2.0 SUMMARY OF THE ALTERNATIVES

This section provides a description and basis for all alternatives considered in Amendment 1. The ecological, economic, and social impacts of these alternative are discussed in later chapters.

2.1 COMMERCIAL MANAGEMENT MEASURES

2.1.1 Large Coastal Shark (LCS) Classification

The following alternatives explore different possibilities for dividing the species in the LCS complex. These alternatives also consider the timing of fishery closures.

Alternative A1 Separate LCS groupings (Ridgeback/Non-ridgeback), different closure dates possible - (No Action)

This alternative would separate the LCS complex into ridgeback and non-ridgeback shark groupings and would establish commercial quotas for each grouping. Because separate quotas would be established for each grouping, it would be possible to have different closure dates in the event that one quota is filled before the other.

Many LCS species are characterized by a mid-dorsal ridge that is easily identified even after the fish has been headed, gutted, and finned. As such, the mid-dorsal ridge is useful as a diagnostic characteristic for management and enforcement purposes. Splitting LCS into two groupings could enable managers to be more responsive to the needs of individual species within each grouping, consistent with the recommendation from the 2002 LCS stock assessment regarding more species-specific management. For example, ridgeback LCS pup from March through August along the eastern seaboard, whereas non-ridgeback LCS pup from May through August primarily in the south Atlantic in Florida and Gulf of Mexico. Under this alternative, consideration could be given to closing the ridgeback LCS fishing season before the non-ridgeback LCS season, to reduce fishing mortality during ridgeback LCS pupping season.

Alternative A2 Separate LCS groupings (Ridgeback/Non-ridgeback), same closure date

This alternative is similar to alternative A1 in that the LCS complex would be separated into ridgeback and non-ridgeback shark groupings and commercial quotas would be established for each grouping. However, under this alternative, both groupings would close when the first of the two quotas is filled.

Similar to the alternative A1, alternative A2 also divides LCS based upon the mid-dorsal ridge characteristic. However, this alternative recognizes that directed shark fisheries exhibit mixed species catch composition. According to bottom longline observer data from 2000 to mid-2002, LCS comprise 66.2 percent of total shark catches (Burgess and Morgan, 2003). Of LCS catches, sandbar, tiger, and blacktip sharks represented 59 percent, 19 percent, and 8 percent respectively

(Burgess and Morgan, 2003). This mixed fishery information suggests that although fishermen can target certain species, increases in regulatory discards could occur during partial closures. This alternative provides managers the flexibility to address species-specific concerns within each grouping, and could also minimize regulatory discards by implementing a single closure for the LCS fishery.

Alternative A3 *Aggregate LCS, one closure date - Preferred Alternative*

This alternative aggregates LCS species into one group and establishes one commercial quota for the complex. Because there will be only one quota under this alternative, there will be only one closure date possible.

This alternative is based upon data which documents that directed shark fisheries exhibit mixed species catch composition. The Commercial Shark Fishery Observer Program (CSFOP), documented over 33 million hook hours of effort and yielded over 9,000 sharks representing 28 different species, including 6,461 LCS representing 14 species, 3,228 SCS representing two species, and 45 pelagic sharks representing two species between 2000 and mid-2002 (Burgess and Morgan, 2003). As noted above, most LCS catches were sandbar, tiger, and blacktip sharks. Under this alternative, species identification is not as important when estimating closure dates.

Alternative A4 Species-specific groupings, different closure dates possible

This alternative would establish species-specific commercial quotas. Under this alternative, closures would occur when the quotas for each individual species are filled. Because the management unit is comprised of many species and because market demands for individual species differ, it is likely that multiple closure dates would occur. The 2002 LCS stock assessment notes that risk-neutral management of the LCS complex may result in excessive regulation related to some species and excessive risk of overfishing on others (Cortes *et al*., 2002). To this end, the 2002 LCS stock assessment recommends that every effort be taken to manage on a species-specific basis (Cortes *et al*., 2002).

Other shark classification alternatives considered but not further analyzed at this time

Alternative A5 Aggregate complex, closure occurs when quota is reached for species of highest vulnerability

Similar to A3, this alternative would aggregate the LCS into one complex and would establish one quota for the aggregate. However, the quota would be set based on the level of effort the species of highest vulnerability could withstand. Under this alternative, the season for each complex would close when the quota for the species of highest vulnerability (e.g., species with overfished/overfishing status) is filled.

To date there is limited data available on individual LCS species beyond that of sandbar and blacktip. Without species-specific assessments, it is difficult to say which LCS species have

highest vulnerability or even what the quota should be for any individual species. Given this, NOAA Fisheries does not feel this alternative is a viable option at this time. NOAA Fisheries may consider this alternative in the future.

2.1.2 Quota Administration

The following alternatives define how commercial quotas will be temporally and spatially applied. These alternatives correspond to all shark groupings including LCS, SCS, and pelagic sharks. In all cases, NOAA Fisheries would announce the length of the fishing season prior to the start of the fishing season.

Alternative B1 Semi-annual season - (No Action)

This alternative would implement a semi-annual season (i.e., two per year) for commercial shark fisheries. Under this alternative, the first season would operate between the dates of January 1 and June 30. The second season would operate between the dates of July 1 and December 31 of each year. Both periods may be shortened to ensure that commercial quotas are not exceeded.

This alternative is consistent with traditional fishing practices. Semi-annual seasons have been in place since 1993 and seek to provide equitable access by all user groups to fish available at different times of the year.

Alternative B2 No regional quotas - (No Action)

This alternative would not implement regional quotas for commercial shark fisheries. This alternative has been in place since 1993 due to lacking regional data on which to base further consideration of such quotas to date.

Alternative B3 *Regional quotas - Preferred Alternative*

This alternative will implement regional quotas for the Gulf of Mexico (Texas - West coast Florida), South Atlantic (East coast Florida - North Carolina and the Caribbean), and North Atlantic (Virginia - Maine) commercial shark fisheries. This alternative is based upon regional differences in fisheries, shark pupping seasons, and fish availability. For example, catch rates for LCS caught on the west coast of Florida in winter are higher (3.56 sharks per 10,000 hook-hr) than catch rates of North Carolina (0.23 sharks per 10,000 hook-hr) (Burgess and Morgan, 2003). This information suggests that fish availability is higher off western Florida compared to North Carolina during winter months.

Regional quotas will be set on the basis of average historical landings (over the past three years) expressed as a percentage of average landings across all regions (See Tables 2.1 and 2.2). Averages were calculated in order to minimize uncertainty associated with inter-annual fluctuations in regional landings data as well as differences in reported landings, which were

derived from two separate databases. For years 1999-2001, the Gulf of Mexico, South Atlantic and North Atlantic accounted for four percent, 83 percent, and 13 percent of the total SCS landings, respectively. During the same time period, the Gulf of Mexico, South Atlantic, and North Atlantic accounted for 42 percent, 54 percent, and four percent of the total LCS landings, respectively. This alternative will divide annual quotas for LCS and SCS based upon these regional percentages and will further divide these quotas evenly by fishing season. Fishery participants will be allowed to fish in any region, provided that the season for the region in question is open and that the quota for that region has not been taken. The open season for each region will close when the quota for that region is taken.

Given that regional quotas will be based on average landings over the previous three calendar years, it is possible for percentages to change and vary over time. NOAA Fisheries will periodically assess changes to percentages in regional landings data. Should such changes require quota adjustments this will be carried out via a framework action.

Alternative B4 *Trimester season - Preferred Alternative*

This alternative will implement a trimester season (i.e., three per year) for commercial shark fisheries. Under this alternative, the first trimester season will operate between the dates of January 1 and April 30, the second trimester season will operate between May 1 and August 31, and the third trimester season will operate between September 1 and December 31. All three trimester seasons may be shortened to ensure that commercial quotas are not exceeded. The basis for this alternative is that there are temporal differences in fishing practices, fish availability, and pupping activity. Under this alternative, the annual quota will not need to be split equally between trimester seasons. Instead, this alternative will allow managers to establish quotas for each trimester based on markets, pupping season, and other relevant factors.

Alternative B5 Quarterly season

This alternative would implement a quarterly season for commercial sharks fisheries. This alternative divides the calendar year into four open seasons including (1) Q1 January 1 - March 31, (2) Q2 April 1 - June 30, (3) Q3 July 1 - September 30, and (4) Q4 October 1 - December 31. All four quarters may be shortened to ensure that commercial quotas are not exceeded. The basis for this alternative is that there are temporal differences in fishing practices, fish availability, and pupping activity. Under this alternative, the annual quota would not need to be split equally between quarters. Instead, this alternative would allow managers to set quotas for each quarter based on markets, pupping season, and other relevant factors.

2.1.3 Quota Basis

The following alternatives define the basis (i.e., process, methodology, and resulting quotas) for commercial quota specifications. The basis outlined for LCS depends to a large extent upon the classification selected (See Section 2.1.1). The specification outlined also depends in part on

both the rebuilding time frame (See Section 4.1) and stock assessment recommendations. Table 2.3 outlines the calculations used to determine quota specifications. These alternatives apply to all shark groupings including LCS, SCS, and pelagic sharks. NOAA Fisheries will assess the appropriateness of percent reductions and/or increases, as outlined in the following alternatives, as new information becomes available in future stock assessments. The quota basis for pelagic sharks will not change until such time as a stock assessment is completed. The quotas listed below would be split appropriately between the season and regions as described in alternatives B1-B5 above.

Alternative C1 Quota Basis from 1999 HMS FMP - (No Action)

This alternative would implement commercial quota levels of 620 mt dw (1,366,852 lb dw) for ridgeback LCS and 196 mt dw (432,102 lb dw) for non-ridgeback LCS, which are the quota levels established in the 1999 HMS FMP. As described in the HMS FMP, these quota levels were based on the rebuilding projections from the 1998 LCS stock assessment for sandbar and blacktip sharks. These quota levels have never been implemented.

