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C. APPENDIX: QUOTAS AND RETENTION LIMIT CALCULATIONS FOR FINAL ENVIRONMENTAL IMPACT STATEMENT

Based on public comment, the National Marine Fisheries Service (NMFS) conducted additional analyses to consider a new non-sandbar large coastal shark (LCS) quota, overharvests in 2007, regional quotas, and regional retention limits. The basis for how sandbar and non-sandbar quotas were determined (with regard to landings and discards in other fisheries) is outlined in Appendix A. Appendix C is meant to describe new analyses that were considered with respect to public comments as well as recommendations received from science centers within NMFS. This section is structured so as to explain what was proposed in the Draft Environmental Impact Statement (DEIS) (NMFS, 2007) and how that would be changed in the Final Environmental Impact Statement (FEIS). An overall summary of what would be implemented in the FEIS with regard to quotas, regions, and retention limits can be found in Section C.2.

C.1 Considerations based on public comment

Quotas

Draft Environmental Impact Statement

Non-Sandbar LCS

During the comment period on the DEIS for Amendment 2 to the Consolidated Highly Migratory Species (HMS) Fishery Management Plan (FMP), NMFS received recommendations regarding the proposed quota for the non-sandbar LCS complex from the Southeast Fisheries Science Center (SEFSC). NMFS had originally used logbook data to estimate the non-sandbar LCS quota, based on historical landings from 2003 to 2005 as recommended by the 2005/2006 blacktip stock assessment (see Appendix A). Logbook data also allowed NMFS to estimate associated effort and landings by permit type, number of fishing vessels by permit type, and the amount of landings by fishing vessel. NMFS had originally proposed a non-sandbar LCS quota of 541.2 mt dw based on landings reported in the HMS and Coastal Fisheries logbook (582.4 mt dw of average historical landings – 41.2 mt dw shark research and display quota = 541.2 mt dw). In addition, based on discards and recreational landings (a total of 463.2 mt dw; Appendix A, Table A.3), NMFS proposed a total allowable catch (TAC) for non-sandbar LCS as 1,045 mt dw (Appendix A, Table A.3).

Sandbar Sharks

In the DEIS, NMFS proposed a sandbar shark quota of 116.6 mt dw (see Appendix A). Unlike the blacktip stock assessment, the 2005/2006 sandbar shark stock assessment recommended a TAC, or total mortality across all fisheries, of 158.3 mt dw (220 mt ww) in order to attain a 70-percent probability for sandbar sharks to rebuild by 2070. Chapter 1 outlines the rebuilding plan for sandbar sharks.

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Non-Sandbar LCS

During the comment period, the SEFSC recommended using HMS shark dealer reports (*i.e.*, southeast and northeast general canvass and SEFSC quota monitoring databases) to calculate historical landings of non-sandbar LCS since the stock assessments were, in part, based on landings reported by HMS shark dealer reports. The HMS shark dealer reports also include landings by both state and Federal shark fishermen, because Federal shark dealers are required to report all landings, whereas logbook data only captures Federally permitted shark fishermen. Thus, dealer reports include all shark landings, resulting in a higher non-sandbar LCS quota, and are more consistent with datasets used for quota monitoring and stock assessments. The average annual combined landings of the predominate LCS species besides sandbar sharks (blacktip, bull, hammerhead sharks, lemon, nurse, silky, tiger, and smooth hammerhead sharks) as reported by the HMS shark dealer reports from 2003 to 2005 was 719 mt dw (Cortés, pers. comm; Cortés and Neer, 2005, SEDAR 11 LCS05/06-DW-16: http://www.sefsc.noaa.gov/sedar/Sedar_Documents.jsp?WorkshopNum=11&FolderType=Data). With the inclusion of discards and recreational landings of non-sandbar LCS (*i.e.*, an additional 463.2 mt dw; Appendix A, Table A.3), the aggregate TAC for non-sandbar LCS would be 1,182.2 mt dw (719 mt dw of commercial landings + 463.2 mt dw in discards and recreational landings = 1,182.2 mt dw).

