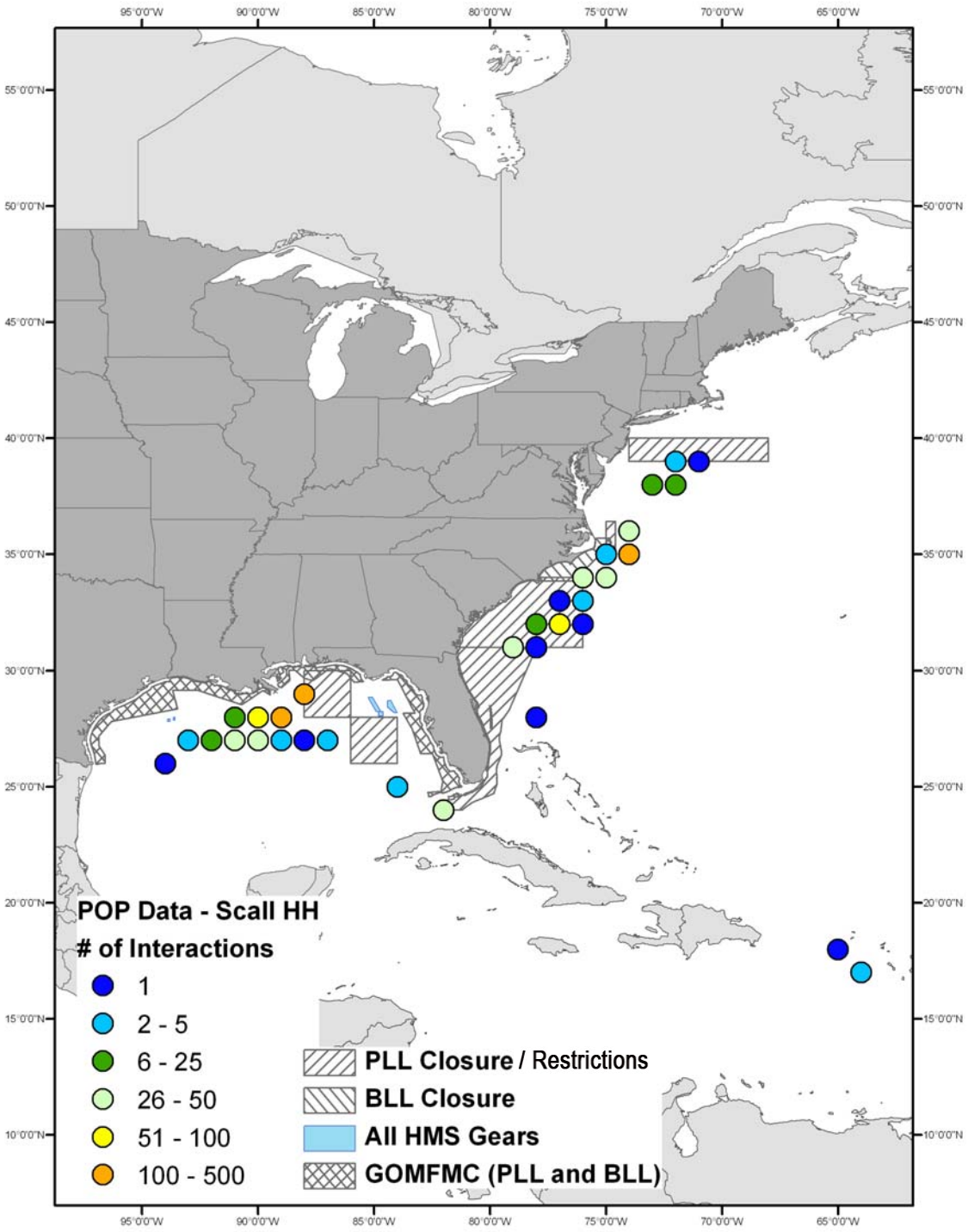

Figure 2.26 **Scalloped hammerhead shark interactions where at least one scalloped hammerhead shark was observed on PLL sets in by the Pelagic Observer Program, 2006-2009. Points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent.**

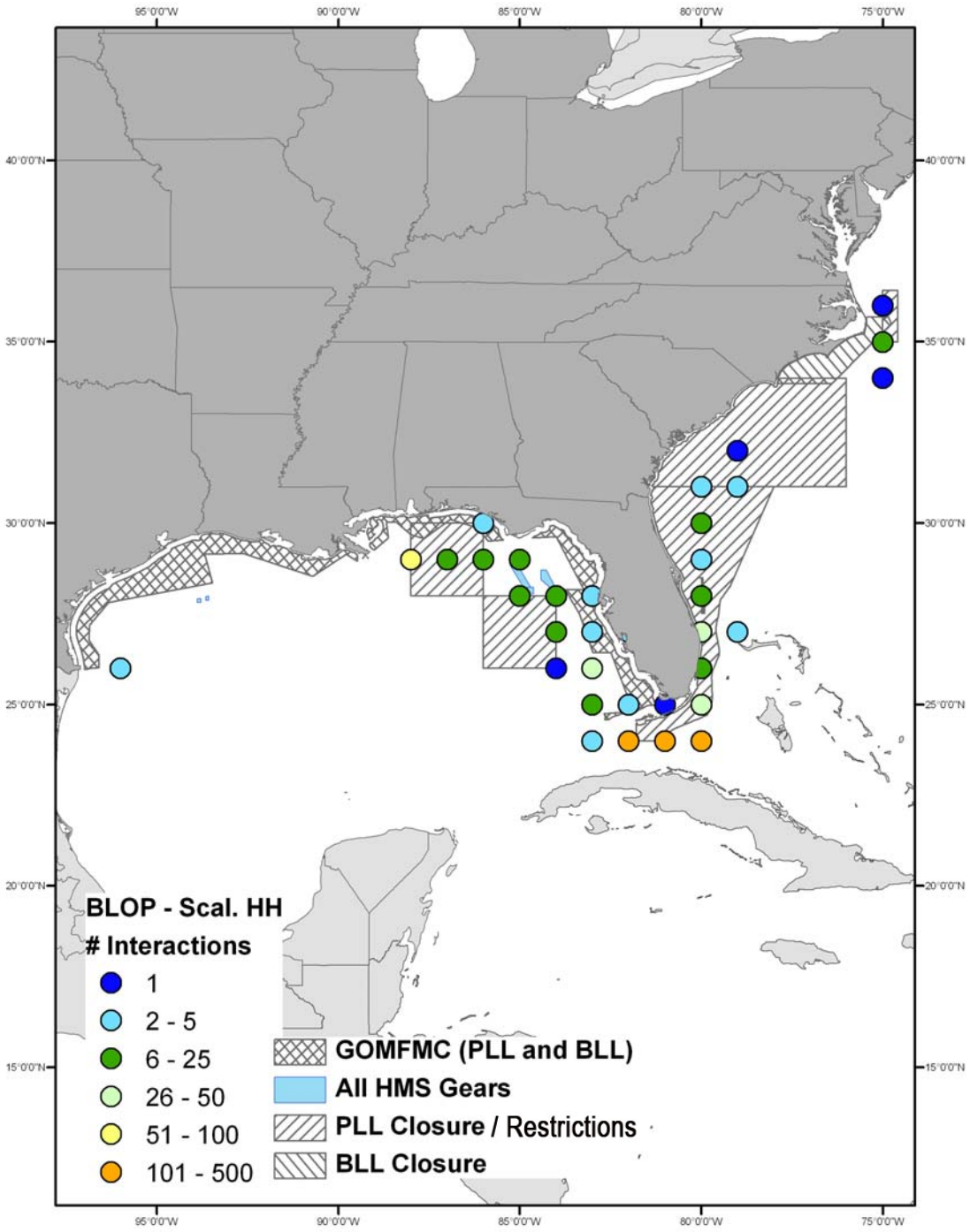

Figure 2.27 **Scalloped hammerhead shark interactions observed on BLL sets in by the Bottom Longline Observer Program (BLLOP), 2006-2009. BLLOP points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