Additionally, this alternative would implement a commercial quota of 359 mt dw (791,451 lb dw) for the SCS complex. This is the quota that was implemented in the 1999 HMS FMP and was 10-percent higher than the highest landings by commercial fishermen, including fishermen fishing in state waters. This management measure was a precautionary measure to prevent expansion of this fishery, pending a new stock assessment. At the time of the HMS FMP, the highest landings were in 1997 (320 mt dw/705,472 lb dw). Updating the landings through 2001 (highest 326 mt dw/718,700 lb dw in 2001) would result in the same quota level (See Table 2.4). This quota level has never been implemented.

Lastly, this alternative would establish a commercial quota of 92 mt dw (202,823 lb dw) for porbeagle, 273 mt dw (601,856 lb dw) for blue, and 488 mt dw (1,075,845 lb dw) for other pelagic sharks. The porbeagle shark quota is approximately 10-percent higher than the highest annual porbeagle landings (1990-1998). The blue shark quota is equivalent to the average weight of blue sharks discarded dead by longline fisheries targeting tunas and swordfish for the period 1987 to 1997. The pelagic shark quotas are identical to those that were implemented in the 1999 HMS FMP, pending a new stock assessment.

Under this alternative, dead discards and state landings after a Federal closure would be counted against the following years quota.

Alternative C2 *Quota based upon percentage of Maximum Sustainable Yield (MSY) - Preferred Alternative*

This alternative will implement commercial quota levels based on the MSY level calculated in the stock assessment. This MSY level is then reduced by an appropriate amount as recommended by the stock assessment or by 25 percent to calculate optimum yield (OY).

Optimum yield is split into three parts: commercial landings, recreational harvest, and dead discards. These three parts are calculated based on recent history of the fishery. The commercial quota is equal to the proportion of commercial landings from OY. Commercial landings include landings by federally permitted fishermen and state-permitted fishermen. Thus, this alternative sets a commercial landings quota using MSY to calculate OY as a proxies for total allowable catch (TAC) (See Figure 2.1). Under this alternative, dead discards and recreational landings are taken off before calculating the quota and will not be taken off the quota at the end of the season. Overharvests and/or underharvests as well as state landings by state-permitted fishermen after a Federal closure will be accounted for in the same season of the following year's quota. The quota will be adjusted after each stock assessment, as appropriate. Under this alternative, the commercial quota could be increased without a change in MSY if either dead discards or recreational harvest decrease. Alternatively, if dead discards or recreational harvest increase, then commercial quotas could decrease.

Given the current 2002 LCS stock assessment, this alternative, if combined with either alternative A1 or A2, would implement commercial quota levels of 1,017 mt dw (2,242,078 lb dw) for ridgeback LCS and 509 mt dw (1,122,141 lb dw) for non-ridgeback LCS (Table 2.3). The quota for ridgeback LCS is based upon catch-per-unit-effort (CPUE) data, which suggests that silky and tiger shark populations are not decreasing. As such, NOAA Fisheries feels that a 45-percent reduction (see below for explanation of 45-percent reduction) in addition to the other preferred alternatives is reasonable and should rebuild the LCS complex. The quota for non-ridgeback LCS is based upon a 50-percent reduction in catch as recommended in the 2002 LCS stock assessment. This reduction is also based upon declining CPUE trends for non-ridgeback LCS.

Given the current 2002 LCS stock assessment, this alternative, if combined with preferred alternative A3, will implement a commercial quota of 1,017 mt dw (2,242,078 lb dw) for the LCS aggregate. The LCS aggregate quota is based upon a 45-percent reduction of average maximum sustainable catch[1] (MSC) for LCS (Table 2.3), multiplied by the percent contribution of commercial catch to total catch for the LCS complex. The percent reduction has been revised based upon public comment received during public hearings on draft Amendment 1. NOAA Fisheries reduced the 50-percent recommended reduction by five percent after consider the following factors: (1) while the stock assessment did say that the LCS complex should be reduced by 50 percent, it also said that the reductions should be on species other than sandbar and blacktip; (2) observer data indicates that sandbar and blacktip sharks comprise approximately 67 percent of the LCS catch, indicating that a quota reduction would mostly apply to those species; (3) the peer reviews indicated that the complex assessment may not be as accurate as individual species because of biological differences between species; (4) CPUE data for silky, tiger, and scalloped hammerhead do not indicate a decline; and (5) the other preferred measures such as the time/area closure will reduce mortality and/or dead discards. NOAA Fisheries originally reduced the quota by 40 percent not 45 percent. However, based on public comment,

[1]MSC is used interchangeably with MSY in the 2002 LCS stock assessment.

NOAA Fisheries is revising the time/area closure. Additionally, after considering the advice from the SEFSC regarding draft Amendment 1, NOAA Fisheries felt that a more risk averse approach would be appropriate. Thus, NOAA Fisheries feels that a 45-percent reduction in addition to the other preferred alternatives is reasonable and will rebuild the LCS complex. This is consistent with the 1999 HMS FMP, which sets $F_{target} < F_{MSY}$ as the target control rule during rebuilding.

Given the current 2002 LCS stock assessment, this alternative, if combined with alternative A4, would implement commercial quota levels of 991 mt dw (2,184,759 lb dw) for sandbar sharks, 1,473 mt dw (3,247,376 lb dw) for blacktip sharks, and 95 mt dw (209,437 lb dw) for other LCS ridgeback and non-ridgeback sharks (See Table 2.3). The quotas for sandbar and blacktip sharks are based upon average MSC for each species, multiplied by 75 percent of MSC for each species. The 1999 HMS FMP sets $F_{target} = 0.75F_{MSY} = F_{OY}$ as the target control rule for healthy stocks. These quotas are further multiplied by the percent contribution of commercial catch to total catch for each of these species. The quota for other LCS is based upon the average MSC for all LCS, multiplied by the percent contribution of commercial catch to total catch for non-sandbar and non-blacktip sharks as well as all LCS, and further reduced by 45 percent, as recommended by the stock assessment and taking into consideration other factors described earlier in this section.

Given the current 2002 SCS stock assessment, this alternative would implement a commercial quota of 454 mt dw (1,000,888 lb dw) for the SCS complex. The SCS quota is based upon 75 percent of the average MSY for the complex, multiplied by the percent contribution of commercial catch to total catch for the SCS complex. The 1999 HMS FMP sets $F_{target} = 0.75F_{MSY} = F_{OY}$ as the target control rule for healthy stocks.

Under this alternative commercial quotas of 92 mt dw (202,823 lb dw) for porbeagle, 273 mt dw (601,856 lb dw) for blue, and 488 mt dw (1,075,845 lb dw) for other pelagic sharks, which were originally implemented in the 1999 HMS FMP, would be maintained pending a stock assessment. Once a stock assessment is conducted, NOAA Fisheries would either implement pelagic shark quotas consistent with an ICCAT recommendation, if applicable, or set pelagic shark quotas using the same method as described above for LCS and SCS.

Alternative C3 Quota based upon average landings for past three years

This alternative would implement commercial quota levels based on average landings, calculated over the past three years (1999-2001) from the latest stock assessment. Average landings would be reduced by an appropriate amount as recommended by the stock assessment. Overharvest and/or underharvests as well as state landings after a Federal closure would be accounted for in the same season of the following year's quota. The quota would be adjusted after each stock assessment, as appropriate.

Given the current 2002 LCS stock assessment, this alternative, if combined with either alternative A1 or A2, would implement commercial quota levels of 794 mt dw (1,750,452 lb dw)

for ridgeback LCS and 931 mt dw (2,052,483 lb dw) for non-ridgeback LCS (See Table 2.3). The quota for ridgeback LCS is based upon average landings of sandbar sharks (past three years), plus 50 percent of the unclassified shark average landings (past three years), plus addition of the other ridgeback species average landings (past three years). The quota for non-ridgeback LCS is based upon average landings of blacktip and spinner sharks (past three years), plus a 20 percent addition of blacktip and spinner average landings (past three years), plus a 50 percent of unclassified sharks average landings (past three years), plus a 50 percent addition of unclassified shark average landings (past three years), plus 50 percent subtraction of the other non-ridgeback species average landings (past three years). Similar quota levels were implemented under the 2003 emergency rule (67 FR 8990, December 27, 2002; extended 68 FR 31983, May 29, 2003).

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with preferred alternative A3</u>, would implement commercial quota levels of 931 mt dw (2,052,483 lb dw) for the LCS aggregate (See Table 2.3). The LCS aggregate quota is based upon a 45-percent reduction of average landings for LCS (past three years). The 45-percent reduction is based on the 50 percent suggested in the stock assessment as modified by the factors considered in alternative C2 above.

Given the current 2002 LCS stock assessment, this alternative, <u>if combined with alternative A4</u>, would implement commercial quota levels of 635 mt dw (1,399,921 lb dw) for sandbar sharks, 740 mt dw (1,631,404 lb dw) for blacktip sharks, and 221 mt dw (487,217 lb dw) for other LCS ridgeback and non-ridgeback sharks (Table 2.3). The quota for sandbar sharks is based upon average landings of sandbar sharks (past three years). The quota for blacktip sharks is based upon a 20 percent addition of blacktip and spinner average landings (past three years). The quota for other LCS ridgeback and non-ridgeback sharks is based upon 50-percent reduction in average landings of other LCS non-ridgeback sharks (past three years).

Given the current 2002 SCS stock assessment, this alternative would implement a commercial quota of 300 mt dw (661,380 lb dw) for the SCS complex. This quota amount equates to the average SCS landings over the past three years.

Under this alternative commercial quotas of 92 mt dw (202,823 lb dw) for porbeagle, 273 mt dw (601,856 lb dw) for blue, and 488 mt dw (1,075,845 lb dw) for other pelagic sharks, which were originally implemented in the 1999 HMS FMP, would be maintained pending a stock assessment. Once a stock assessment is conducted, NOAA Fisheries would either implement pelagic shark quotas consistent with an ICCAT recommendation, if applicable, or set pelagic shark quotas using the same method as described herein for LCS and SCS.