In addition, under the preferred alternative suite 4, NMFS would establish a small shark research fishery. NMFS also received comments regarding how the quotas should be allocated between the research fishery and non-research shark fisheries. In particular, there was concern that if the sandbar and non-sandbar LCS fishery closed when either quota was filled at 80 percent, the research fishery could close down prematurely while sandbar quota was still available. Therefore, NMFS has created a separate non-sandbar LCS base quota for the research fishery. In the DEIS, NMFS determined that while fishermen in the research fishery harvested the sandbar shark quota of 116.6 mt dw, they would also harvest approximately 50 mt dw of the non-sandbar LCS quota (see Appendix A). Thus, to allow the research fishery to remain open if the non-sandbar LCS quota is filled outside the research fishery, NMFS would allocate 50 mt dw of non-sandbar LCS base quota to the research fishery. NMFS would continue to monitor sandbar shark discards through the observer program covering trips outside of the research fishery that are targeting other species, depending on available funding. In the FEIS, NMFS would close each shark fishery when each quota reaches 80 percent. This should allow for the research fishery to continue year-round. Such research could also focus on other shark species if the sandbar quota within the research fishery is fulfilled (see Chapter 4 under the preferred alternative suite 4 for research objectives of the shark research fishery).

Based on the SEFSC recommendations, NMFS revised the non-sandbar commercial LCS quota in the FEIS. After accounting for the shark research and display quota (41.2 mt dw), discards and recreational landings of non-sandbar (463.2 mt dw), and the separate non-sandbar LCS quota for the shark research fishery (50 mt dw), the base quota for non-sandbar LCS outside the research fishery would be 627.8 mt dw for the preferred alternative suite 4 (719 mt dw in commercial landings – 41.2 mt dw shark research and display quota – 50 mt dw of non-sandbar LCS quota for the research fishery = 627.8 mt dw; Table C.1). For alternative suites 2 and 3,

which would not have a separate non-sandbar LCS quota for a research fishery, the base quota would be 677.8 mt dw (719 mt dw average historical landings via dealer reports – 41.2 mt dw shark research and display quota = 677.8 mt dw; Table C.1).

In addition, NMFS also considered regional quotas for non-sandbar LCS (see “*Regions*” discussion below). To do so, NMFS evaluated the average percentage of landings of non-sandbar LCS in the Gulf of Mexico versus the Atlantic region (North Atlantic and South Atlantic regions combined). On average, 70 percent of the total non-sandbar LCS landings occurred in the Gulf of Mexico whereas 30 percent of the non-sandbar LCS landings occurred in the Atlantic region each year. For the preferred alternative suite 4, this would result in non-sandbar LCS regional base quotas of 439.5 mt dw in the Gulf of Mexico region (70 percent x 627.8 mt dw = 439.5 mt dw) and 188.3 mt dw in the Atlantic region (30 percent x 627.8 mt dw = 188.3 mt dw; see Table C.1). For alternative suites 2 and 3, the annual non-sandbar LCS base quotas would be 474.5 mt dw in the Gulf of Mexico region (677.8 mt dw x 70 percent = 474.5 mt dw) and 203.3 mt dw in the Atlantic region (677.8 mt dw x 30 percent = 203.3 mt dw; Table C.1). However, these base quotas would be adjusted to account for overharvest of the LCS complex in 2007 (see “*Overharvests*” discussion below).

Table C.1 Base quotas and overharvests

A. Regions	B. Sandbar Base Quota (mt dw)	C. Non- Sandbar LCS Base Quota (mt dw)*	D. Non- Sandbar LCS Base Quota Within Research Fishery (mt dw)	E. Resulting Non- Sandbar LCS Base Quota Outside Research Fishery† (mt dw)	F. Quota not harvested during 2008 1st trimester season (mt dw)	G. Total 2007 Overharvest from 2007 2nd and 3rd Combined Trimester (mt dw)	H. 2007 Overharvest from 2007 2nd and 3rd Combined Trimester Adjusted for Quota not Harvested in 2008 1st Trimester (mt dw) (G-F)	I. % Sandbar Landings (based on avg. 2nd and 3rd trimester total harvest in 2006 & 2007)	J. % Non- Sandbar Landings (based on avg. 2nd and 3rd trimester total harvest in 2006 & 2007)	K. Sandbar Overharvest (mt dw) (H*I)	L. Non- Sandbar LCS Overharvest (mt dw) (H*J)
One	116.6	677.8	50	627.8	66.2	520	453.8	41%	59%	186.1	267.7
Atlantic	116.6	203.3	50	188.3	13.9	72.3	58.4	63%	37%	36.8	21.6
GOM		474.5		439.5	52.3	447.7	395.4	27%	73%	106.8	288.6

*Base quota for alternative suites 2 and 3

†Base quota for alternative suite 4

Sandbar Sharks

Despite these changes in the non-sandbar LCS quota, the sandbar shark base quota would still remain 116.6 mt dw (see Appendix A). Unlike the blacktip stock assessment, the 2005/2006 sandbar shark stock assessment recommended a total allowable catch (TAC), or total mortality across all fisheries, of 158.3 mt dw (220 mt ww) in order to attain a 70-percent probability for sandbar sharks to rebuild by 2070 (NMFS, 2006; see Chapter 1 for the rebuilding plan for sandbar sharks). After accounting for landings and discards in other HMS as well as non-HMS fisheries (see Appendix A for more details), NMFS estimated that a commercial quota of 116.6 mt dw could keep overall landings and discards of sandbar sharks below 158.3 mt dw per year. Therefore, since this quota is not based on historical landings, as is the non-sandbar LCS quota, NMFS is not changing the base quota for sandbar sharks at this time.