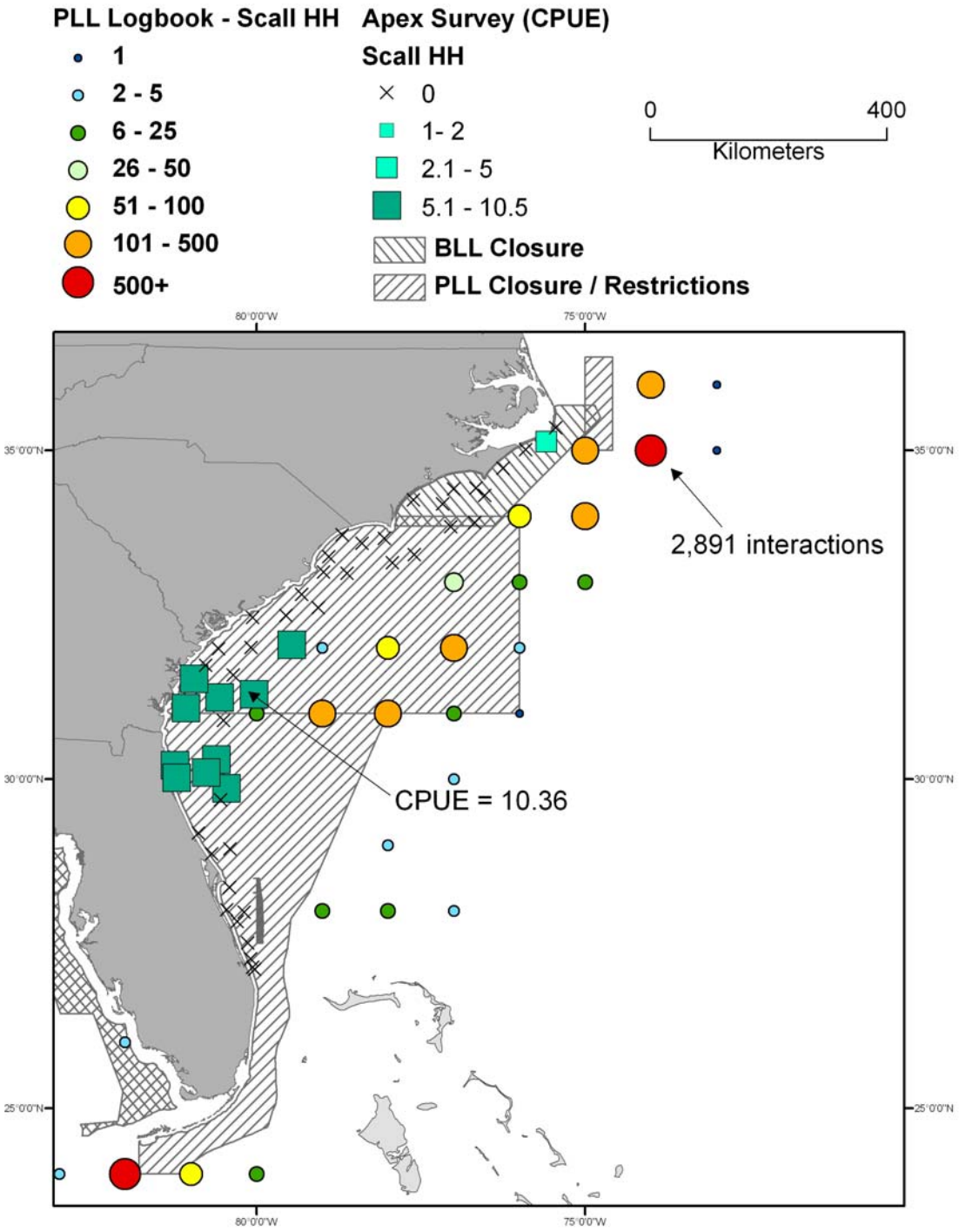

Figure 2.28 **PLL sets with scalloped hammerhead shark interactions in the South Atlantic region based on HMS logbook data and scalloped hammerhead shark CPUE (number of scalloped hammerhead/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). HMS Logbook points**

at

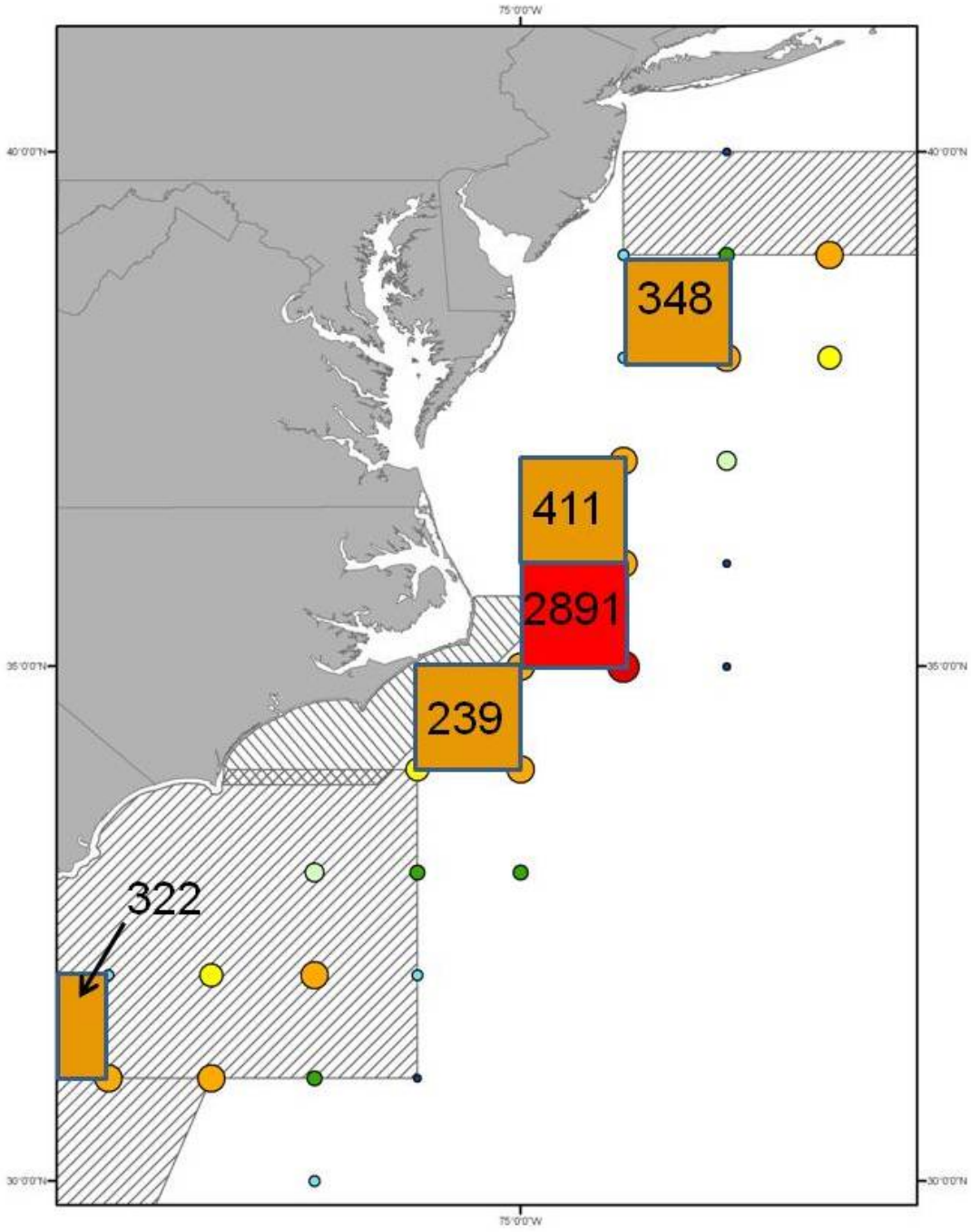

Figure 2.29 **PLL sets with scalloped hammerhead shark interactions from 2006-2010 in the vicinity of the Mid-Atlantic Shark Closed Area and the Florida East Coast Closed Area based on HMS logbook data. HMS Logbook points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent. High interaction grid cells are labeled with the number of interactions that occurred within. Please see Figure 2.28 for grid cell interaction ranges.**

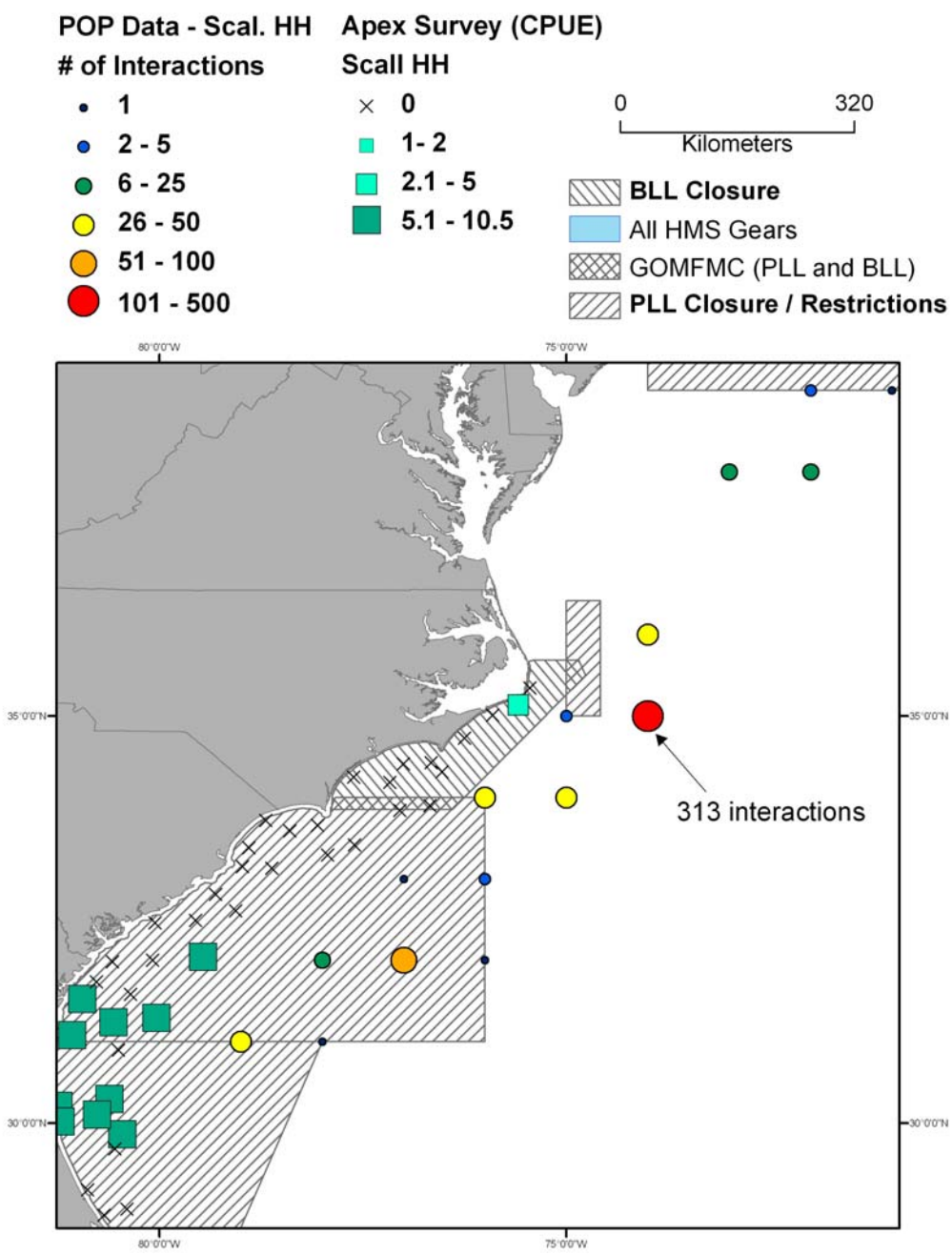

Figure 2.30 **Scalloped hammerhead shark interactions observed on PLL sets by the Pelagic Observer Program (POP), 2006-2009 in the vicinity of the Mid-Atlantic Shark Closed Area and the Florida East Coast Closed Area, and scalloped hammerhead shark CPUE (number of scalloped hammerhead/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). POP points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