<u>Other quota basis alternatives considered but not further analyzed at this time</u>

Alternative C4 Quota based upon maintaining constant fishing mortality (F) over time

This alternative would allocate the quota based upon maintaining a constant fishing mortality over time to reach F_{MSY} (in the case of rebuilding stocks) or F_{OY} (in the case of healthy stocks). Constant fishing mortality approaches (e.g., fixed amount, varying percentage) are inconsistent with current harvest management strategies focused on maintaining constant catch (varying amount, fixed percentage) over time (Cortes, pers. comm. 2003). Additionally, calculating a specific quota amount based on a percentage of F_{MSY} or F_{OY} is difficult and could be more inaccurate than calculating a quota based on MSY itself. Therefore this alternative is not being further analyzed at this time. NOAA Fisheries may reconsider this alternative in the future, if appropriate.

2.1.4 Commercial Minimum Size

The following alternatives consider minimum sizes for commercially harvested sharks.

Alternative D1 4.5 feet fork length for Ridgeback LCS - (No Action)

This alternative would implement a 4.5 feet (137 cm) fork length minimum size for commercially-caught ridgeback LCS. This alternative would not implement a minimum size for non-ridgeback LCS, SCS, or pelagic sharks. This alternative was adopted under the 1999 HMS FMP but never implemented.

This alternative is based upon existing data (Sminkey and Musick, 1995), which approximates 4.5 feet in fork length to the size of first maturity for female sandbar sharks, the primary species in the fishery. Additionally, sandbar sharks, unlike blacktip sharks, segregate by size. According to the 2002 stock assessment, sandbar sharks are not overfished, however overfishing is occurring (Cortes *et al*., 2002). Implementation of a minimum size is one option available to address this overfishing status.

Alternative D2 *No minimum size - Preferred Alternative*

This alternative will not implement a minimum size for any commercially-caught LCS, SCS, or pelagic shark. This alternative has been implemented in commercial fisheries since 1993. This alternative is based primarily upon observer data which show that the directed shark fishery is a mixed fishery (Burgess and Morgan, 2003). Observer data (2000-2001) document high mortality for spinner (36.7 percent alive), night (23.7 percent alive), dusky (18.8 percent alive), scalloped hammerhead (13.2 percent alive), blacktip (12.3 percent alive), silky (10.3 percent alive), and great hammerhead sharks (5.4 percent alive) following longline captures (Burgess and Morgan, 2003). While some species, such as sandbar, segregate by size and therefore may benefit from a size limit, other species do not. As such, observer data suggest that minimum sizes or catch-and-release measures enacted for those species could have little positive effect on reducing fishing mortality (Burgess and Morgan, 2003).

Alternative D3 5 feet fork length for all LCS

This alternative would implement a minimum size of five feet (152 cm) fork length for all commercially-caught LCS. This alternative would not implement a minimum size for SCS or pelagic sharks. This alternative is based upon existing data (Sminkey and Musick, 1995), which approximates five feet in fork length to the size above which all female sandbar sharks are sexually mature. As such, this alternative would give the majority of female sandbar sharks the opportunity to reproduce before recruiting to the commercial fishery. According to the 2002 stock assessment, sandbar sharks are not overfished, however overfishing is occurring (Cortes *et al*., 2002). Additionally, the 2002 LCS stock assessment recommended protection for juveniles and reproductive females (Cortes *et al*., 2002). This alternative may also provide protection for other LCS species, such as blacktip.

Alternative D4 — 5 feet fork length for Ridgeback LCS; 4.5 feet fork length for Non-ridgeback LCS

This alternative would implement minimum sizes of five feet fork length for commercially-caught ridgeback LCS and 4.5 feet fork length for commercially-caught non-ridgeback LCS. This alternative would not implement a minimum size for SCS or pelagic sharks. This alternative is based upon existing data, which approximates five feet in fork length to the size above which all female sandbar sharks are sexually mature and 4.5 feet in fork length to the median size at which female blacktip sharks become sexually mature (Sminkey and Musick, 1995; Carlson and Baremore, 2002). As such, this alternative would give all female sandbar sharks and the majority of blacktip females the opportunity to reproduce before recruiting to the commercial fishery. According to the 2002 stock assessment, sandbar sharks are not overfished, however overfishing is occurring (Cortes *et al*., 2002). Additionally, the 2002 LCS stock assessment recommended protection for juveniles and reproductive females (Cortes *et al*., 2002).

Alternative D5 — 4.5 feet fork length for Atlantic Non-ridgeback LCS; 4 feet fork length for Gulf of Mexico Non-ridgeback LCS

This alternative would implement minimum sizes for commercially caught non-ridgeback LCS only. Specifically, this alternative would implement a 4.5 feet fork length minimum size for non-ridgeback sharks caught in the Atlantic Ocean and a four feet fork length minimum size for non-ridgeback sharks caught in the Gulf of Mexico. This alternative would not implement a minimum size for SCS or pelagic sharks. Carlson and Baremore (2002) found that the median sizes at which female blacktip sharks become mature in the Atlantic and Gulf regions are 126.6 cm fork length and 117.3 cm fork length respectively. The 4.5 feet minimum size limit for non-ridgeback LCS brings the median size in the Atlantic region (126.6 cm or 4.15 feet) up to a rounded length and the 4.0 feet (117.3 cm or 3.8 feet) minimum size limit for Gulf region non-ridgeback sharks does the same for the median size in the Gulf region.

Alternative D6 — Minimum size for overfished species (or where overfishing is occurring) only

This alternative would implement minimum sizes for commercially-caught overfished species of LCS and SCS only. Based on the results of the 2002 LCS stock assessment, the LCS complex is overfished. As such, under this alternative, a minimum size of five feet fork length would be implemented for the LCS complex. The minimum size implemented for LCS would be removed when sufficient information is available to suggest that the complex is no longer overfished. Based upon the results of the 2002 SCS stock assessment, overfishing is occurring on finetooth sharks (Cortes, 2002). As such, a minimum size of 4.0 feet (e.g., 123 cm TL) fork length is suggested for finetooth to allow for 50 percent of all female finetooth to reach sexual maturity (Carlson *et al*., 2003) and lower fishing mortality on immature finetooth. Similarly, minimum sizes would be considered for other aggregates/species should scientific information suggest that additional aggregates/species are, in fact, overfished.

2.2 RECREATIONAL MANAGEMENT MEASURES

2.2.1 Recreational Retention Limits

Alternative E1 — One shark per vessel per trip plus one Atlantic sharpnose shark per person per trip (No Action)

This alternative would maintain the current recreational retention limits of one shark per vessel per trip, inclusive of LCS, SCS, and pelagic sharks. It would also maintain the allowance for one Atlantic sharpnose shark per person per trip to accommodate charter and headboat operations. This retention limit was implemented in the HMS FMP, in part, to reduce the harvest of sandbar and blacktip sharks to aid in the rebuilding of overfished fisheries for LCS, and to address misidentification issues.

Alternative E2 — *Existing catch limits (E1) plus the addition of one bonnethead shark per person per trip - Preferred Alternative*

This alternative would allow the retention of one bonnethead shark per person per trip in addition to the existing catch limits (E1). The existing retention limit will continue to aid in rebuilding LCS, which are overfished and still experiencing overfishing. Bonnethead sharks are an important recreational catch in some regions, are easy to identify, and, according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished (Cortes, 2002).

Alternative E3 — Existing catch limits (E1) plus the addition of one pelagic shark per vessel per trip

This alternative would allow the addition of one pelagic shark per vessel per trip to the existing catch limits (E1). This alternative could continue to aid in rebuilding LCS while also allowing anglers who fish outside the range of Atlantic sharpnose sharks the opportunity to land an additional shark per vessel per trip.

Alternative E4 Existing catch limits (E1) plus an allowance for vessels with HMS Angling permits participating in registered tournaments or HMS CHB permit holders on for-hire trips to retain one shark per person, up to two sharks per vessel, per trip, as well as one bonnethead shark per person per trip

In addition to existing catch limits (E1), this alternative would allow permitted charter/headboat vessels carrying multiple paying passengers or vessels with HMS Angling permits competing in registered tournaments to retain one additional shark per vessel per trip, up to two sharks per vessel per trip. It would create a retention limit similar to that in effect in the recreational swordfish fishery. It would also allow the retention of one bonnethead shark per person per trip, giving anglers a greater chance of landing a shark. Bonnethead sharks are an important recreational catch in some regions, they are easy to identify, and according to the 2002 SCS stock assessment, they are not experiencing overfishing and are not overfished (Cortes, 2002).

Alternative E5 Other retention limit that considers existing state recreational retention limits

This alternative would identify a retention limit that considers existing state recreational retention limits (Appendix 3). A retention limit similar to those that exist in most states could minimize confusion with Federal regulations and make enforcement less complicated.

Alternative E6 No retention, catch-and-release fishing for all recreational shark fisheries, inclusive of all LCS, pelagic species, and SCS.

This alternative would implement catch-and-release fishing for all recreational shark fisheries, inclusive of all LCS, SCS, and pelagic species. This alternative would require all sharks to be released in a manner that maximizes the probability of survival. This alternative would aid in rebuilding LCS and help prevent overfishing on SCS and pelagic sharks.

Alternative E7 No retention limit

Under this alternative, there would be no retention limit for recreational shark fisheries, inclusive of all LCS, SCS, and pelagic species. Any shark caught, could be retained.

2.2.2 Recreational Minimum Sizes

Alternative F1 4.5 feet fork length for all sharks, no size limit for Atlantic sharpnose sharks (No Action)

This alternative would maintain the existing size limit of 4.5 feet (137 cm) fork length for all sharks and no size limit for Atlantic sharpnose sharks. The 4.5 feet (137 cm) fork length size limit approximates the size of first maturity for female sandbar sharks. Sharks caught in

recreational fisheries are thought to have low post-release mortalities and the current 4.5 feet fork length size limit could minimize fishing mortality on the most sensitive stages/sizes by continuing catch-and-release fishing on juvenile and subadult sharks. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002). The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and Atlantic sharpnose sharks. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002).