Overharvests

Draft Environmental Impact Statement

During the development of the DEIS, NMFS was not aware of the overharvests that occurred during the shark 2007 fishing season. Therefore, the quotas for sandbar sharks and non-sandbar LCS in the DEIS were based on the recommendations from the shark stock assessment as explained in Appendix A. In the FEIS, the non-sandbar LCS quota would be modified as explained above in the “*Quotas*” section, however, the sandbar shark quota would remain as explained in Appendix A. These quotas would be considered the “base quotas.”

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During the comment period for the DEIS, NMFS compiled landings updates for the 2007 shark fishery. In doing so, NMFS calculated large overharvests of LCS that occurred in 2007, predominantly in the Gulf of Mexico region during the 2007 2nd and 3rd combined trimester. To account for these overharvests, NMFS must adjust the sandbar and non-sandbar LCS quotas in the FEIS and the final rule. Table C.1 shows the amount of overharvest that was determined in the different regions as of December 21, 2007 (Column G in Table C.1). Column G represents the amount of landings that occurred above the adjusted 2007 2nd and 3rd combined trimester quotas. These adjusted quotas for the 2007 2nd and 3rd combined trimester were 69 mt dw in the North Atlantic region, 163.7 mt dw in the South Atlantic regions, and 83.1 mt dw in the Gulf of Mexico region. However, as if December 21, 2007, landings during the 2007 2nd and 3rd combined trimester were 123.6 mt dw in the North Atlantic region, 181.4 mt dw in the South Atlantic region, and 530.8 mt dw in the Gulf of Mexico region.

Based on landings during the 2007 2nd and 3rd combined trimester, there was a total overharvest of 520 mt dw of LCS in all regions. When broken down by region, this resulted in a LCS overharvest of 72.3 mt dw in the Atlantic region, and a LCS overharvest of 447.7 mt dw in the Gulf of Mexico region (Column G in Table C.1). After accounting for the 2008 1st season LCS quota that was not harvested due to closure, there was a total overharvest of 453.8 mt dw of LCS in all regions (Column H in Table C.1). However, when broken down by region, this resulted in a LCS overharvest of 58.4 mt dw in the Atlantic region and 395.4 mt dw in the Gulf of Mexico region (Column H in Table C.1).

In order to account for these overharvests, NMFS must lower the “base quotas” for sandbar sharks and non-sandbar LCS that are explained above. These lowered quotas as a result of overharvests in 2007 would be termed “adjusted quotas.” Because of differences in management measures in 2007 compared to those preferred in this amendment (*i.e.*, differences in species complexes), NMFS does not have the actual tonnage of the sandbar shark overage by region for 2007. Instead, NMFS only has the total LCS overage in aggregate by region. Therefore, to determine the amount of overharvest that should be attributed to the sandbar shark quota versus the non-sandbar LCS quota, NMFS must estimate the sandbar shark versus non-sandbar LCS overage using the species composition percentages of the total landings in the 2nd and 3rd combined trimester in 2006 and 2007.