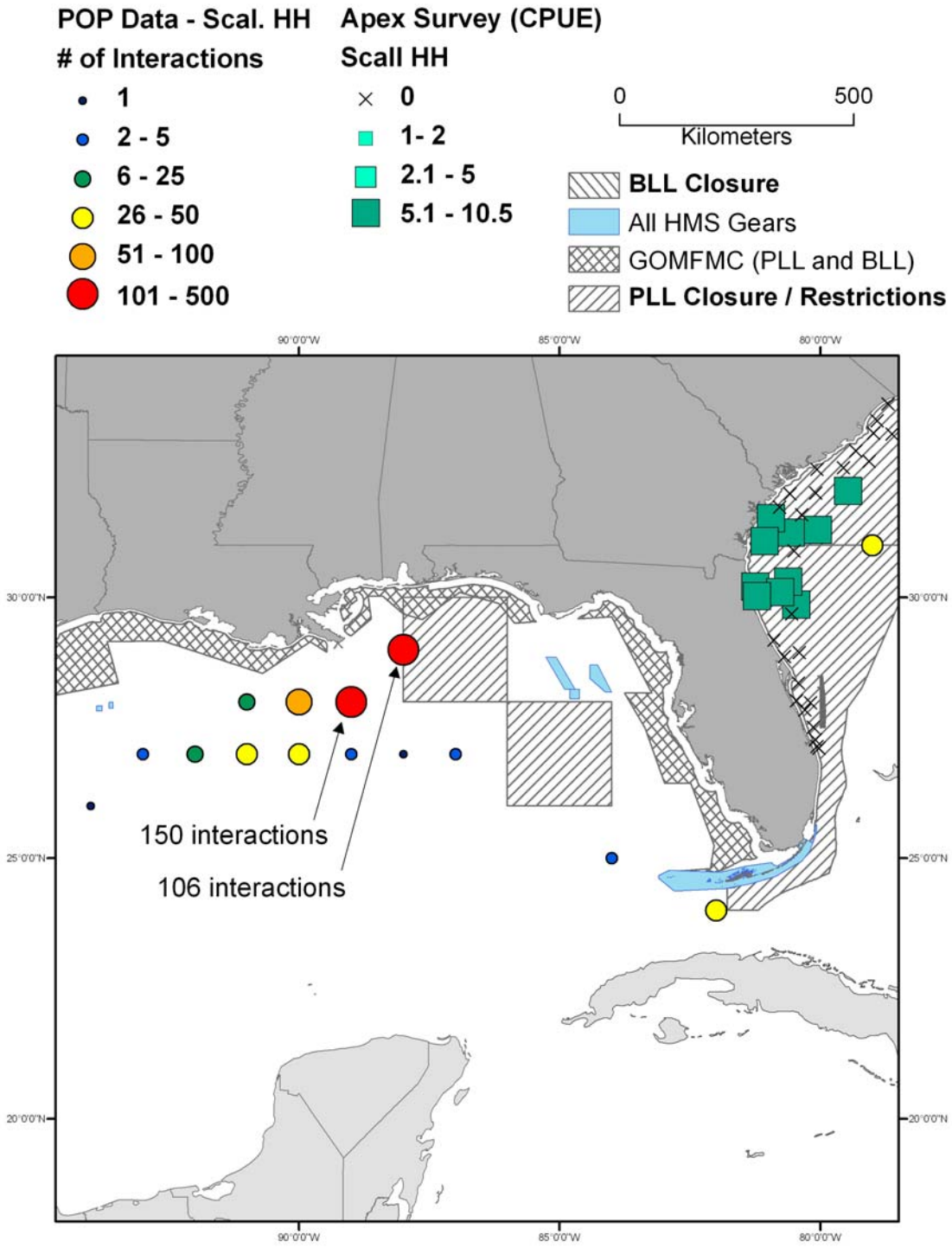

Figure 2.31 **Scalloped hammerhead interactions in the Gulf of Mexico and South Atlantic region reported by the Pelagic Observer Program (POP), 2006-2009, and scalloped hammerhead shark CPUE (number of scalloped hammerhead/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). POP points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

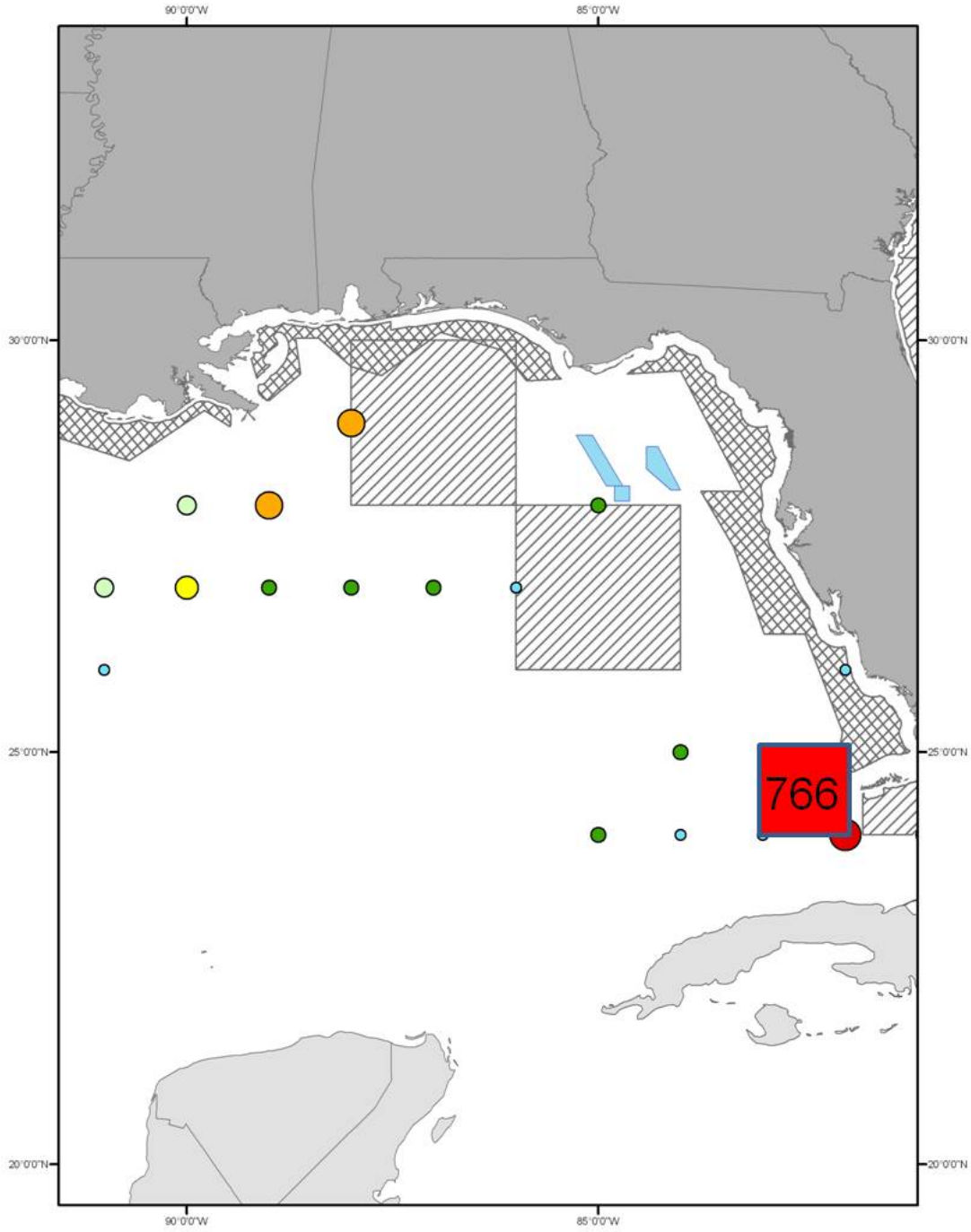

Figure 2.32 **PLL sets with scalloped hammerhead shark interactions from 2006-2010 in the Gulf of Mexico region based on HMS logbook data. HMS Logbook points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent. High interaction grid cells are labeled with the number of interactions that occurred within. Please see Figure 2.28 for grid cell interaction ranges.**