Alternative F2 — *Existing size limits (F1) plus no size limit for bonnethead sharks - Preferred Alternative*

This alternative would allow the retention of bonnethead sharks with no minimum size in addition to the existing size limits (F1). Bonnethead sharks are an important recreational catch in some regions, are easy to identify, do not commonly reach the current 4.5 feet fork length minimum size, and according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished (Cortes, 2002).

Alternative F3 — 5.0 feet fork length for all sharks, no size limit for Atlantic sharpnose and bonnethead sharks

This alternative would increase the existing size limit to 5.0 feet fork length for all sharks, maintain no size limit for Atlantic sharpnose sharks, and allow the retention of bonnethead sharks with no minimum size. The 5.0 feet fork length (152.4 cm) minimum size approximates the size above which all female sandbar sharks have been found to be mature. This limit would allow all female sandbar sharks to be sexually mature before recruiting to the recreational fishery. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002). This alternative may provide increased protection for other shark species such as dusky sharks by essentially creating a catch-and-release fishery for juvenile and subadult stages. Sharks caught in recreational fisheries are thought to have low post release mortalities and the 5.0 feet fork length size limit could increase protection for many sensitive stages/sizes. The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and for the Atlantic sharpnose shark which has no minimum size. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002). Additionally, Atlantic sharpnose do not reach 5.0 feet fork length. No size limit for bonnethead sharks was included in this alternative because bonnethead sharks are an important recreational catch in some regions, do not reach 5.0 feet fork length, and according to the 2002 SCS stock assessment, are not experiencing overfishing, and are not overfished.

Alternative F4 — 5.0 feet fork length for all ridgeback LCS, 4.5 feet fork length all non-ridgeback LCS, SCS, and pelagic sharks, no size limit for Atlantic sharpnose and bonnethead sharks

This alternative would increase the existing size limit to 5.0 feet fork length for all ridgeback LCS, retain the 4.5 feet fork length size limit for all non-ridgeback LCS, SCS, and pelagic sharks, maintain no size limit for Atlantic sharpnose sharks, and allow the retention of bonnethead sharks with no minimum size. The 5.0 feet fork length (152.4 cm) minimum size for ridgeback LCS approximates the size above which all female sandbar sharks have been found to be mature. The 4.5 feet fork length (137 cm) minimum size limit for non-ridgeback is slightly larger than the median size at which female blacktip sharks become mature. These limits could allow all female sandbar sharks and a majority of female blacktip sharks to be sexually mature before recruiting to the recreational fishery. The 2002 LCS stock assessment recommended protecting juveniles and reproductive females (Cortes *et al.*, 2002). These limits may provide increased protection for other shark species such as dusky sharks by essentially creating a catch-and-release fishery for juvenile and subadult stages. Sharks caught in recreational fisheries are thought to have low post release mortalities and these size limits for ridgeback and non-ridgeback sharks will continue to minimize fishing mortality on the most sensitive stages/sizes. The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and for the Atlantic sharpnose shark which has no minimum size. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002). Additionally, Atlantic sharpnose sharks do not reach the 4.5 foot minimum size. No size limit for bonnethead sharks was included in this alternative because bonnethead sharks are an important recreational catch in some regions, do not commonly reach the current 4.5 feet fork length minimum size, and according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished.

Alternative F5 — 4.5 feet fork length all sharks except no size limit for Atlantic sharpnose and bonnethead sharks and regional non-ridgeback LCS minimum sizes (4.5 feet fork length for all Atlantic non-ridgeback LCS, 4.0 feet fork length for all Gulf of Mexico non-ridgeback LCS)

This alternative would retain the 4.5 feet fork length minimum size limit for all sharks (including Atlantic non-ridgeback LCS, SCS, and pelagic sharks) and allow a minimum size of 4.0 feet fork length for non-ridgeback LCS in the Gulf region. This alternative allows for a smaller size limit for non-ridgeback LCS in the Gulf region while still allowing the majority of female blacktip sharks to be sexually mature before recruiting to the recreational fishery. The 4.5 feet fork length (137 cm) minimum size limit for Atlantic non-ridgeback LCS is slightly larger than the median size in the Atlantic region (126.6 cm) and the 4.0 feet fork length (122 cm) minimum size limit for Gulf region non-ridgeback LCS approximates the median size in the Gulf region (117.3 cm). The 2002 SCS stock assessment indicated that the current level of removals is sustainable for the small coastal shark aggregate and Atlantic sharpnose sharks. The assessment predicted that the stock biomass of Atlantic sharpnose sharks in any given year from 1972 - 2000 exceeded the biomass producing MSY (Cortes, 2002). Additionally, Atlantic sharpnose sharks do not reach the 4.5 foot minimum size. No size limit for bonnethead sharks was included in this alternative because bonnethead sharks are an important recreational catch in some regions, do not commonly

reach the current 4.5 feet fork length minimum size, and according to the 2002 SCS stock assessment, are not experiencing overfishing and are not overfished.

Alternative F6 No size limit for any sharks

Under this alternative, sharks in the LCS, SCS, or pelagic shark management groups of any size could be landed. This would allow anglers to land shark species that do not commonly reach the current minimum size limit (i.e., blacknose, bonnethead, and finetooth sharks).

2.2.3 Authorized Gears for Recreational Shark Fishing

Alternative G1 Any authorized gear (No Action)

This alternative would continue to allow any authorized gear to be used to fish for sharks recreationally. These gears are handgear, longline, and gillnet.

Alternative G2 *Only allow handline and rod and reel gear in the recreational shark fishery - Preferred Alternative*

This alternative would limit the allowable gears in the recreational shark fishery to handline and rod and reel gear. This alternative would promote consistency within HMS recreational fisheries. Presently, fishermen may use gears traditionally considered to be commercial gears to land sharks recreationally provided that they have an HMS Angling permit. Under alternative G2, vessels that have been issued both an HMS charter/headboat permit and a shark limited access permit would be able to use commercial gear types as long as the vessel is not on a for-hire trip.

2.3 DEEPWATER AND OTHER SHARKS

Alternative H1 Retain established species group (No Action)

This alternative would maintain the current deepwater/other species group in the management unit. The deepwater/other species are not subject to permit and reporting requirements, retention limits, or quotas as established in the HMS FMP. They were included in the management unit in the HMS FMP in order to extend the ban on finning to all Atlantic shark species.

Alternative H2 *Remove species group from management unit; data collection only - Preferred Alternative*

This alternative would remove the deepwater/other species group from the management unit and require data collection only. This alternative was identified because there are no significant landings of species in this group and the Shark Finning Prohibition Act now protects these species from being finned.

2.4 PROHIBITED SPECIES

Alternative I1 Retain established species group (19 species) (No Action)

This alternative maintains the current prohibited species group, which includes the 19 species identified in the HMS FMP. The HMS FMP prohibited the retention of these species because they were known to be vulnerable to overfishing, uncommon, or seriously depleted. NOAA Fisheries has provided the maximum protection possible to these species within its fisheries management jurisdiction.

Alternative I2 Return to the five species in 1997; white, sand tiger, bigeye sand tiger, whale, and basking sharks

This alternative would return to the 1997 prohibition on the possession of whale, basking, sand tiger, bigeye sand tiger, and white sharks within Federal waters. These five species were identified as highly susceptible to overexploitation and the prohibition on possession was a precautionary measure to ensure that directed fisheries did not develop. This alternative would allow dusky sharks and other occasionally-caught sharks currently in the prohibited species group to be landed, counted against trip limits, and utilized.

Alternative I3 Retain established prohibited species group (I1) and add finetooth shark

This alternative would add the finetooth shark to the prohibited species group. The 2002 SCS stock assessment indicated that finetooth sharks, although not overfished, are experiencing overfishing (Cortes, 2002). Although finetooth sharks are common bycatch in other non-HMS fisheries, this alternative may help reduce mortality of this species.

Alternative I4 Retain established species group (I1) and remove dusky shark

This alternative would remove the dusky shark from the prohibited species group. Dusky sharks have a high bycatch mortality and are usually dead when gear is retrieved. Fishermen find it difficult to avoid interacting with them and allowing dusky sharks to be retained and counted against trip limits and quotas could reduce overall effort in the fishery.

Alternative I5 Retain established species group (I1) and add the deepwater/other species

This alternative would add the species presently in the deepwater/other group to the prohibited species group. This alternative was included to be proactive and take a precautionary approach to managing these species. There are only minor landings of these species through bycatch in other fisheries.

Alternative I6 *Retain established prohibited species group (I1) and establish criteria for the addition and removal of species to/from the prohibited species group - Preferred Alternative*

This alternative would establish criteria for the addition and removal of species to/from the prohibited species group. A species could be added to the prohibited species list if at least two of the following criteria are met: (1) There is sufficient biological information to indicate the stock warrants protection, such as indications of depletion or low reproductive potential or the species is on the ESA candidate list; (2) the species is rarely encountered or observed caught in HMS fisheries; (3) the species is not commonly encountered or observed caught as bycatch in fishing operations; or (4) the species is difficult to distinguish from other prohibited species (i.e., look-alike issue). Alternatively, a species could be removed from the prohibited species list if it meets only one criterion.

For example, if after review of available data, a shark species was found to be depleted (criterion 1) and was rarely encountered (criterion 2), NOAA Fisheries could add the species to the prohibited species list using the regulatory framework adjustment process. Conversely, if a shark species was shown to meet only one criterion, for example, it is rarely caught in HMS fisheries (criterion 2) but stock assessments show few signs of depletion (e.g., HMS gear types are not efficient at catching the shark species or the species is caught in areas not fished by HMS fishermen), it is not observed caught as bycatch in other fisheries, and does not look like other prohibited species, the species could be removed from the prohibited species list using the same regulatory framework adjustment process.

This alternative would clarify reasons for prohibiting species, ease the administrative burden of addition and removal of species, and allow for more rapid and adaptive management of the species. Additions to or removals from the prohibited species list will be accomplished through a framework rulemaking process, as necessary.