NMFS first determined the species composition of the total landings in the 2nd and 3rd combined trimester in 2006 and 2007. NMFS then took the average species composition for the two years to account for temporal variability in species composition of landings. Based on this average, NMFS then determined the percentage of sandbar sharks versus non-sandbar LCS that were harvested for one region as well as the percentage of sandbar sharks and non-sandbar LCS harvested in the Gulf of Mexico and Atlantic regions (columns I and J in Table C.1). NMFS applied these percentages to the total amount of overharvest in one overall region and to the amount of overharvest in each region (column H in Table C.1). Because catch composition of sandbar sharks and non-sandbar LCS varied among regions, the consideration of regions affected the amount of sandbar versus non-sandbar LCS overharvest that would be deducted from the base quotas. For instance, if NMFS considered only one region, then 41 percent of the overharvest would be deducted from the sandbar base quota and 59 percent of the overharvest would be deducted from the non-sandbar LCS quota. This would result in 186.1 mt dw deducted from the sandbar quota ($453.8 \text{ mt dw} \times 41 \text{ percent} = 186.1 \text{ mt dw}$; column K in Table C.1) and 267.7 mt dw deducted from the non-sandbar LCS base quota ($453.8 \text{ mt dw} \times 59 \text{ percent} = 267.7 \text{ mt dw}$; column L in Table C.1). However, if NMFS considered two regions, 63 percent of the landings in the Atlantic was sandbar sharks and 37 percent was non-sandbar LCS. From the 58.4 mt dw of overharvest in the Atlantic region, 36.8 mt dw would be deducted from the sandbar shark base quota ($58.4 \text{ mt dw} \times 63 \text{ percent} = 36.8 \text{ mt dw}$) and 21.6 mt dw would be deducted from the non-sandbar LCS base quota in the Atlantic region ($58.4 \text{ mt dw} \times 37 \text{ percent} = 21.6 \text{ mt dw}$; Table C.1). Conversely, since 27 percent of the total landings in the Gulf of Mexico were sandbar sharks, and 73 percent were non-sandbar LCS landings. Therefore, of the 395.4 mt dw overharvest in the Gulf of Mexico, 106.8 mt dw would be deducted from the sandbar shark base quota and 288.6 mt dw would be deducted from the non-sandbar LCS base quota in the Gulf of Mexico region (Table C.1). This results in a total overharvest of 143.6 mt dw deducted from the sandbar shark base quota if two regions are considered whereas 186.1 mt dw of overharvest would be deducted from the sandbar shark base quota if only one region was considered (Table C.1). However, the total overharvest of 453.8 mt dw would still be accounted for with the consideration of one region ($186.1 \text{ mt dw} + 267.7 \text{ mt dw} = 453.8 \text{ mt dw}$) or two regions ($36.8 \text{ mt dw} + 21.6 \text{ mt dw} + 106.8 \text{ mt dw} + 288.6 \text{ mt dw} = 453.8 \text{ mt dw}$). Therefore, allocation of the overharvests between the different quotas would depend on the consideration of one versus two regions. The overall amount deducted from the sandbar shark quota versus non-sandbar LCS quota would differ depending on the consideration of regions due to differences in

catch composition between regions; however, the total amount of the overharvest would be accounted regardless of the number of regions considered.

Given the large amount of overharvests in 2007, NMFS evaluated the adjusted quotas (base quota minus overharvests in 2007) when the overharvests shown in columns K and L of Table C.1 were spread out over one to five years (see Table C.2). For alternative suites 2 and 3 (which would not include a research fishery set aside for non-sandbar LCS), NMFS took the amount of overharvest and divided it over one to five years. These amounts were then subtracted from the base quotas shown in column C in Table C.1. For simplicity, NMFS is only showing the adjusted quota after the overharvests have been divided over five years in Table C.2.

The 2005/2006 LCS stock assessment did not include the 2007 overharvests when the assessment scientists determined the rebuilding timeframe for sandbar sharks since those overharvests occurred after the conclusion of the assessment and before NMFS could conduct another assessment before completion of the FEIS. However, the SEFSC conducted *ad hoc* projections to evaluate how the overharvests in 2007 would affect the overall rebuilding timeframe from the original 2005/2006 LCS stock assessment. In addition, the SEFSC evaluated how accounting for the overharvests in one year (up to that year's sandbar shark quota for the research fishery or 116.6 mt dw) and then in subsequent years until the entire overharvest has been accounted for or accounting for them over five years would affect the rebuilding timeframe for sandbar sharks. The SEFSC found that when the actual level of harvest in 2007 was accounted for in their projections, there was no significant change in the rebuilding timeframe for sandbar sharks compared to the original sandbar shark assessment. In addition, the SEFSC found that accounting for the entire overharvest in one year (up to that year's sandbar shark quota for the research fishery or 116.6 mt dw) and then in subsequent years until the entire overharvest has been accounted for or accounting for the overharvest over five years would result in similar outcomes for the stock, with the same rebuilding timeframe resulting from either scenario. This is most likely the case because of the longevity of the species and the ratio of immature to mature individuals in the catches. Overall, the SEFSC found that reducing the commercial quota to account for overharvests in 2007 would have positive ecological impacts on the stock by lowering overall mortality, which could allow the stock to rebuild more quickly, regardless of how quickly the overharvest from 2007 were accounted for.

Table C.2 Adjusted quotas after overharvests spread out over five years for sandbar sharks for alternative suites 2 through 4 and non-sandbar LCS for alternative suites 2 & 3. Note: see Tables C.3 and C.4 for the non-sandbar LCS adjusted quotas under alternative suite 4.