APPENDIX 5 SANDBAR SHARK INTERACTION MAPS AND DATA

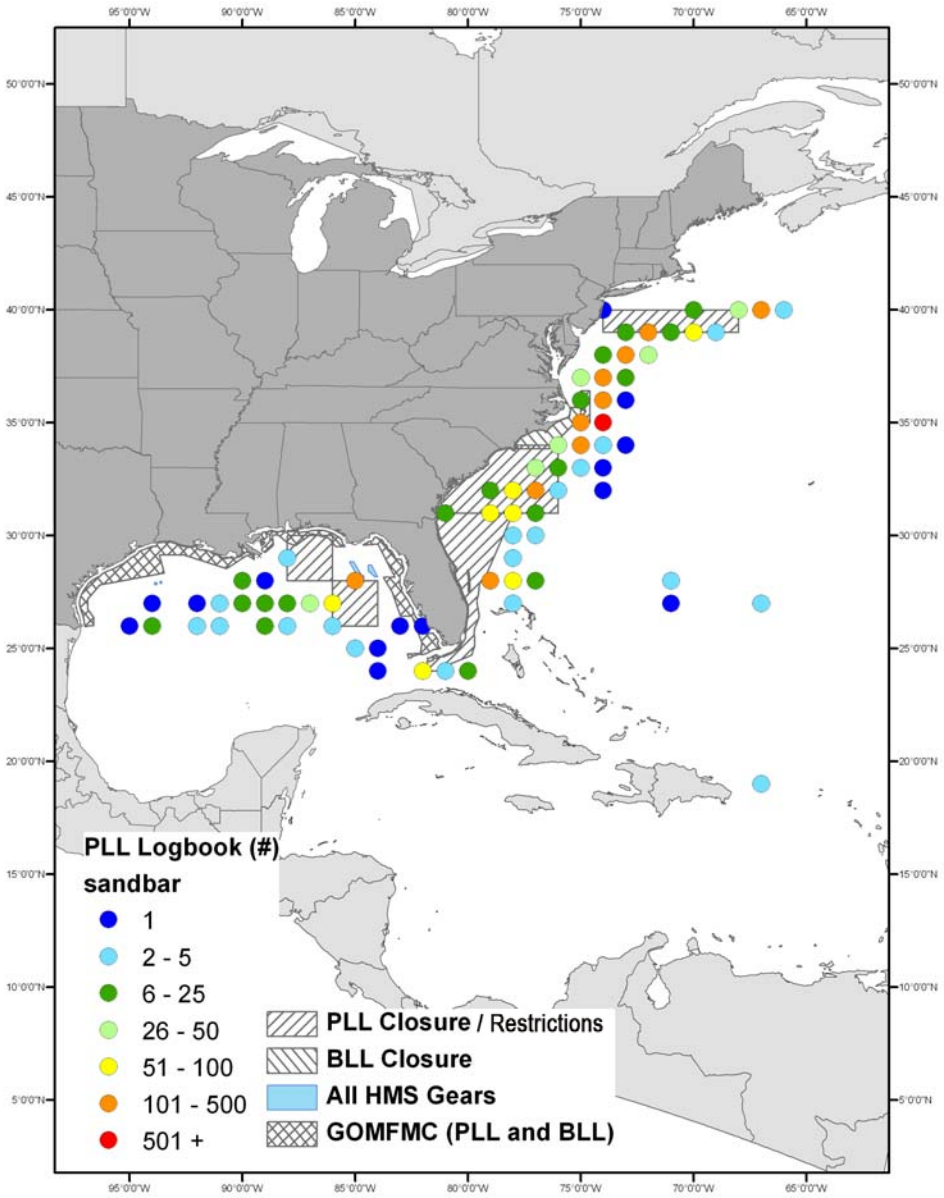

Figure 2.33 **Sandbar shark interactions on PLL gear from the HMS logbook, 2006-2010. Points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

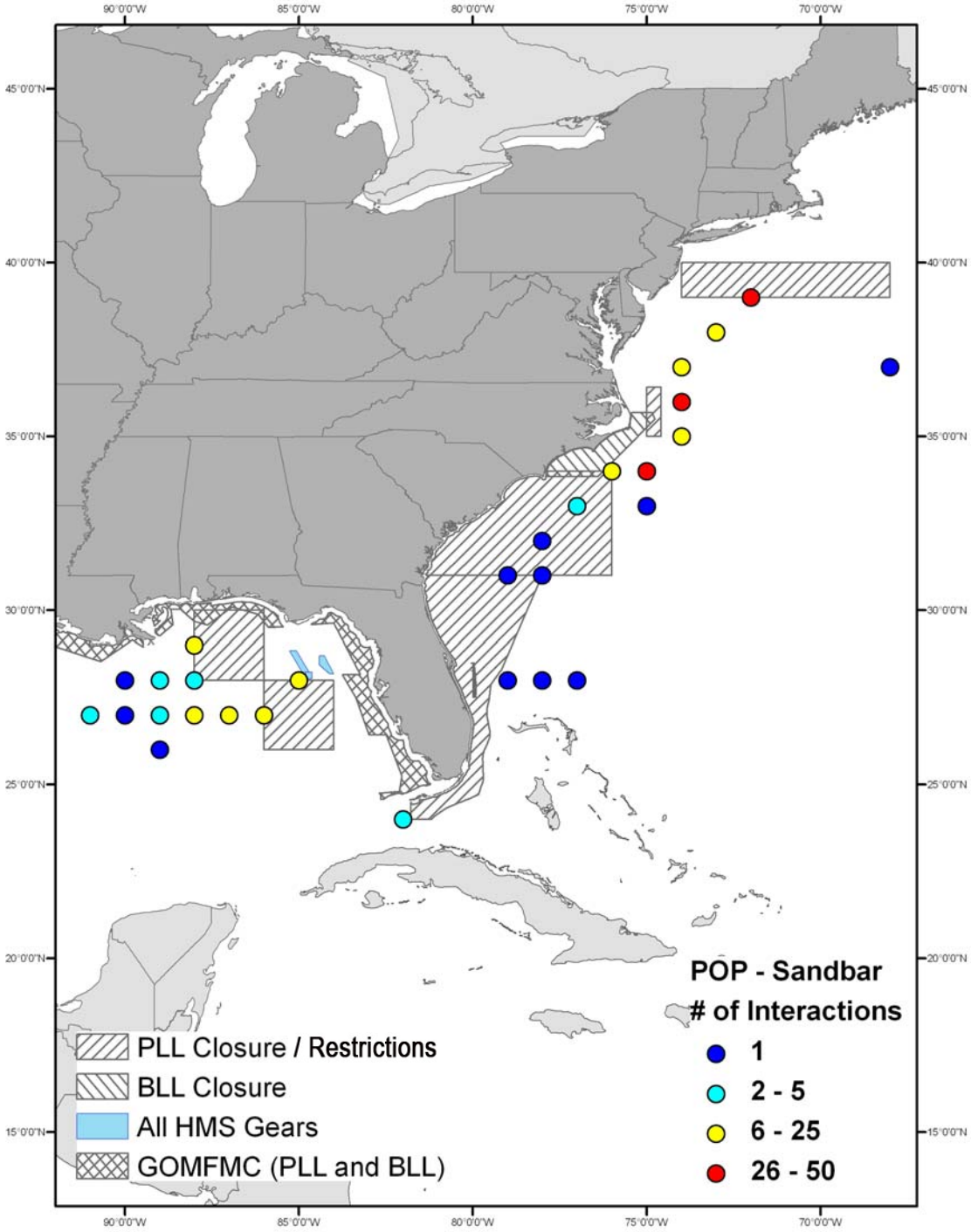

Figure 2.34 **Sandbar shark interactions where at least one sandbar shark was observed on PLL sets in by the Pelagic Observer Program, 2006-2009. Points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent.**