2.5 BYCATCH REDUCTION MEASURES

2.5.1 Gear Restrictions

Alternative J1 Gillnet - net checks, ALWTRP, observers; Bottom longline - post guidelines (No Action)

This alternative would maintain the existing requirements on shark gillnet and bottom longline vessels. Currently, vessels participating in the shark gillnet fishery have observer, net check, and Atlantic Large Whale Take Reduction Plan (ALWTRP) requirements. Bottom longline vessels are required to post sea turtle handling and release guidelines.

Alternative J2 Existing bottom longline bycatch reduction measures (J1) plus closing the shark gillnet fishery permanently/Remove gear from list of authorized gear types

This alternative would close the shark gillnet fishery permanently and would remove gillnet gear from the list of authorized gear types. This would end the need for observer coverage in the shark gillnet fishery and eliminate the associated costs and financial burden for fishermen as well as the administrative burden for NOAA Fisheries. It would eliminate bycatch and bycatch mortality of protected resources associated with this fishery and could reduce fishing effort in the right whale critical habitat. It could also reduce bycatch of other HMS and non-HMS species.

Alternative J3 Existing bycatch reduction measures (J1) and allow only strikenet method in shark gillnet fishery

This alternative would require that vessels operating in the shark gillnet fishery set gear using the strikenet method only. The shark strikenet fishery produces little bycatch (no observed protected species interactions/the majority of catch is target species) and could allow for a reduction in current observer coverage levels in the shark gillnet fishery outside right whale calving season. Alternative J3 would allow incidental shark landings from vessels participating in other gillnet fisheries, such as the mackerel fishery, to minimize discards. This alternative was preferred in draft Amendment 1. As described in Chapter 4, NOAA Fisheries is not selecting it in the final Amendment, but will consider other options to reduce bycatch in this fishery in a future rulemaking.

Alternative J4 *Existing bycatch reduction measures (J1) plus requiring Vessel Monitoring Systems (VMS) on shark gillnet vessels during right whale calving season and requiring VMS on directed bottom longline shark fishing vessels operating near the time/area closure off North Carolina - Preferred Alternative*

This alternative would require VMS on shark gillnet vessels during right whale calving season and would require VMS on directed bottom longline shark fishing vessels operating near the time/area closure off North Carolina. This alternative is consistent with the rationale for requiring VMS on pelagic longline vessels (i.e., enforcement of time/area closures) and would show when vessels are operating in closed areas, could allow vessels to transit closed areas without special gear stowage procedures, and would allow for the collection of real-time data. Monitoring and enforcement are essential components of fisheries management. Monitoring fishing vessels facilitates enforcement of NOAA Fisheries' conservation and management regulations by enabling detection of violations. Monitoring also promotes compliance by having a general deterrent effect. Lack of proper monitoring and enforcement makes it difficult to gauge the effectiveness of conservation and management measures and could compromise their success. In the case of overfished stocks (LCS), successful monitoring and enforcement of time/area closures is necessary to prevent further overfishing and subsequent decline to

dangerously low stock levels. VMS is considered a very successful aid to enforcement in other fisheries where it is used. If used in conjunction with closed areas, alternative J4 could enhance rebuilding to maximum sustainable yield levels for LCS. VMS may also allow more finely defined closure areas. This alternative would have substantial costs for fishermen required to obtain a VMS unit, although it could reduce the need for observer coverage in the shark gillnet fishery and lessen those associated costs. This alternative may also reduce administrative burden for NOAA Fisheries, including enforcement costs. It also promotes the safety of life at sea by providing optional communication and emergency location features in some NOAA-approved VMS units.

Alternative J5 *Existing bycatch reduction measures (J1) plus requiring the use of non-stainless steel corrodible hooks, the possession of release equipment on vessels with shark bottom longline gear (line cutters, dipnets, and, when approved, dehooking devices), and that bottom longline vessels move 1 nautical mile after an interaction with a protected species - Preferred Alternative*

This alternative would require the use of non-stainless steel corrodible hooks aboard shark bottom longline fishing vessels. Corrodible hooks could reduce post release mortality of turtles, marine mammals, sharks, and finfish by reducing the amount of time a hook remains embedded in an animal. This alternative is similar to requirements in the pelagic longline fishery and would require the possession of release equipment (line cutters, dipnets, and, when approved, dehooking devices) on vessels with shark bottom longline gear to facilitate removal of entangled or hooked animals. This equipment is inexpensive, relatively simple to use, and may reduce the post release mortality of turtles, marine mammals, sharks and other fishes. This alternative is also similar to requirements in the pelagic longline fishery in that it would require all bottom longline vessels to move one nautical mile after an interaction with a protected species to reduce the probability of another interaction.

Alternative J6 Existing bycatch reduction measures (J1) plus limiting shark bottom longline gear to a maximum of 10 miles of mainline, limiting soak time to 10 hours or less, and requiring the use of non-stainless steel corrodible circle hooks

This alternative would cap the allowable length of shark bottom longline gear to 10 miles, establish a 10 hour maximum soak time, and require that all shark bottom longlines be rigged with non-stainless steel corrodible circle hooks.

Periodically, fishermen are forced to cease gear haul-back operations, leave the remainder of their longline gear and catch in the water, and return to port for offloading because they have reached the 4,000 lb trip limit or for other reasons. Capping the allowable length of each shark bottom longline gear in the water could reduce the chances of one set catching more than the 4,000 lb trip limit and could reduce the mortality of species remaining attached to the gear. The

CSFOP observed nine trips from 1994 - 2002 that reached the 4,000 lb trip limit with one set. Of those nine trips, three could only be partially retrieved due to reaching the trip limit. These sets used 12.0, 6.0, and 13.3 miles of mainline with an average of 10.4 miles. (G. Burgess, pers. comm., 2003).

This alternative would also establish a 10 hour maximum soak time. Shorter soak times could allow incidental catch and bycatch to be released sooner and with less injury. This could lead to increased survivability of protected and non-target species. In a recent analysis performed by the Virginia Institute of Marine Science, researchers found that soak time influenced hooking mortality of dusky sharks. The researchers found that hooking mortality for dusky sharks was 85 percent for soak times greater than 20 hours, 79 percent for soak times greater than 15 hours, and 57 percent for soak times less than 15 hours. Dusky sharks were found to have the lowest hooking mortality (five percent) on sets with soak times less than 10 hours (Romine *et al.*, 2001).

This alternative would also require that all shark bottom longlines be rigged with non-stainless steel corrodible circle hooks. The use or possession of straight shank ("J") hooks, or any variation of stainless steel hook, would be prohibited on shark bottom longline vessels. Circle hooks generally lodge in the corner of the mouth rather than in the throat or gut. Sharks and finfish that are not retained are more likely to be released with less injury. Protected species would also likely benefit from reduced injuries, as circle hooks are less likely to hook in the throat or gut. Circle hooks have been found to significantly reduce the rate of hook ingestion by loggerhead turtles and reduce the associated post-hooking mortality (Watson, *et al.*, 2003).

Alternative J7 — Existing bycatch reduction measures (J1) plus requiring the retention of all sharks caught in commercial shark fisheries; no discards allowed

This alternative would require all sharks caught in commercial shark fisheries to be retained and landed. It could virtually eliminate the bycatch of sharks in the commercial shark fishery. This alternative could reduce the fishing effort needed to reach trip limits and fill quotas, thus reducing potential interactions with protected species. It would also negate the need for prohibited species (Alternatives I1 through I6)).

Alternative J8 — Existing bycatch reduction measures (J1) plus requiring commercial and recreational fishermen to attend workshops on present regulations, species identification, and release techniques

This alternative would require both commercial and recreational fishermen to attend workshops discussing regulations, identification of shark (and possibly other) species, as well as marine mammal, sawfish, and sea turtle release techniques. By attending workshops, fishermen could gain a better understanding of current regulations and the intent behind them, and be able to comply with regulations more easily if they possessed better information on shark species identification. Discussions and demonstrations of release techniques for protected species could help to reduce bycatch mortality.

Alternative J9 Existing bycatch reduction measures (J1) and close all LCS fisheries when the quota for either LCS subgroup is reached

This alternative would close all LCS fisheries when the quota for either the ridgeback or non-ridgeback shark subgroups is filled, if subgroups are established. This alternative is easier to enforce than separate closures, and may provide increased protection for species in the subgroup for which the quota has been reached. It could decrease regulatory discards, reduce mortality of LCS, decrease protected resource interactions, and decrease mortality of non-target species. This alternative is further analyzed under alternative A2 and is not discussed further.

2.5.2 Time/Area Closures

Alternative K1 No time/area closures (No Action)

This alternative would not implement any time/area closures. This is the no action alternative that the fishery has been operating under since the 1993 FMP. Currently, there are no time or area closures (other than directed LCS closures related to quotas) specific to the commercial or recreational harvest of Atlantic sharks. This action maintains the current management structure and does not close any particular areas or times to directed or incidental shark fisheries. This action allows directed and incidental fisheries to continue to retain Atlantic sharks within the bounds of implemented regulations (species management groups, commercial quotas and retention limits, recreational retention limits, prohibited species, fishing seasons).

Bycatch issues would be addressed through other means such as quotas, trip limits, gear restrictions, and length of seasons. Additionally, although several coastal bays and estuaries have been identified as important pupping and nursery areas for sandbar and dusky sharks (notably Delaware Bay, DE, Chesapeake Bay, MD, Great Bay, NJ), these areas are primarily within state waters and outside of NOAA Fisheries' jurisdiction. Under this alternative, NOAA Fisheries would continue to work with Atlantic and Gulf of Mexico states and Regional Fishery Management Councils and Commissions to develop consistent state and Federal shark regulations.