Regions	Adjusted Quotas if Overharvests Spread Over 5 Years (mt dw)	
	<i>Sandbar Sharks for Alt. Suites 2-4</i>	<i>Non-Sandbar LCS for Alt. Suites 2 & 3</i>
One	79.4	624.3
Atlantic	87.9	198.9
GOM		416.7

Sandbar Sharks

NMFS evaluated the resulting adjusted quotas if the overharvests in 2007 were accounted for over one to five years. For example, if NMFS deducted the entire overharvest of 2007 from the sandbar shark base quota in one year, the end result would be -69.5 mt dw or -27 mt dw of adjusted sandbar shark quota, depending on whether or not regions were considered (one region: 116.6 mt dw – 186.1 mt dw = -69.5 mt dw; two regions: 116.6 mt dw – (36.8 mt dw + 106.8 mt dw) = -27 mt dw; Table C.1). The remaining 27 mt dw overharvest would then be deducted in the next calendar year. However, accounting for the overharvests in the shortest time period (*i.e.*, one year plus 27 mt dw in the next calendar year) would preclude any sandbar shark research during that time. Thus, NMFS also evaluated the resulting sandbar quota if the overharvest was spread over two, three, four, and five years. The resulting sandbar quota would be 44.8 mt dw, 68.8 mt dw, 80.7 mt dw, or 87.9 mt dw per year, respectively. Based on projections run by the SEFSC, accounting for the entire overharvest in one year (and the remaining 27 mt dw in the next calendar year) or accounting for the overharvest over five years would result in similar outcomes for the stock, with the same rebuilding timeframe resulting for either scenario. In addition, the overall rebuilding timeframe would be shorter than if the 2007 overharvests were not accounted for in this amendment.

Given accounting for the 2007 overharvests in one year (up to that year’s sandbar shark quota for the research fishery or 116.6 mt dw) and then in subsequent years until the entire overharvest has been accounted for would preclude a shark research fishery for at least one year, and sandbar sharks would rebuild within the same timeframe if NMFS spread out the 2007 overharvest over one or five years, in alternative suite 4 NMFS prefers to spread the sandbar overharvest over five years to allow for a much-needed research to occur; smaller quotas would jeopardize NMFS’ abilities to accomplish shark research objectives and could disrupt the collection of fishery dependent data. In addition, it is likely that there will be a new assessment within the next five years. That assessment will need the data collected from the shark research fishery and could result in new shark management measures. For this reason, NMFS chose not to spread out the 2007 overharvest beyond five years. This would result in a five year adjusted sandbar quota of 79.4 mt dw for one region or 87.9 mt dw for two regions (Table C.2). However, any additional overharvests that occurred during each year between 2008 and 2012 would be deducted from this adjusted quota in the following year, or depending on the level of overharvest, over multiple years until the entire overharvest was accounted for. If additional overharvests do occur, this may result in a reduced sandbar shark quota that may preclude a shark research fishery in future years. This would result in the loss of fishery dependent data for future stock assessments; however, since the shark research fishery would be monitored through

scientific observer reports, NMFS anticipates that the sandbar shark quota would be monitored in an almost real-time manner that would help prevent future overharvests.

Non-Sandbar LCS

NMFS also evaluated the non-sandbar LCS adjusted quotas over one to five years based on overharvests in 2007. To complement the timeframe for paying back the sandbar overharvests, NMFS would choose five years to account for the non-sandbar LCS overharvests as well. Alternative suites 2 and 3 (which would not have a non-sandbar LCS quota set aside for a research fishery) would have a five year non-sandbar LCS adjusted quota of 624.3 mt dw for one region or 416.7 mt dw in the Gulf of Mexico region and 198.9 mt dw in the Atlantic region (Table C.2).

Overharvests under alternative suite 4 were applied slightly differently to the base quotas than as explained for alternative suites 2 and 3 due to the research quota set aside for non-sandbar LCS. Since the sandbar shark base and adjusted quotas would affect the amount of non-sandbar LCS that would be harvested within the research fishery, NMFS had to adjust the non-sandbar LCS quota for the research fishery for overharvests as well. This, in turn, affected the amount of non-sandbar LCS quota available outside the research fishery. Based on the adjusted sandbar quota, NMFS estimated the reduced amount of non-sandbar LCS quota that would be taken in the shark research fishery. NMFS used the same approach as described in Appendix A to determine how much non-sandbar LCS quota would be taken when the shark research fishery harvested the adjusted sandbar quota.