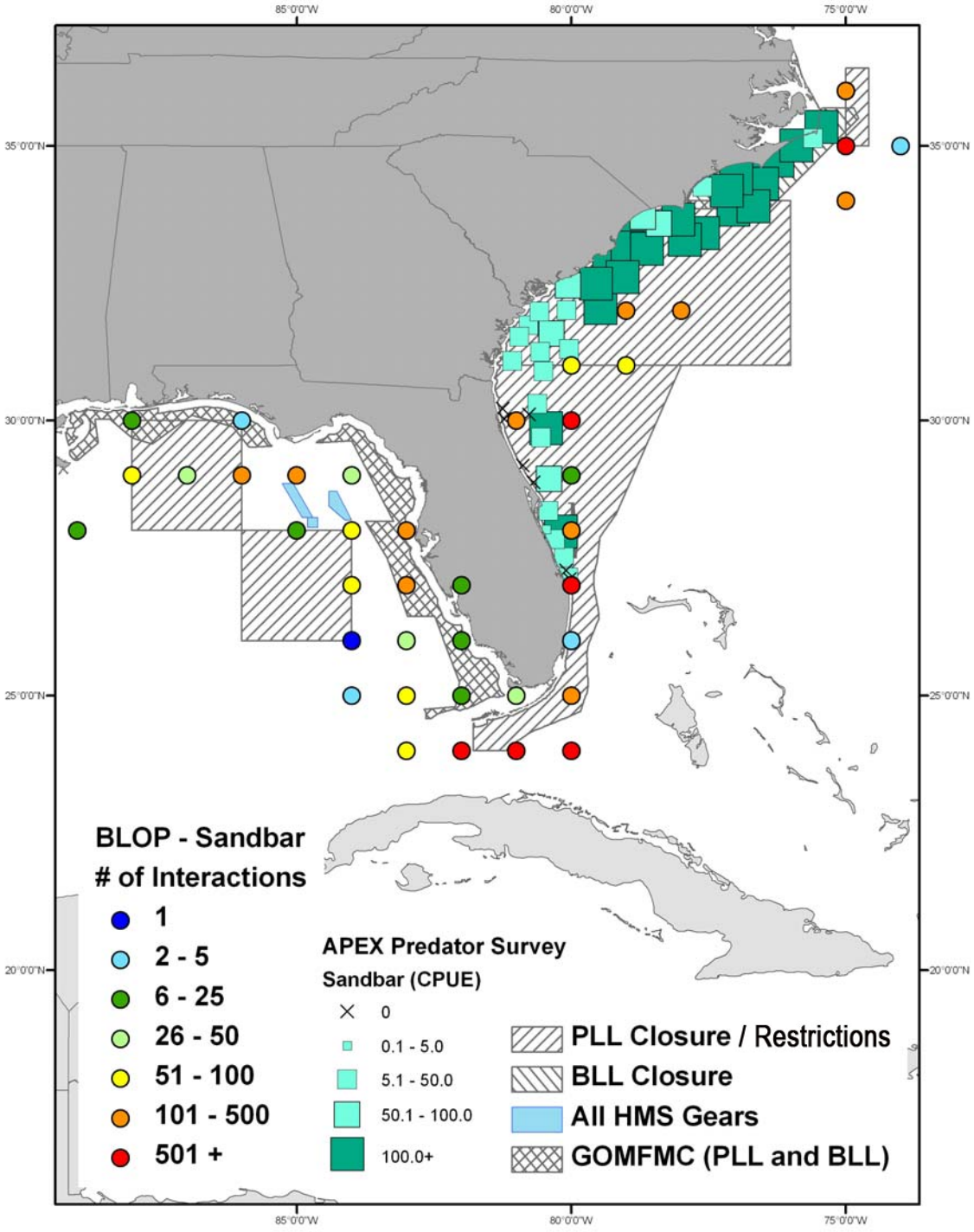

Figure 2.35 **Sandbar shark interactions observed on BLL sets in by the Bottom Longline Observer Program (BLLOP), 2006-2010 and sandbar shark CPUE (number of sandbar/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). BLLOP points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

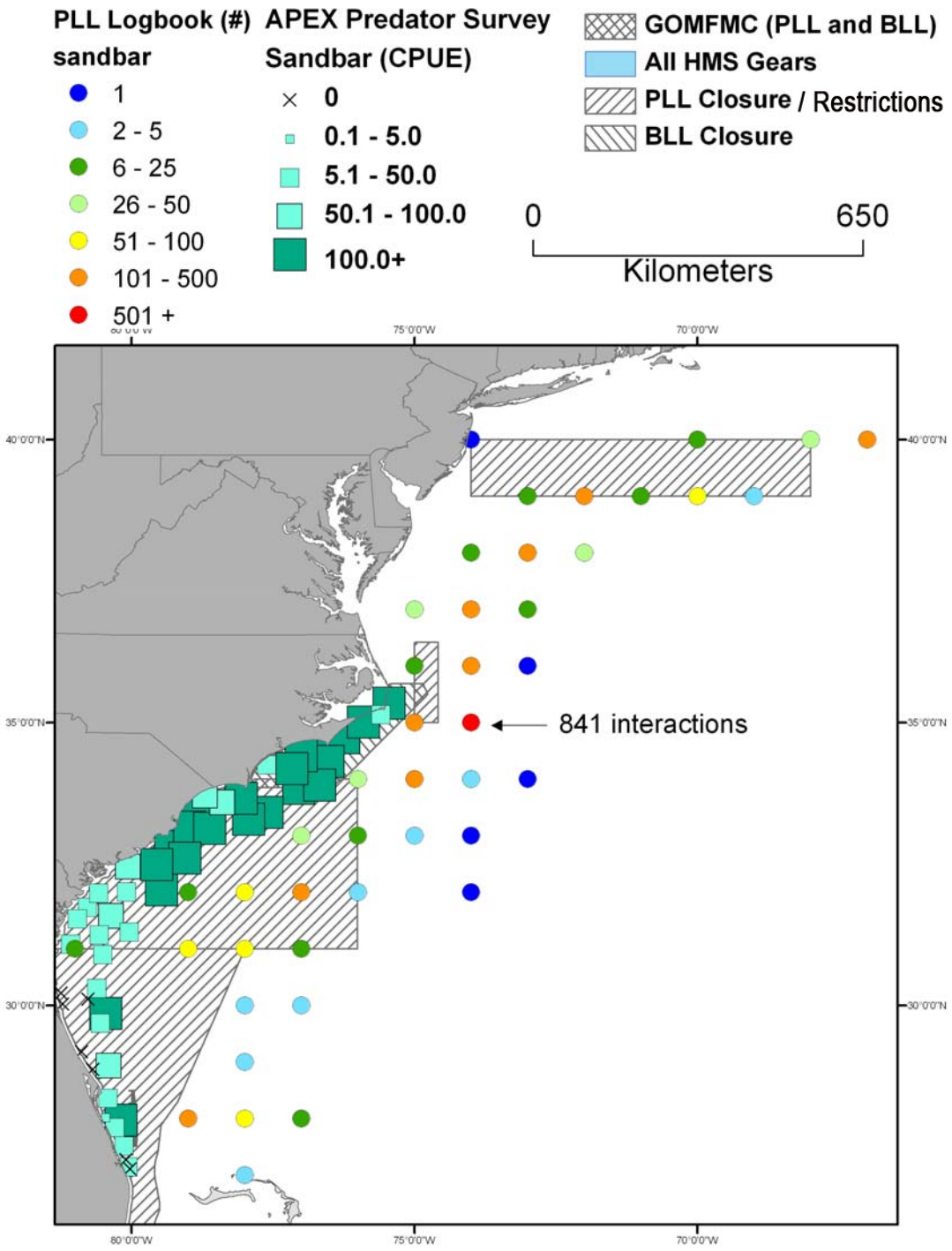

Figure 2.36 **Sandbar shark interactions observed on PLL sets in by the HMS Logbook, 2006-2009 and sandbar shark CPUE (number of sandbar/10,000 hook hours) from the 2009 Apex Predators Coastal Shark Survey (April 6 – May 20, 2009). POP points represent interactions that took place within 1x1 degree grid cells, and are located at the southeast corner of the grids they represent.**

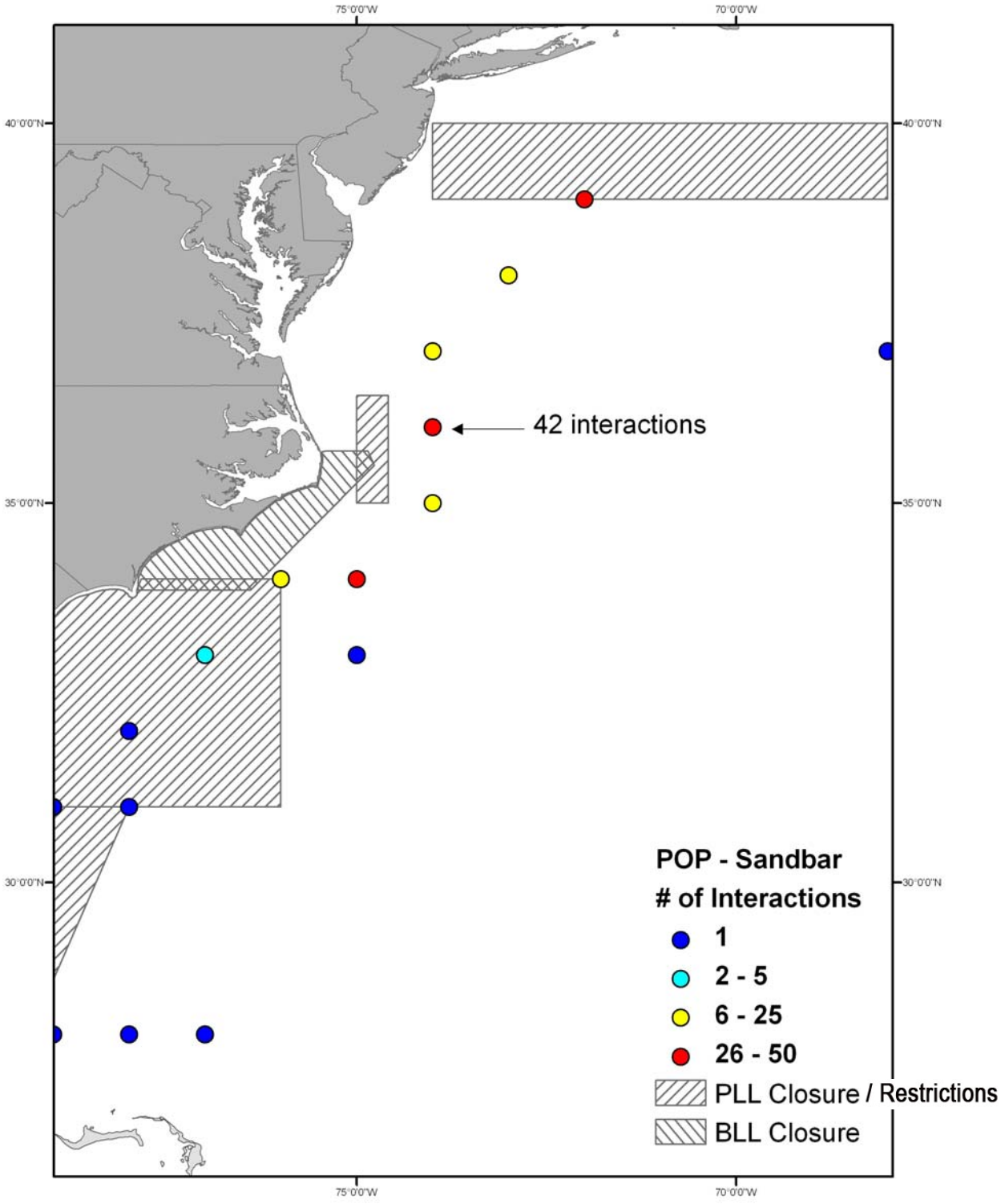

Figure 2.37 **Sandbar shark interactions observed on PLL sets in by the Pelagic Observer Program (POP), 2006-2009 in the vicinity of the Mid-Atlantic Shark Closed Area and the Florida East Coast Closed Area. Points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent.**