Alternative K2 *Time/area closure for sandbar and dusky shark nursery and pupping areas off of North Carolina during the winter fishery - Preferred Alternative*

This alternative will implement a time/area closure for sandbar and dusky shark nursery and pupping areas encompassing EFH and HAPC areas identified off of North Carolina from January through July. Alternative K2 would close an area from Oregon Inlet, North Carolina at 35°41' North, offshore to 74°51' West, then following the 60 fathom contour to 35°30' North and 74°46' W, and continuing along the 60 fathom contour south to 33°51' North and 76°24' West to all directed shark bottom longline fishing from January through July. The closure encompasses approximately 4,490 nm^2 (Figure 2.2). The area has been revised from the original area proposed

in the draft Amendment. A detailed analysis of the revised time/area closure and associated impacts is provided in Chapter 4.6.2.

The area will be closed to all vessels issued a directed shark limited access permit that have bottom longline gear on board. This area has been identified as an important nursery and pupping ground for sandbar and dusky sharks and closing this area to bottom longline fishing would reduce the bycatch of neonates and juveniles which are known to be concentrated in this area. Closing this area is also consistent with the 2002 LCS stock assessment which identified dusky sharks as highly susceptible to overexploitation due to low population growth rates, and recommended a reduction in fishing mortality, particularly for prohibited species. Dusky shark populations are considered especially susceptible to mortality of the juvenile stages.

Dusky sharks are one of the slowest growing sharks found in inshore waters to the outer reaches of the continental shelf and are often caught on bottom longlines, making them highly vulnerable to overfishing. Female dusky sharks reach sexual maturity at about 17 years and 300 cm. Data indicate that a higher percentage of dusky sharks are being taken in North Carolina waters from January through July than in any other area of the Atlantic or Gulf of Mexico. The size of catches ranges from neonate (<110 cm) to juvenile (110-299 cm) to adult (>300 cm) stages. Of the dusky sharks observed caught in the North Carolina winter fishery, 26 percent were discarded or released as bycatch. Despite being on the prohibited species list, many are being observed landed.

Shark bottom longline observer data also show high rates of neonate and juvenile sandbar sharks less than 137 cm fork length (FL) being caught in from January through July off of North Carolina. The 137 cm FL corresponds to the recreational minimum size limit for sharks which is 4.5 feet FL. It also corresponds to the female smallest size at maturity. For instance, one data series for the winter fishery off North Carolina in 2001 shows approximately 83 percent of 1188 sandbar sharks observed caught were less than 137 cm, with an average length of approximately 120 cm. Sandbar shark pups are born from March to early August and measure about 60 cm at birth. Sandbar neonates size range is < 71 cm and juveniles range from 71-147 cm total length (TL).

Alternative K3 — Time/area closure for all shark nursery and pupping areas during pupping season based on EFH identifications for neonate and juvenile sharks

This alternative would implement a time/area closure for all shark nursery and pupping areas based on EFH identified areas for neonate and juvenile sharks. The presence of important pupping and nursery areas in many coastal bays and estuaries is the basis for this alternative. Nursery and pupping areas are located from Cape Canaveral, FL, to Great Bay, NJ, on the East coast, and from Tampa Bay, FL, to Brownsville, TX, on the Gulf coast. Although many of the important nursery and pupping areas are in state waters and outside of NOAA Fisheries' jurisdiction, there are some areas that are within NOAA Fisheries' jurisdiction. The LCS complex as a whole is overfished and overfishing is occurring, and this alternative would reduce

the bycatch of neonate and juvenile sharks, would help address overfishing, and would maximize protection of these critical early life stages. Fishing would continue in non-EFH identified areas.

The LCS stock assessment noted that juvenile survival is the vital rate that most affects overall population growth rates, thus lending support to protection of early life stages.

Other time/area closure alternatives considered but not further analyzed at this time.

Alternative K4 Time/area closure for finetooth shark pupping and nursery areas in EFH identified off St. Andrews Bay, Florida

This alternative would implement a time/area closure for finetooth shark pupping and nursery areas identified as EFH in the 1999 HMS FMP and where tagging and research studies continue to show large numbers of neonate and juvenile finetooth sharks. According to the 2002 SCS stock assessment, finetooth sharks are experiencing overfishing, and under the Magnuson-Stevens Act, NOAA Fisheries needs to act to prevent overfishing. A time/area closure could accomplish this goal. However, of the areas identified as EFH for juvenile and subadult sharks, all are in nearshore waters and coastal bays and estuaries, and accordingly, are outside of NOAA Fisheries' jurisdiction. Additionally, all observed takes of finetooth sharks are in state waters. NOAA Fisheries intends to continue working with Atlantic and Gulf of Mexico states, the Regional Fishery Management Councils, and the Atlantic States Marine Fisheries Commission to implement shark harvest regulations that will meet conservation objectives. Therefore, this alternative was considered but not further analyzed at this time.

Alternative K5 Time/area closure to protect smalltooth sawfish critical habitat

The smalltooth sawfish was recently listed as an endangered species (68 FR 15674, April 1, 2003). However, NOAA Fisheries determined that the designation of critical habitat for the sawfish is not determinable at this time. Without information about critical habitat, NOAA Fisheries does not have sufficient information to identify an appropriate time/area closure. Once a recovery plan is developed and critical habitat identified, NOAA Fisheries will reconsider a closure to protect sawfish habitat. This alternative was considered but not further analyzed at this time.

2.6 ESSENTIAL FISH HABITAT

Alternative L1 Maintain current EFH identified areas (No Action)

This alternative would maintain current EFH identified areas. This is the no action alternative that the fishery has been operating under since the 1999 HMS FMP, which identified shark EFH areas. This alternative would be employed if there were no new information available with which to update EFH identified in the 1999 HMS FMP.

Alternative L2 Identify EFH for the fishery management unit (FMU) based on the entire geographic range of the species

This alternative would identify EFH based on the entire geographic range of the species, resulting in the widest possible extent of EFH. This alternative would implement the most precautionary approach to identifying EFH. All areas where a species is known to be present would be identified as EFH. This alternative is based on the premise that the most cautious approach possible should be taken in identifying EFH areas.

Alternative L3 Existing EFH and, as appropriate, identify EFH for the FMU for each species and life stages as those habitats necessary for spawning, breeding, feeding, or growth to maturity

This alternative would identify EFH for each species and life stage as those habitats necessary for spawning, feeding, breeding, or growth to maturity, based on new information available since the 1999 HMS FMP. If no new information is available, then the existing EFH identifications would be maintained. This alternative would include 100 percent of the observed distribution, as opposed to alternative L2 which represents 100 percent of the entire geographic range, and would thus represent an area reduced in size from alternative L2. The basis for this alternative is to evaluate each species and life stage individually to ultimately comprise the EFH identification for the fishery. This alternative would identify a subset of the entire geographic range of the species which encompasses those habitats considered most important to spawning, breeding, feeding and growth to maturity. This would result in a higher degree of confidence that the area is EFH and does not include marginal habitat. From a management perspective, a narrowing of EFH as described above, could result in a higher level of protection and a greater ability to enhance and conserve EFH.

Alternative L4 *Existing EFH and, as appropriate, increase or decrease the EFH areas identified for individual species in the FMU based on special needs - Preferred Alternative*

This alternative would increase or decrease the geographic scope of EFH as new information becomes available for each species in the FMU based on the specific needs of the species. This alternative would begin with 100 percent of the observed distribution in alternative L3 above and expand or reduce the area based on the status of the stock. If new information is not available, the existing EFH areas would be maintained. The basis for this alternative is to provide flexibility to increase or decrease the extent of EFH based on the status of the stock. Since overfished resources are considered to be at greater risk, the percentage of habitat identified as EFH for overfished species would be greater than that of fully fished or not overfished species. For species that are not overfished the EFH area may be refined or narrowed to those areas considered essential and not beyond.

This alternative could lead to identification of EFH based on a percent of the observed distribution. For example, for overfished species, 90 percent of the observed range of distribution could be identified as EFH, whereas 75 percent of the range of distribution might be identified as EFH for species that are not overfished. Assigning percentages to a given species' distribution provides a more objective approach to identifying EFH based on the status or health of the stock. The EFH regulations at 50 CFR 600.815 (a)(1)(iv)(C) specify that "If a species is overfished and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species may be considered essential..." Thus, habitat loss would have to be evaluated before all of the species' habitat could be identified as EFH. This alternative differs from the other alternatives by allowing for an expanded range of EFH to be re-evaluated for refinement once the species is not considered overfished.

2.7 EXEMPTED FISHING PERMIT (EFP) ADMINISTRATION

The following alternatives define governance systems under which EFPs could be issued and administered.

Alternative M1 Maintain combined permitting system for scientific research, exempted fishing, and public display - (No Action)

This alternative would maintain a combined permitting system for shark scientific research, educational/public display, and exempted fishing permits. NOAA Fisheries would monitor and track all sources of mortality by counting "takes" against the 60 mt ww shark quota and would continue to authorize takes for public display with exempted fishing permits. This alternative has been in place since 1999.

Alternative M2 *Develop separate display permitting system for HMS, apart from research or exempted fishing permits - Preferred Alternative*

This alternative will require creation and implementation of a separate display permitting system, which would operate apart from exempted fishing activities focusing on scientific research. This alternative is an administrative change that will allow managers to separate "for profit activities" or public displays for educational purposes from that of scientific research. Under this alternative, HMS taken for public display, research, or exempted fishing purposes will continue to be applied against the 60 mt ww shark quota or other appropriate quota and applicants would continue to apply under the existing system. NOAA Fisheries will continue to work with the states to account for collections in state waters.

Other EFP alternatives considered but not further analyzed at this time

Due to the need for additional public comment, NOAA Fisheries has decided to postpone action on the following alternatives until a future HMS FMP amendment (68 FR 40907, July 9, 2003). Given that these issues will be considered further in a forthcoming plan amendment, comments are requested on the following possible alternative options.

1. Exempted Fishing Permit (EFP) Application Requirements

The following alternative options outline possible application requirements that applicants would have to meet before an EFP will be issued. These alternatives, which are not mutually exclusive, would apply to all HMS including Atlantic tuna, swordfish, billfish, and shark.