NMFS first determined the number of trips it would take to land the adjusted sandbar quotas, assuming a 4,000 lb dw sandbar and non-sandbar LCS trip limit (however, this trip limit would be based on the research objectives for a given year). The number of trips was determined by looking at the catch composition of directed BLL trips reported in the BLL observer program (Hale and Carlson, 2007). The observer program data indicated that 70 percent of the catch on directed shark BLL trips in the South Atlantic region was comprised of sandbar sharks versus 30 percent of the catch on directed shark BLL trips in the Gulf of Mexico region. Based on one region and spreading the overharvests over five years, NMFS estimated that the sandbar adjusted quota for the research fishery would be 79.4 mt dw (Table C.2). By taking a precautionary approach and assuming that 70 percent of a 4,000 lb dw trip limit (or 2,800 lb dw) is made up of sandbar sharks and 30 percent (or 1,200 lb dw) is made up of non-sandbar LCS, the 79.4 mt dw of sandbar adjusted quota could be caught in approximately 62 trips ($79.4 \text{ mt dw} = 180,998 \text{ lb dw}$; $180,998 \text{ lb dw} / 2,800 \text{ lb dw} = 62 \text{ trips}$). Based on two regions and spreading the overharvests over five years, NMFS estimated that the sandbar adjusted quota for the research fishery would be 87.9 mt dw (Table C.2). Using the same approach as described above, NMFS estimated that the 87.9 mt dw of sandbar adjusted quota could be caught in approximately 69 trips ($87.9 \text{ mt dw} = 193,784 \text{ lb dw}$; $193,784 \text{ lb dw} / 2,800 \text{ lb dw} = 69 \text{ trips}$).

Using the same catch composition as above (2,800 lb dw of sandbar sharks and 1,200 lb dw of non-sandbar LCS per trip), 62 trips to harvest 79.4 mt dw of adjusted sandbar quota for one region would result in 33.7 mt dw of non-sandbar LCS quota being harvested in the shark research fishery ($62 \text{ trips} \times 1,200 \text{ lb dw} = 74,400 \text{ lb dw}$ or 33.7 mt dw) (Table C.3). When two regions are considered, 87.9 mt dw of sandbar quota harvested in 69 trips would result in 37.5 mt

dw of non-sandbar LCS quota being harvested in the shark research fishery (69 trips x 1,200 lb dw = 82,800 lb dw or 37.5 mt dw) (Table C.3). Therefore, the adjusted non-sandbar LCS quota for the shark research fishery would be 33.7 mt dw if one region is considered and 37.5 mt dw if two regions are considered.

Table C.3 Adjusted non-sandbar LCS quota within the research fishery for alternative suite 4

A. Regions	B. Non-Sandbar LCS Quota Minus Shark Research and Display Quota(mt dw)	C. Non-Sandbar LCS Adjusted Quota Within Research Fishery (mt dw)	D. Resulting Non-Sandbar LCS Base Quota to Subtract Overharvests From Outside Research Fishery (mt dw)
One	677.8	33.7	644.1
Atlantic	203.3	37.5	192.1
GOM	474.5		448.2

This would result in a non-sandbar LCS quota of 644.1 mt dw outside the research fishery for one region, or 192.1 mt dw in the Atlantic region, and 448.2 mt dw in the Gulf of Mexico region for two regions under alternative suite 4 (Table C.3). From these numbers, NMFS subtracted the amount of overharvest shown in column L of Table C.1 spread out over one to five years for one or two regions (Column B in Table C.4). For the preferred alternative suite 4, this results in a five year adjusted non-sandbar LCS quota of 590.6 mt dw for one region or 187.8 mt dw in the Atlantic region and 390.5 mt dw in the Gulf of Mexico region for two regions (Column D in Table C.4).

Table C.4 Adjusted non-sandbar LCS quotas outside the research fishery after overharvests spread out over five years for alternative suite 4.

Regions	A. Total Non-Sandbar LCS Overharvest (mt dw)	B. Amount of Non-Sandbar LCS Overharvest Divided Over 5 Years	C. Resulting Non-Sandbar LCS Base Quota to Subtract Overharvests From Outside Research Fishery (mt dw)	D. Adjusted Non-Sandbar LCS Quota if Overharvest accounted for over 5 years for Alt. Suite 4 (mt dw) (C-B)
One	267.7	53.5	644.1	590.6
Atlantic	21.6	4.3	192.1	187.8
GOM	288.6	57.7	448.2	390.5

Regions

Draft Environmental Impact Statement

In the DEIS, NMFS preferred one overall region for quotas and retention limits. Based on one region, NMFS calculated sandbar and non-sandbar LCS quotas and retention limits for the different alternative suites as explained in Appendix A.