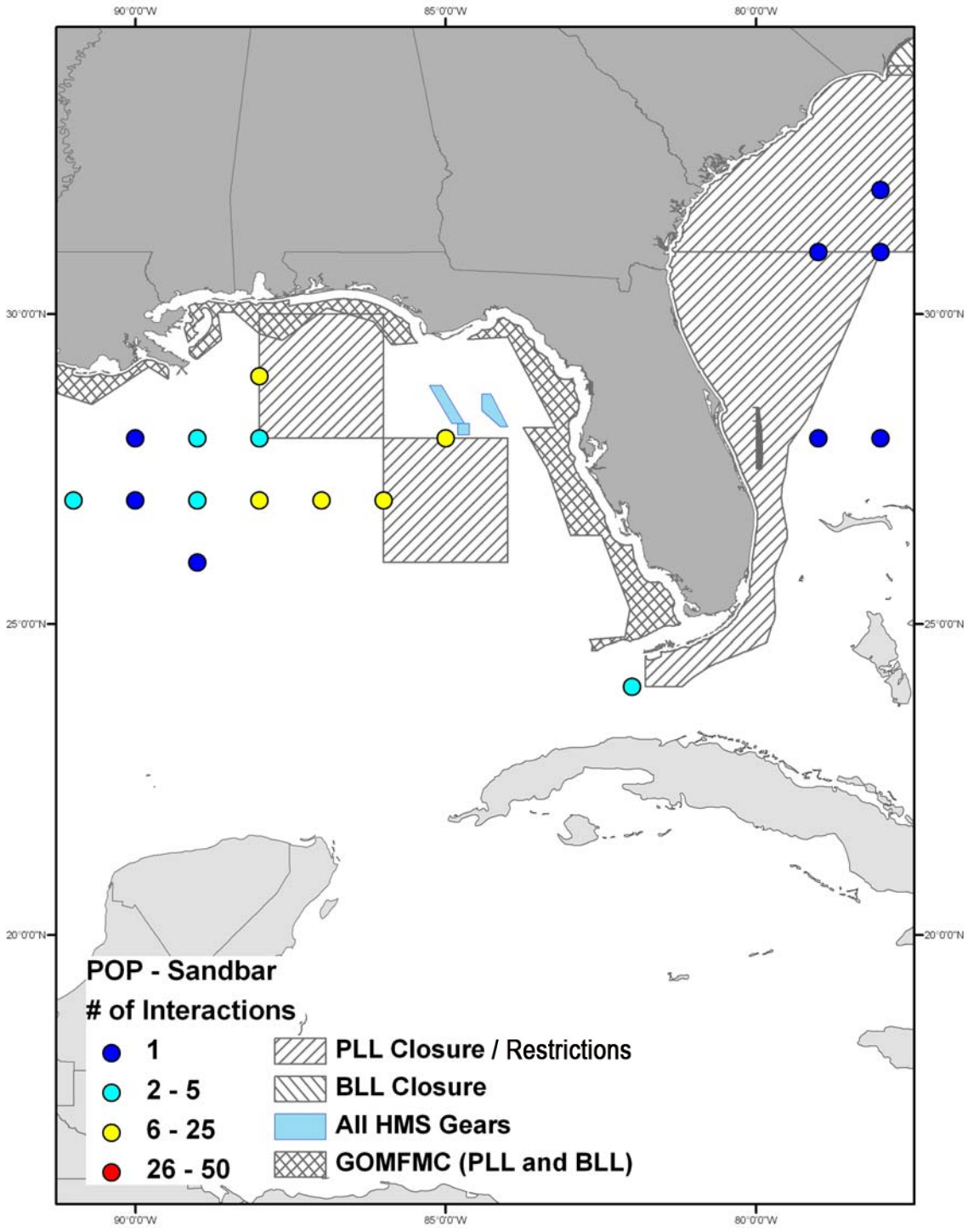

Figure 2.38 **Sandbar shark interactions observed on PLL sets in by the Pelagic Observer Program (POP), 2006-2009 in the Gulf of Mexico region. Points represent interactions that took place within 1x1 degree squares, and are located at the southeast corner of the grids they represent.**

APPENDIX 6 SUMMARY OF COMMENTS RECEIVED DURING SCOPING

A.1 Why is NMFS Amending the Consolidated HMS FMP?

On October 2, 2006 (71 FR 58058), the National Marine Fisheries Service (NMFS) finalized the 2006 Consolidated Atlantic Highly Migratory Species (HMS) Fishery Management Plan (FMP). The Consolidated HMS FMP replaced and consolidated all previous plans for Atlantic tunas, swordfish, sharks, and billfish. In 2010/2011, the Southeast Data, Assessment and Review (SEDAR) panel conducted the SEDAR 21 stock assessments for three species of sharks, consisting of four stocks; Atlantic blacknose, Gulf of Mexico blacknose, sandbar, and dusky sharks. The dusky and Atlantic blacknose shark stock assessments indicated that both stocks are overfished with overfishing occurring, the sandbar shark stock assessment indicated that the stock is overfished and that overfishing is no longer occurring on the stock, and the Gulf of Mexico blacknose shark stock assessment was rejected due to lack of model fit (see section 1.2.4). More information on the results of this assessment can be found in a Federal Register notice published on October 7, 2011 (76 FR 62331), and in the assessment itself, which is available via the SEDAR website (http://www.sefsc.noaa.gov/sedar/). NMFS also published a Federal Register notice on April 28, 2011 (76 FR 23794) determining that the status of scalloped hammerhead shark stock as overfished with overfishing occurring based on a stock assessment published in the North American Journal of Fisheries Management (Hayes et al. 2009). Given the results of the SEDAR 21 assessments, and the results of Hayes et al. (2009) changes to the 2006 Consolidated HMS FMP are required and will be made via an amendment implementing new rebuilding plans for depleted blacknose, dusky, scalloped hammerhead, and sandbar shark stocks and ensure sustainable fisheries for other shark stocks.

A.2 What is the Purpose of Scoping?

The first phase in amending an FMP or in preparing an environmental impact statement (EIS) is called scoping. During scoping, the public is given an opportunity to consider and comment on all the issues related to the subject at hand that have been identified by NMFS, as well as recommend additional issues for consideration during the rulemaking process. For this amendment, NMFS presented a broad range of potential shark issues during the scoping process. These issues included, but were not limited to, commercial and recreational measures to rebuild scalloped hammerhead, sandbar, dusky and blacknose sharks. The advice and comments received during scoping are critical because they are used to identify and explore the full range of alternative approaches to future management and to define future priorities, and because it allows public involvement in the initial stages of the process, prior to analyzing, proposing, or adopting regulations.

To facilitate the process of collecting comments, NMFS presented an issues and options presentation at the September 2011 HMS Advisory Panel meeting, made it available on the HMS website (http://www.nmfs.noaa.gov/sfa/hms/), and held five public hearings along the Atlantic and Gulf of Mexico coasts and one conference call to collect scoping comments (76 FR 62331, October 7, 2011). NMFS also requested to present the issues and options presentation to the five Atlantic Regional Fishery Management Councils as well as the Atlantic States and Gulf States

Marine Fisheries Commissions (76 FR 62331, October 7, 2011). The comment period for scoping ended on December 31, 2011 (76 FR 62331, October 7, 2011).

During the scoping meetings, the public identified a number of issues and options beyond those presented by NMFS. NMFS considers the comments received when deciding which measures to include in Draft Amendment 5 to the 2006 Consolidated HMS FMP. Not all the issues raised or presented in the issues and options presentation or during scoping will be included in Draft Amendment 5. Some issues may be included in future amendments; other issues may be handled outside the FMP amendment process.

A.3 What Were the Comments Received?

Below is a summary of all the major comments received during scoping either verbally or in writing. Comments are categorized by major issue, but are not arranged in any particular order within a given category. The major issues include: the SEDAR 21 sandbar, dusky and blacknose shark stock assessment, the Hayes et al. (2009) scalloped hammerhead stock assessment, effort controls, time/area closures, gear configurations, and general comments. Because not all the comments received were related to the list of issues in the issues and options presentation, there is not a direct correlation between this document and the issues and options presentation. Additionally, responses to comments are not included in this document. Rather, the comments themselves will aid in developing the draft amendment and proposed rule documents, both in prioritizing the types of issues to be addressed and in the analyses of the alternatives themselves.

A.3.1 Scalloped hammerhead

If NMFS can identify a discrete area where scalloped hammerheads congregate, a time/area closure might be appropriate.

Any time/area closures should include a sunset provision to ensure performance is assessed and the closure re-examined.

A dynamic time/area closure around some oceanographic attribute (e.g., water temperature) might provide for a more effective closure.

Since scalloped hammerheads come to the vessel dead, time/area closures seem to be the only option.

Scalloped hammerhead sharks should be added to the prohibited species list. Particularly since the United States supported a Convention on International Trade in Endangered Species (CITES) listing for the species in 2010.

NMFS needs to examine scalloped hammerhead mortality in other fisheries, and address that mortality as well.

There is not much interaction with hammerhead sharks in the Louisiana area. Closing the overall LCS fishery if a subquota for hammerheads is reached would have negative impacts on fishermen in the Louisiana area, especially since hammerhead sharks are not commonly caught off Louisiana. Do not link the non-sandbar LCS quota to any scalloped hammerhead quota.