Alternative N1	Applications must contain information specified in 50 CFR Part 635.32 and 50 CFR Part 600.745 (No Action)
Alternative N2	Require mandatory background checks on vessels listed in application and authorize NOAA Fisheries with right to deny permit on basis of previous fisheries violation
Alternative N3	Require mandatory permit application form

2. Exempted Fishing Permit (EFP) Quota Basis

The following alternative options would define the basis for EFP quotas specifications for all HMS. The specification outlined herein depends to a large extent upon the species selected for research/display, stock status of that species, and, where appropriate, ICCAT quota recommendations for research activities. These alternatives would apply to all HMS including Atlantic tuna, swordfish, billfish, and shark.

Alternative O1	Shark quota = 60 mt; No EFP quota for Tuna, swordfish and billfish quotas because EFPs are issued consistent with ICCAT quota recommendations - (No Action)
Alternative O2	Shark display quota based upon average number of fish authorized[2] over the past three years; Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish authorized over the past three years, which ever is less
Alternative O3	Shark display quota based upon average number of fish requested[3] over the past three years; Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish requested over the past three years, which ever is less

[2]Authorized by NOAA Fisheries via EFPs

[3]Requested by the applicant in previous EFP applications.

Alternative O4	Shark display quota based upon average number of fish authorized during 2002 (most recent calendar year); Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish authorized over the past three years, which ever is less
Alternative O5	Shark display quota based upon average number of fish requested during 2002 (most recent calendar year); Tuna, swordfish and billfish quotas based upon ICCAT quota recommendations (numbers of fish or pounds, as appropriate) or average number of fish authorized over the past three years, which ever is less

Table 2.1 Commercial Landings (lb dw) of SCS by Region and Year. Source: Cortes pers. comm., 2003.

	Landings (lb dw)							
	Gulf of Mexico[4]		South Atlantic[5]		North Atlantic[6]		Totals	
	Canvass[7]	QMS[8]	Canvass	QMS	Canvass	QMS	Canvas	QMS
1999	36,300	62,353	1,080,213	589,948		74,149	1,116,513	726,450
2000	35,605	49,221	1,038,847	392,554		115,147	1,074,452	556,922
2001	26,865	2,626	1,328,419	483,221		210,219	1,355,284	696,066
Total	98,770	114,200	3,447,479	1,465,723	0	399,515	3,546,249	1,979,438
Average	32,923	38,067	1,149,160	488,574	0	133,172	1,182,083	659,813
Total Combined	212,970		4,913,202		399,515		5,525,687	
Average Combined	35,495		818,867		133,172		987,534	
% (Based on Average Combined Landings)	4		83		13		100	

[4]Gulf of Mexico includes landings from Florida West coast, Louisiana, and Texas.

[5]South Atlantic includes landings from Florida East coast, Georgia, South Carolina, and North Carolina. South Atlantic also contains landings for the Caribbean including Puerto Rico and the Virgin Islands.

[6]North Atlantic includes landings from Virginia, Delaware, Maryland, New Jersey, New York, Rhode Island, Massachusetts, and New Hampshire.

[7]Canvass is a data collection system where states report landings directly to NOAA Fisheries. Dressed weights were obtained from round weights using conversion factors (1.39 for all states).

[8]Quota Monitoring System (QMS) allows dealers to report landings directly to NOAA Fisheries.

Table 2.2 Commercial Landings (lb dw) of LCS by Region and Year. Source: Cortes pers. comm., 2003.

	Landings (lb dw)							
	Gulf of Mexico[9]		South Atlantic[10]		North Atlantic[11]		Totals	
	Canvass[12]	QMS[13]	Canvass	QMS	Canvass	QMS	Canvas	QMS
1999	1,592,299	1,515,989	987,793	4,054,605	123,324	29,338	2,703,416	5,599,932
2000	1,062,680	1,338,762	956,331	1,658,124	238,425	65,904	2,257,436	3,062,790
2001	1,354,003	727,278	885,533	1,378,304	75,147	176,365	2,314,683	2,281,947
Total	4,008,982	3,582,029	2,829,657	7,091,033	436,896	271,607	7,275,535	10,944,669
Average	1,336,327	1,194,010	943,219	2,363,678	145,632	90,536	2,425,178	3,648,223
Total Combined	7,591,011		9,920,690		708,503		18,220,204	
Average Combined	1,265,169		1,653,448		118,084		3,036,701	
% (Based on Average Combined Landings)	42		54		4		100	

[9]Gulf of Mexico includes landings from Florida West coast, Louisiana, and Texas.

[10]South Atlantic includes landings from Florida East coast, Georgia, South Carolina, and North Carolina. South Atlantic also contains landings for the Caribbean including Puerto Rico and the Virgin Islands.

[11]North Atlantic includes landings from Virginia, Delaware, Maryland, New Jersey, New York, Rhode Island, Massachusetts, and New Hampshire.

[12]Canvass is a data collection system where states report landings directly to NOAA Fisheries. Dressed weights were obtained from round weights using conversion factors (2 for NC and 1.39 for other states).

[13]Quota Monitoring System (QMS) allows dealers to report landings directly to NOAA Fisheries.

Table 2.3 Process for Calculating Quota [14] Alternatives

Alternative		A3 (*Preferred* - LCS Classification)	A1 (*No Action)* & A2 (Separate LCS groupings)	A4 (Species-specific LCS Classification)
		Complex	Grouping	Species Specific
- 1999 HMS FMP) C1	LCS	NA	▸ LCS Ridgebacks = HMS FMP = **620 mt dw** ▸ LCS Non-ridgebacks = HMS FMP = **196 mt dw**	NA
	SCS		▸ SCS = HMS FMP = **359 mt dw**	
	Pelagic		▸ Pelagic sharks = HMS FMP = (**92 mt dw Porbeagle; 273 mt dw blue; 488 mt dw other pelagic sharks**)	
▸ - MSY)	LSC	▸ LCS = 344,000 (Table 2.8) *0.33 (% of total catch; Table 2.5) *0.55 (LCS stock assessment, peer reviews, observer data, CPUE) = 62,436 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002) = 2,241,452.4 lbs/2,204.6 = **1,017 mt dw**	▸ LCS Ridgebacks = (See Complex) = **1,017 mt dw** ▸ LCS Nonridgebacks = 1,017 * 0.5 (stock assessment, peer reviews, observer data, CPUE) = **509 mt dw**	▸ Sandbar = 133,000 (Table 2.8) * 0.75 (HMS FMP Optimum Yield) = 99,750 fish * 0.61 = 60,847.5 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002)= 2,184,425.25 lbs/2,204.6 = **991 mt dw** ▸ Blacktip = 389,000 (Table 2.8) * 0.75 (HMS FMP Optimum Yield) = 291,750 fish * 0.31 (% of total catch; Table 2.5)= 90,442.5 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002) = 324,6885.75 lbs/2,204.6 = **1,473 mt dw** ▸ Other LCS= 344,000 (Table 2.8) *0.093 (non-sandbar and non-blacktip % of commercial; Table 2.5) = 31,992 fish *0.33 (% total catch; Table 2.5) = 10,557.36 fish *0.55 (LCS stock assessment, peer reviews, observer data, CPUE) = 5,806.548 fish * 35.9 lbs (2001 average weight; Cortes and Neer, 2002) = 208,455.0732 lbs/2,204.6 = **95 mt dw**
	SCS	▸ SCS = 2,087 (Table 2.8) * 0.75 (HMS FMP Optimum Yield) = 1,565.25 mt dw * 0.29 % commercial (Table 2.6) = **454 mt dw**		
	Pelagic	▸ Pelagic Porbeagle = **92 mt dw** ▸ Pelagic Blue = **273 mt dw** ▸ Pelagic Other = **488 mt dw**		

[14]Quotas listed in Table 2.3 do not account for over and/or under-harvests of quota in the previous year.

Table 2.3 Process for Calculating Quota Alternatives (continued)

Alternative		A3 (*Preferred* - LCS Classification)	A1 (*No Action)* & A2 (Separate LCS groupings)	A4 (Species-specific LCS Classification)
		Complex	Grouping	Species Specific
C3 (Average Landings)	LCS	▸ LCS = 1,692.7 (Table 2.4) * 0.55 (LCS stock assessment, peer reviews, observer data, CPUE) = **931 mt dw**	▸ LCS Ridgebacks = 634.5 (Table 2.4) + [276.6 * 0.5] (Table 2.4; LCS stock assessment) = 772.8 + 21 (addition of other ridgeback species 3 year average; Table 2.4) = **794 mt dw** ▸ LCS Nonridgebacks = 616.6 + 123.3(Table 2.4; LCS stock assessment) = 739.9 + 138.3 = 878.2 +27.7 (20% addition of unclassified sharks; Table 2.4) = 905.9 + 25 (50% subtraction of other nonridgeback species 3 year average; Table 2.4) = **931 mt dw**	▸ Sandbar = (Sandbar average) = **635 mt dw** ▸ Blacktip = 616.6 (Table 2.4) *0.2 = 123.32 + 616.6 (Table 2.4) = **740 mt dw** ▸ Other LCS = 1,692.7 - (634.5+ 616.6) (Table 2.4) = 441.6 *0.5 (LCS stock assessment) = **221 mt dw**
	SCS	▸ SCS = **300 mt dw** (Table 2.7)		
	Pelagic Sharks	▸ Pelagic Porbeagle = **92 mt dw** (HMS FMP) ▸ Pelagic Blue = **273 mt dw** (HMS FMP) ▸ Pelagic Other = **488 mt dw** (HMS FMP)		

Table 2.4 Commercial Landings (mt dw) of LCS from 1999 Through 2001. Source: NOAA Fisheries, 2003; Cortes and Neer, 2002.