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During the comment period on the DEIS, NMFS received a number of comments regarding the proposed one region for non-sandbar LCS sharks. Commenters felt that since the blacktip stock assessment showed that the Gulf of Mexico blacktip population is healthy and the status is unknown in the Atlantic, NMFS should acknowledge the differences in stock status and maintain specific regions that might allow a sustainable blacktip fishery in the Gulf of Mexico. Regional quotas may allow for a higher quota in the Gulf of Mexico where more non-sandbar LCS are caught compared to the Atlantic region where more dusky and sandbar sharks are caught. Others commented that NMFS should take a more cautious approach in the Atlantic since the Atlantic population status of blacktip sharks is unknown. In addition, there was concern regarding how 2007 overharvests would be accounted for if there was only one region; overharvests in one area, such as the Gulf of Mexico, would potentially have to be paid back by fishermen everywhere. Based on these public comments, NMFS considered regional quotas and retention limits for two regions, the Atlantic and Gulf of Mexico regions. NMFS choose to evaluate two regions based on the results of the blacktip shark assessment and on how NMFS interacts with the two Marine Fisheries Commissions, the Atlantic States Marine Fisheries Commission and the Gulf of Mexico States Marine Fisheries Commission. In doing so, NMFS evaluated the retention limits and associated discards for the different alternative suites with and without regions (Table C.5 and Table C.6).

Based on overharvests in 2007, results for the 2005/2006 blacktip stock assessments, and the fact that the ASMFC is developing an interstate shark management plan that would implement measures in state waters of the Atlantic, NMFS would choose to set regional quotas for non-sandbar LCS. For the preferred alternative suite 4, the regional non-sandbar LCS base quotas would be 439.5 mt dw in the Gulf of Mexico region and 188.3 mt dw in the Atlantic region (see “*Quotas*” discussion above; Table C.1). Based on overharvests in 2007, the adjusted

regional non-sandbar LCS quotas would be 390.5 mt dw in the Gulf of Mexico region and 187.8 mt dw in the Atlantic region for five years (Table C.4). This would allow more non-sandbar LCS quota in the Gulf of Mexico (predominately comprised of blacktip sharks) to be harvested from a healthy blacktip population. In addition, it would allow for regional accountability for overharvests in 2007 and in terms of any future overharvests. However, since the sandbar quota would be taken within the shark research fishery, which would be proportioned out over space and time to ensure adequate sampling, there would be one overall sandbar shark base quota of 116.6 mt dw. The adjusted annual sandbar shark quota would be 87.9 mt dw for five years (from 2008 until the end of 2012).

Retention Limits

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Retention limits for the different alternative suites in the DEIS are described in Appendix A.

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In the FEIS, NMFS reconsidered retention limits for the different alternative suites based on the revised non-sandbar LCS quota, overharvests in 2007, and regions. NMFS considered two approaches for calculating retention limits. One is considered the ratio approach, and the other approach divides the available quota over historical effort. Each approach is described below.

Ratio Approach - One approach calculated retention limits based on the catch composition as reported in observer program data when fishermen were targeting sharks under past retention limits (4,000 lb dw LCS/vessel/trip). This approach was used to calculate the retention limits for alternative suites 2 and 3. Since the overall quota for non-sandbar LCS is higher than the overall sandbar quota, dividing the available quota over the average historical fishing effort would result in higher retention limits for non-sandbar LCS. Since shark fisheries are typically mixed fisheries where sandbar sharks are caught in combination with non-sandbar LCS, this could result in sandbar sharks being discarded as fishermen reach their sandbar trip limit, but continue fishing to fulfill their non-sandbar LCS retention limits.

Basing the retention limit on the catch composition ratio could help reduce sandbar discards. The catch composition ratio of sandbar to non-sandbar LCS varies by region with a 1:4 ratio (1 sandbar shark for 4 non-sandbar LCS) in the Gulf of Mexico region, a 1:1.4 ratio in the South Atlantic region, and an average ratio of 1:2.7 for the combined regions. When considering one region, NMFS used the average ratio of sandbar to non-sandbar LCS to evaluate retention limits whereas for two regions, NMFS used the regional ratio of sandbar to non-sandbar LCS (Table C.5). Thus, NMFS calculated the number of sandbar sharks that could be retained per trip while staying within the allocated sandbar shark quota (79.4 mt dw or 87.9 mt dw; Table C.2). To do this, NMFS multiplied the number of sandbar sharks per trip by the number of historical trips that were taken by different permit types for each alternative suite. NMFS then based the non-sandbar LCS retention limit on the number of sandbar sharks per trip. For instance, if there was a three sandbar shark trip limit in the Gulf of Mexico, then fishermen could potentially

retain up to 12 non-sandbar LCS without having to discard sandbar sharks (3 sandbar sharks x 4 = 12 non-sandbar LCS). However, the approach would severely limit fishermen's ability to harvest the available non-sandbar LCS quota. Given the lower sandbar shark retention limit, fishermen would only harvest a small portion of the non-sandbar LCS quota under the different alternative suites (see column H in Table C.5). Thus, NMFS did not choose to use this approach for setting retention limits.