There used to be a meat market for scalloped hammerhead in the late 80s and early 90s.

The SEDAR system should have been used for the scalloped hammerhead stock assessment. The data from the early years of MRFSS is not reliable and was used in Hayes et al paper; it should not be accepted as a stock assessment. MRFSS data will be re-estimated in early 2012 – what will this do to the assessment? It is a trends analysis, it's not a stock assessment and shouldn't be used. Who were the reviewers of the paper who deemed it acceptable for use as a stock assessment? Scalloped hammerheads are highly migratory, but only U.S. data was used. The data that the Hayes et al. (2009) used was not broken down by species.

NMFS needs to present more information about where scalloped hammerheads are found and where they are caught. This would inform time/area closure discussions.

A size limit might not work for hammerhead sharks.

We should investigate the linkage with Mexico and shared shark stocks. The Mexican fishery is about five times larger than the U.S. fishery in the Gulf of Mexico. Scalloped hammerhead is a top 5 species for them, making up about three percent of Mexican landings. We should pursue bilateral talks with Mexico to address these issues.

Let's not increase dead discards for great hammerheads with restrictions specifically for scalloped hammerheads.

The conservation community has used the Hayes et al. (2009) stock assessment as the basis for an Endangered Species Act (ESA) petition.

Domestic restrictions on scalloped hammerhead sharks do nothing to protect the shark across its entire world wide range.

Some fishermen in southern Florida are seeing scalloped hammerheads in much deeper water.

Scalloped hammerhead should be listed under the ESA and fishing for the species should be prohibited

NMFS should prohibit the retention of scalloped hammerheads in U.S. waters by adding them to the prohibited species list

U.S. support of CITES proposal, ICCAT's hammerhead Recommendation, and ESA petition all point to a species in trouble.

Smooth and great hammerheads should also be added to the prohibited species list too due to look alike issues.

A recent genetic study showed that replenishment of the depleted Northwest Atlantic and Gulf of Mexico population scalloped hammerhead population rests on local reproduction as opposed to immigration from elsewhere (Chapman *et al.* 2009). Thus, the future survival and recovery of this population depends on U.S. state and federal policy.

NMFS's shark ICCAT rule does not reduce scalloped hammerhead mortality enough to allow rebuilding, therefore, further action is needed.

Florida's hammerhead prohibition does not reduce scalloped hammerhead mortality enough to allow rebuilding, therefore, further action is needed.

Current LCS retention limit based on numbers of sharks encourages the retention of larger individuals within the LCS complex, including scalloped hammerheads.

Because mortality of released scalloped hammerheads is high, especially in bottom longline fisheries, NMFS should take additional measures to reduce bycatch mortality.

NMFS should not accept a stock assessment from outside the SEDAR process. The Hayes et al. (2009) dependence on flawed MRFSS data, the assumptions about the historic commercial fishing mortality and the breakdown of the Hayes modeling with the removal of the Onslow Bay, NC independent longline survey all caused issues that need to be better addressed by the NMFS science center. The NMFS needs to convene a full benchmark assessment for Scalloped hammerhead sharks. The Hayes et al. (2009) paper can be used as a reference document and should be debated in full at the data workshop.

A.3.2 Dusky Shark Comments

Overfishing on a prohibited species concerns PLL fishermen because the solution is often closed areas.

NMFS needs to update dusky at-vessel mortality on slide 13 since it uses data from before circle hooks were required in 2004.

NMFS needs to provide more information about where and in what sector dusky mortality is occurring to facilitate discussion. Are some of the concentrations in the mid-Atlantic?

NMFS should have low confidence in recreational fishermen identifying a dusky shark.

Due to the pessimistic assessment, dusky sharks should be declared endangered.

How many dusky are caught in the research fishery? Since they are often caught with sandbars, there might be a lot of dusky data available through the research fishery

The catch-free model used in the dusky stock assessment is the same model that was used in other assessments that have been rejected. The dusky assessment should have been rejected as well.

Since the species is already prohibited, time/area closures might be the only option.

At-vessel mortality is probably what is driving overfishing on dusky sharks. Currently working a hook timer study on at-vessel mortality. Preliminary results suggest that the tipping point time for dusky sharks is around 3 hours.

Prohibiting the retention encourages dead discarding of non-target and prohibited species because the fishermen will fish until they have their 33 head.

Dusky sharks rebuilding by 2099 and 2400 is troubling. I think these numbers are problematic and they lead to a creditability problem. I would urge NMFS not to publish this type of data because it reduces the creditability of the stock assessment. It's a stumbling block and the general public just won't understand.

The necessary fishing mortality reduction could be achieved solely through the recreational fishery.

More information on where recreational fishermen are catching dusky sharks can inform solutions and help target outreach to better educate anglers.

Dusky stock are increasing in in-shore waters across all age ranges.

When targeting grouper, tile fish, and other bottom fish, fishermen sometimes encounter large dusky sharks.

To reduce bycatch mortality of dusky sharks by 2/3, management measures could include time and/or area closures, gear and soak time restrictions and mandate of gear technology changes demonstrated to reduce bycatch of this species.

It is important for NMFS to identify the areas and times when the greatest bycatch of dusky sharks is occurring and consider instituting time/ area closures to protect this species.

The SEDAR 21 dusky demographic data was too extreme, with wrong average weights when converting numbers of sharks into whole sharks and issues with age to maturity and maximum age issues.

Dusky shark tags have been recovered by Mexican fishermen and a recent tag recovery from Central America demonstrates a straddling stock issue, however, the assessment only used U.S. data and assumes one regional stock.

The catch free model is not appropriate for dusky sharks.

A.3.3 Sandbar Shark Comments

Since SEDAR 21 concluded that the species can rebuild within a reasonable timeframe under the current TAC, we should not take action on sandbar sharks.

Any of the measures to stop overfishing and/or rebuild the other species will positively impact the sandbar stock

There has been some success in breeding sandbar sharks in captivity.

The science is not reflecting what fishermen are seeing on the water. The sandbar population appears to very high. Fishermen in the research fishery are seeing a high CPUE for sandbar sharks. The shark data from Virginia north is deficient.

Is there any information coming from the research fishery that can help identify appropriate time/area closures? NMFS could pay for research vessels, captained by commercial fishermen, to go out and fill any research fishery data gaps geographically and/or temporally.

The TAC should go to the 268 mt limit, because there are a lot of sandbars out there; NMFS should accept the upper limit as the TAC. NMFS should be touting it as a success story.

NMFS must continue to monitor the stock to ensure that overfishing is not occurring, and that fishing mortality remains at a level low enough to rebuild the stock as soon as possible.

Current measures are not appropriately conservative for timely recovery of sandbar sharks, particularly given the vagaries of stochastic factors that may affect the species and the poorly quantified impact of recreational fisheries.

A.3.4 Blacknose Shark Comments

NMFS should split the previous TAC between the GOM and Atlantic using historical landings data (51%/49%), then reduce the Atlantic down to 7,300 sharks.

NMFS should de-link the blacknose and SCS quota. Possibly create a time/area closure around blacknose distribution and close the area after the blacknose quota is reached. This could allow the SCS fishery to continue after the blacknose fishery closes.

NMFS should link the blacknose quota to the SCS fishery because without the linkage, the fishermen will direct on blacknose quota and blow the quota quickly. Then will still get them as bycatch/discards because they are caught within the SCS fishery.

NMFS should focus on recreational fishery – outreach, education, what can and can't be retained.

NMFS should also reduce morality resulting from other, incidental fisheries (e.g. shrimp trawl).

NMFS should reconsider the policy of discouraging blacknose landings. Even if fishermen aren't landing them, there could still be mortality.

Need to look into at-vessel mortality; perhaps it would be advantageous to require the release of blacknose sharks brought to the vessel alive.

Set the Atlantic quota equal to 7,300 sharks, and give the remainder of the sharks from the last assessment (19,200-7,300) to the GOM.

Contrary to some sources, blacknose sharks do grow larger than 54" and can be legally retained in the recreational fishery. This could be one source of recreational mortality.

Florida does not have a minimum size for blacknose and could account for a portion of the recreational landings.

More information on where and when commercial and recreational landings occur will inform solutions.

In the stock assessment, NMFS did not fully consider the impacts turtle excluder devices (TEDs) have on blacknose shark bycatch in shrimp trawls

There is a large recreational fishery for blacknose sharks that is a combination of catch & release and retention.

On the east coast of Florida, blacknose are usually only found within 3 miles of the coast and are therefore unavailable to commercial fishermen due to state law.

NMFS needs to take action to reduce fishing mortality of blacknose sharks in the Atlantic. Due to the unknown status of blacknose sharks in the Gulf of Mexico, NMFS should use a precautionary management approach and should prioritize gathering data and conducting a new assessment.

Estimates of Shrimp trawl bycatch of blacknose sharks are unrealistic considering how this shark has never been a big bycatch issue in shrimp nets since the use of turtle excluding devices (TEDs) were mandated.

A.3.5 General Comments Across All Four Shark Species

NMFS needs more information on where mortality is occurring by location, gear type, and sector.

NMFS needs more information on interactions with other fisheries.

NMFS needs more information on straddling shark stocks and what other countries are catching these stocks.

NMFS needs to educate recreational anglers on how to handle and release sharks. Some anglers gaff the sharks to get them under control even if they do not plan to retain them.

The 33-head trip limit has increased dead discards and reduced product quality. Not allowing fisherman to harvest their limit in an efficient, quick manner is counter-productive. If fishermen could bring more than 33 sharks in at a time, it would get gear out of the water quicker and it would reduce interactions with all the shark species, not just the ones considered in this Amendment.