Year	Sandbar	Blacktip and Spinner	Unclassified	Ridgeback LCS (includes unclassified)	Non-ridgeback LCS (includes unclassified)	Total LCS
1999	589.7	584.1	443.8	829.2	852.9	1,778.0
2000	676.7	747.7	49.3	727.0	820.3	1,684.0
2001	637.0	518.1	336.6	824.0	741.4	1,616.0
Total	1,903.4	1,849.8	829.7	2,380.2	2,414.6	5,078.0
3 year average	634.5	616.6	276.6	793.4	804.9	1,692.7

Table 2.5 Catch History of LCS, Sandbar, and Blacktip (Baseline Scenario). Source: Cortes *et al.*, 2002. LCS averages (numbers of fish in thousands) were obtained from Table 4 in the LCS 2002 stock assessment. Sandbar averages (numbers of fish) were obtained from Table 5 in the LCS 2002 stock assessment. Blacktip averages (numbers of fish) were obtained from Table 6 in the LCS 2002 stock assessment.

	LCS		Sandbar		Blacktip		Non-Sandbar/Blacktip	
	Avg (1999-2001)	*% of Total*	*Avg (1999-2001)*	*% of Total*	*Avg (1999-2001)*	*% of Total*	*Avg (1999-2001)*	*% of Total*
Commercial (Landings)	107.3	33%	47,082	61%	50,215	31%	10,003	12%
Recreational (Catch)	124.5	38%	22,392	29%	52,622	33%	49,486	57%
Bycatch	93.1	29%	7,824	10%	58,065	36%	27,211	31%
Total	324.9	100%	77,298	100%	160,902	100%	86,700	100%

Table 2.6 **Catch History of SCS, Atlantic Sharpnose, Blacknose, Bonnethead, and Finetooth Sharks.** Source: SCS commercial and recreational averages (lb dw) were obtained from Table 1 in the SCS 2002 stock assessment (Cortes, 2002). Commercial and recreational averages (lb dw) for Atlantic sharpnose, blacknose, bonnethead, and finetooth were obtained from Table 2 in the SCS 2002 stock assessment (Cortes, 2002). Bycatch estimates for SCS (lb dw) in the Gulf of Mexico shrimp trawl fishery are derived from Table 12 in the SCS stock assessment (Cortes, 2002).

	SCS		Atlantic Sharpnose		Blacknose		Bonnethead		Finetooth	
	Avg (1999-2000)	*% of Total*	*Avg (1999-2000)*	*% of Total*	*Avg (1999-2000)*	*% of Total*	*Avg (1999-2000)*	*% of Total*	*Avg (1999-2000)*	*% of Total*
Commercial (Landings)	652,000	29%	186,912	15%	157,007	94%	63,704	19%	237,764	99%
Recreational (Catch)	358,000	16%	205,667	17%	9,836	6%	80,023	23%	2,337	1%
Bycatch	1,256,622	55%	848,771	68%	-		198,414	58%	-	
Total	2,266,622	100%	1,241,349	100%	166,843	100%	342,141	100%	240,100	100%

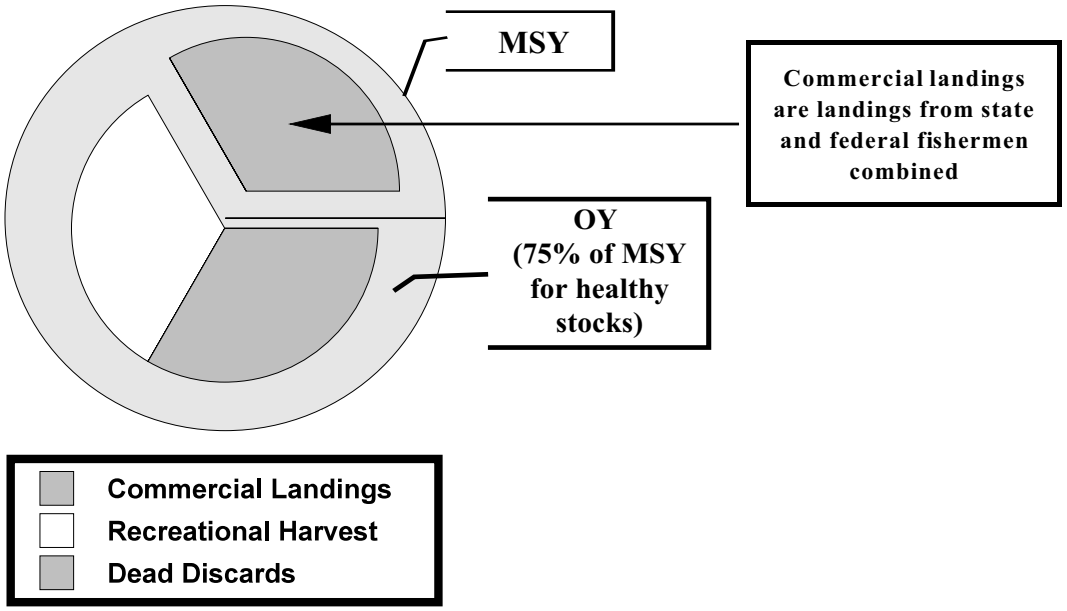
Table 2.7 **Commercial Landings (mt dw) of SCS from 1999 Through 2001.** Source: NOAA Fisheries, 2003; Cortes and Neer, 2002.

Year	Atlantic sharpnose	Blacknose	Bonnethead	Finetooth	Total SCS
1999	108.7	59.1	24.4	111.8	305
2000	64.6	80.8	31.5	91.9	269
2001	88.6	73.0	28.6	136.0	326
Total	261.9	212.9	84.4	339.6	900
3 year average	87.3	71.0	28.1	113.2	300

Table 2.8 Average[15] MSY and MSC for SCS and LCS (respectively). Source: Cortes *et al.*, 2002 and Cortes, 2002.

	Average Maximum Sustainable Yield (MSY, mt dw)	Average Maximum Sustainable Catch (MSC, thousands of fish)
LCS Complex	N/A	344
Sandbar Sharks	N/A	133[16]
Blacktip	N/A	389[17]
SCS Complex	2,087	N/A
Sharpnose	2,200	N/A
Bonnethead	522	N/A
Blacknose	227	N/A
Finetooth	71	N/A

Figure 2.1 Diagram Illustrating Alternative C2.

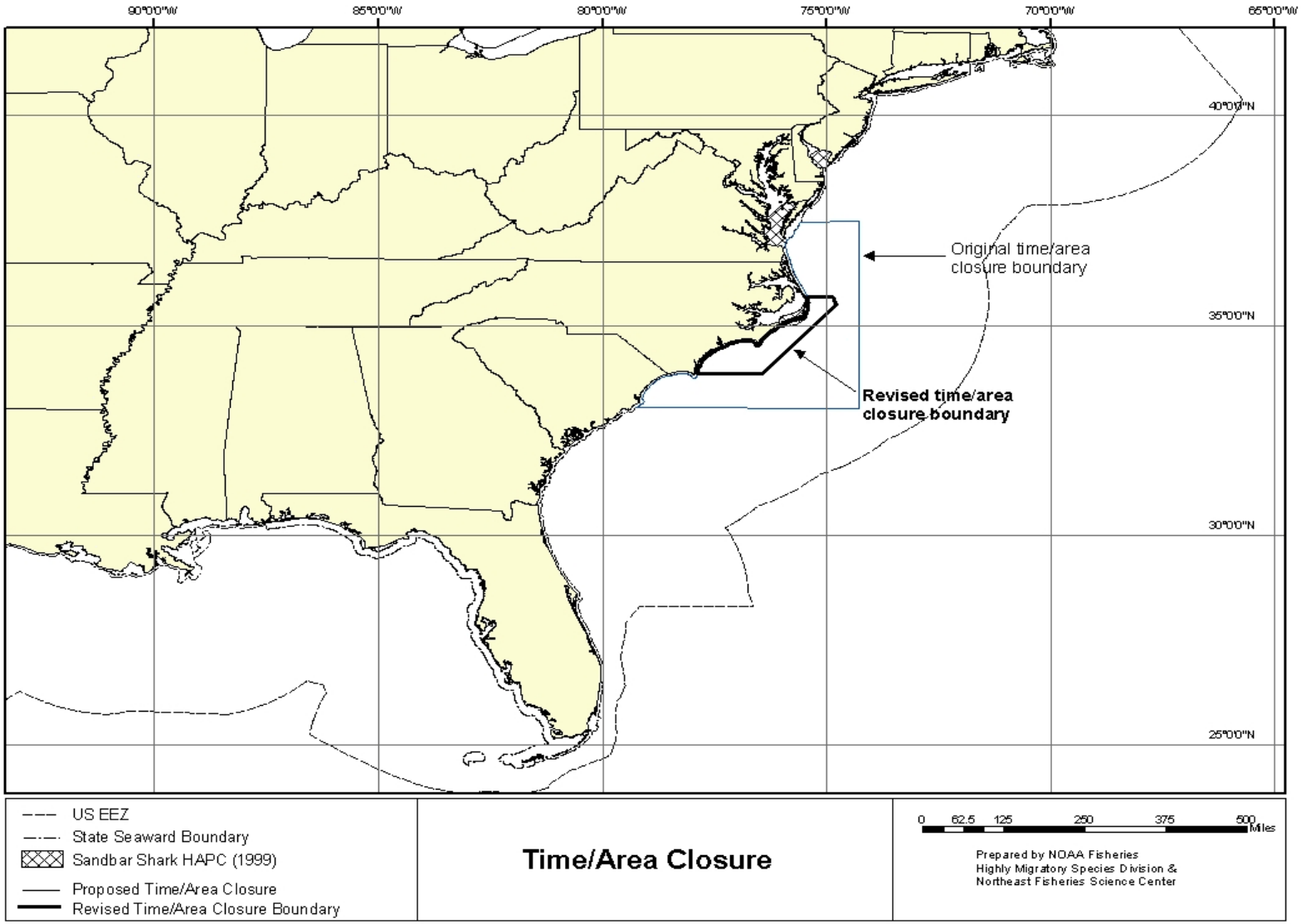


[15]Averages are across all model outputs unless noted otherwise.

[16]Sandbar average MSC is across all surplus production model outputs only.

[17]Blacktip average MSC is across all surplus production model outputs only.

Figure 2.2 Time/Area closure off North Carolina showing the original and revised boundaries.



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