Time/area closures have a tendency to just push effort into other areas and not reduce overall mortality.

For all four species, current federal regulations result in a large number of regulatory discards.

The type of regulations proposed in Amendment 5 – adjustments to quota levels, retention limits, minimize sizes, authorized gears and prohibited species – are proven in many fisheries to have negative consequences and can be anticipated to perpetuate existing problems, especially high mortality from regulatory discards that threatens stock health. Time/area closures used to control mortality often shift effort and mortality to different times and places, minimum size and retention limits mandate discarding of dead fish, and use of smaller quotas and prohibited designation will reduce or stop landings but not necessarily reduce mortality to rebuilding levels. NMFS should accelerate Amendment 6 to explore catch share management options like individual fishing quotas.

NMFS should work toward having consistent management between federal and state waters (e.g., hammerheads in the waters off Florida). It would seem that both reasonable management and reliable enforcement would be facilitated by consistency in regulations between state and federal waters and with consistency across fisheries.

The amount of mortality from recreational fisheries is difficult to quantify due to erratic monitoring and self-reports. Post-release mortality from recreational fisheries is likely underestimated and they (including tournament fishing) need to be better monitored with more appropriately conservative estimates of post-release survival. A study by Campana and colleagues that tracked and estimated mortality of blue sharks released from recreational fishing tournaments (Campana, et. al., 2006) estimated post-release mortality of up to 19 percent, but appears to have been dismissed without consideration. When research regarding post-release

survival is not available for a particular species (e.g., sandbar and blacknose sharks), the NMFS should consider all studies and explain why some may be deemed more relevant than others, particularly when there are disparate estimates of survival. In the calculation of impacts, benefit of the doubt should go to the species.

Quotas should include consideration of impacts of recreational fishing and when a quota is closed for the commercial sector, recreational fishing should be halted as well.

The requirement that tournaments register with NMFS (including those targeting sharks) is not sufficient to track their impacts on species. The number of tournaments offering prizes for catching large sharks has increased over the past decade. The impact of these tournaments is poorly understood. Only a limited number of tournaments is sampled to obtain catch data, and those data from the Large Pelagic Survey (LPS) and Marine Recreational Fisheries Statistics Survey (MRFSS) are extrapolations of information from a limited number of responses to survey questions and is thus likely not accurate and they do not include some takes of large sharks caught in tournaments. As a result of limited data on landings from recreational fishing, the impact of tournaments—and recreational shark fishing in general—is likely to be underestimated.

A.3.6 SEDAR 21 Assessment / Shark Science Comments

NMFS needs to engage the public process to provide more transparency. By the time SEDAR results/data hit the public, they are considered "hard facts" without being run by the public. Peer recommended high-liners could be used to help out with the process, and their opinion should carry some weight. During the SEDAR process, NMFS could email questions out to constituents as they came up. NMFS could also provide regular updates on the SEDAR process to interested parties that are unable to commit the large amount of time required by SEDAR.

The Center of Independent Experts which reviews the SEDAR stock assessments is too closely connected to the SEFSC scientists that performed the assessments. Atlantic shark stock assessments should be conducted by NMFS scientists from the NWFSC.

Some commenters noted that they have a lot of confidence in the SEDAR stock assessments.

Some of the differences between the science and what fishermen are seeing may be due to shifting baselines. Recent entrants to the fishery may be seeing a recovery over the last ten years, more sharks than they have ever seen, but older fishermen may not agree that there are more sharks out there than ever before. Additionally, sharks spatially aggregate at certain times and the stock may appear healthier than reality.

NMFS needs to offer more than one TAC recommendation. Determining appropriate ACLs requires discussion about probabilities and uncertainties, neither of which are provided. The Agency should provide the public with the same stock assessment information that the councils are provided by the SSCs.

The stock assessments for the four species should not be accepted because they rely on fictionalized past landings history for both US commercial and recreational landings.

The stock assessments are not free from bias due to the close relationship among the stock assessment scientists and staff, NGOs, and the American Elasmobranch Society.

A.3.7 Soak Time

Reducing soak times could decrease dead discards.

Soak time restrictions are too difficult to enforce to be effective. It would tie enforcement agents up for hours at a time for monitoring. If NMFS has to use this management tool, a night-soaking ban might have the same effect but would be easier to enforce.

The VMS could be used to monitor soak time remotely, but you would have to have a minimum of at least 4 hours because there are transmission signal gaps. This may be a very costly option for monitoring. NMFS may need to investigate a process where fishermen need to "declare" when setting/hauling gear.

Adding temperature loggers to the line could record soak time for enforcement.

Devices that change color when immersed in water for a certain period of time could record soak time for enforcement.

Some fishermen with smaller vessels purposefully soak gear long enough to ensure that all the sharks are dead to facilitate safe handling.

A.3.8 Gear Modifications

Longer gangion lengths on BLL and PLL may reduce at-vessel mortality.

If NMFS requires the use of new gear technology, there needs to be science to back it up since it might not be effective and could have unintended consequences.

Weak hooks worked in the GOM because it was advantageous that the larger fish are the ones fishermen are trying to avoid. That might not be the same with sharks. The size range of the catch may mean that weak hooks are inappropriate.

Some fisheries use a tended-PLL practice where each gangion has a buoy and fishermen can cruise the line and get live sharks. That would not work for long PLL mainlines, so fishermen would need to set shorter gear.

Buoy gear has been an effective substitute for PLL. Perhaps a bottom buoy gear could be developed.

A.3.9 Circle Hooks

The recreational fishery is mainly catch and release and we should start considering requiring circle hooks in the recreational shark fishery. They have advantages and disadvantages but as a conservation tool it will only help in the commercial and recreational fishery.

Circle hooks could be very good for protecting sharks. The gear works well for fish who approach and consume bait like sharks.

I'm not sure if going to a circle hook would be a big conservation gain.

The effectiveness of circle hooks in the recreational shark fishery has not been studied and there is no proof that their use could reduce post-release mortality in sharks. NMFS should not implement a circle hook requirement unless there is proof that it is effective.

Even if studies haven't been done on the effectiveness of circle hooks in sharks, observer data analyses could look at circle hooks' impact on dusky sharks in the PLL fishery pre- and post-regulation, which could inform their use in BLL.

A study is underway using charter boats to study circle hook effectiveness on post release mortality of blacktip sharks.

J hooks are more expensive than circle hooks.

If a J hook is swallowed by a shark, it has an increased chance of piercing an artery allowing the shark to bleed out.

Circle hooks are very good at lip hooking sharks, but to release them you have to know how to do it safely – otherwise you have to get very close to the mouth in order to exert the right pressure at the right angle.

Dehookers are not useful for removing circle hooks from sharks.

We believe that circle hooks may hold promise as a tool that, combined with other measures, may help reducing mortality in commercial fisheries. While studies have not always shown a large impact, there is an indication that circle hooks may be useful (Kaplan, et al., 2007; Kerstetter and Graves, 2006). The NMFS should support additional experiments that investigate the relative change in catch rates of different species of sharks and the interaction between the type of hook being used and the placement of the hook in the water column, as has been suggested by Afonso and colleagues (2011).

A.3.10 Gear Tending Requirements

NMFS should implement a gear tending requirement. Fishermen should not temporally abandon gear.

Fishermen should not be allowed to leave gear in the water while returning to port with the 33 shark limit.

NMFS could implement a time limit on directed shark fishing trips.

NMFS could redefine "trip" to not only include returning to port, but also returning to report with all fishing gear, including bottom lines and gillnets.

If gear-tending measures require that a vessel remain attached to the gear, it could have severe implication in the PLL fishery. It would cut down on the amount of gear that PLL fishermen could deploy and have implications for the tuna and SWO fisheries. Gear would have to be shortened from 30-40 mi to 5 mi of mainline, and fishermen will have to stay out longer to catch the quota.

A.3.11 Other Comments

NMFS needs to pursue species-specific shark management.

There are too many fishing regulations; it is too hard to comply due to complexity

On-vessel video monitoring could help enforce a variety of regulations.

If ICCAT is going to act on a species, it is dangerous to get too far out in front because it ends up hurting the United States and lead to cuts across the board.

Sharks don't belong at ICCAT and should be managed domestically.

A trip limit based on pounds is more effective than one based on number of fish because it would prevent high-grading. Fishermen will pick the largest sharks to fill the trip limit based on numbers, dumping the smaller ones, which results in a lot of waste.

The push to release billfish began in the 1930s and took until the 1970s to catch on. There should be more effort put into doing the same for sharks.

Display permit quota is ½ of 1 percent of the commercial shark quota, only 50% of the display quota is requested for harvest and only a fraction of those sharks are collected. Speaking on behalf of the Association of Zoos and Aquariums, U.S. aquariums have over 170 million visitors a year, with 50 million of them being children. The animals we collect are kept alive and are used to educate the public. We are in support of the display permit program.

The charter/headboats often follow shrimp boats and will target sharks collecting around the trawl nets with light tackle to provide some good fights for their customers.

In Florida, sharks have migrated out of the area by the time the fishing season is open.

NMFS needs to find a way to discourage the take of sharks for fin value only

Once a stock is rebuilt, will NMFS ever increase the quota?

The 33 head trip limit has created a de facto preference or favor for fisheries in certain geographic areas. There are areas where guys can make multiple trips on 33 head in a day because they are close – they figured out how to direct on the fishery. Other regions where you have to go further offshore, the guys are not directing (true to the intent of Amendment 2) because of the costs vs benefits.

Fishermen should not be allowed to target, catch, or retain sharks. The fines for doing so should be set high enough to discourage the practice. Sharks should be left in the water where they serve a vital ecological function.