Table C.5 Retention limits based on catch composition from observer program data. Note: average sandbar weight is 40.5 lb dw; average non-sandbar LCS weight is 33.7 lb dw; average dusky weight is 74 lb dw (Cortés and Neer, 2005)

A. Alternative Suite	B. Region	C. Non-Sandbar LCS Adjusted Quota (overharvest spread over 5 years) (mt dw)	D. Sandbar Adjusted Quota (mt dw) (overharvest spread over 5 years) (mt dw)	E. Retention limits based on sandbar to non-sandbar catch composition ratio (average ratio 1:2.7; 1:1.4 in Atlantic; 1:4 in GOM)	F. Total Dusky Mortality (mt dw)	G. Total Sandbar Mortality (mt dw)	H. Non-sandbar Quota Harvested Based on Sandbar Retention Limits (mt dw)
1 (status quo)					33.1	594.4	-
2 (only directed permits)	One	624.2	79.4	10 non-sandbar/ 4 sandbar	8.6	97.8	120.7
	Two	GOM: 416.7 ATL: 198.9	87.9	GOM: 20 non-sandbar/ 5 sandbar ATL: 7 non-sandbar/ 5 sandbar	8.6	113.3	164.7
3 (same retention limits for all permits)	One	624.2	79.4	5 non-sandbar/2 sandbar	20.4	87.2	111.2
	Two	GOM: 416.7 ATL: 198.9	87.9	GOM: 8 non-sandbar/2 sandbar ATL: 4 non-sandbar/3 sandbar	20.4	105.1	126.9
3 (different retention limits for different permits)	One	624.2	79.4	<i>(Directed)</i> 8 non-sandbar/3 sandbar <i>(Incidental)</i> 3 non-sandbar / 2 sandbar	20.4	97.3	151.3
	Two	GOM: 416.7 ATL: 198.9	87.9	<i>(Directed)</i> GOM: 12 non-sandbar/3 sandbar ATL: 4 non-sandbar/3 sandbar <i>(Incidental)</i> 3 non-sandbar / 2 sandbar	20.4	109.8	136.3
4 (shark research fishery; same retention limits for all permits)	One	590.6*	79.4	2 non-sandbar	9.0	119.4	77.7
	Two	GOM: 390.5* ATL: 187.8*	87.9	GOM: 3 non-sandbar ATL: 1 non-sandbar	9.1	127.9	76.4

*Accounts for a separate non-sandbar LCS quota allocated to the research fishery

Dividing available quota over the historical number of trips – NMFS also evaluated what retention limits would be if the available quota was divided among the average annual number of trips that were reported in the HMS and Coastal Fisheries logbooks from 2003 to 2005. NMFS projected the number of trips that could be taken by directed and incidental permit holders based on average past fishing effort. NMFS chose to average effort from 2003 to 2005 to remove any anomalies within a given year. The overall choice for the time series of 2003 to 2005 is discussed in Chapter 4. NMFS acknowledges that this level of effort may not be achieved in the future given the reduced retention limits and sandbar quota; therefore, retention limits could be changed as necessary via framework actions based on quota monitoring and achieved fishing effort.

Since each alternative suite dealt with different permit types (*i.e.*, alternative Suite 2: only directed permit holders; alternative Suite 3: directed and incidental permit holders), the number of trips varied among alternative suites, resulting in different retention limits (see Table C.6). NMFS did this for the different alternative suites while considering one versus two regions (Table C.6). For instance, the sandbar retention limit is dependent on which part of the commercial fishery (*i.e.*, directed and/or incidental permit holders) is allowed to retain sandbar sharks. Alternative suite 2 would allow only directed shark permit holders to retain any shark species, and there would be no retention of sandbar sharks with PLL gear. Therefore, the sandbar quota (79.4 mt dw for one region) was averaged over the average annual number of directed shark permit holder trips reported in the Coastal Fisheries Logbook from 2003 through 2005 (*i.e.*, 790 trips). This would result in a sandbar trip limit of five sandbar sharks overall for directed permit holders (Table C.6). NMFS took the same approach for the non-sandbar LCS quota.

In addition, NMFS received comments regarding one retention limit for both directed and incidental permit holders. Since there has been a historic distinction in retention limits based on permit type, and because of differences in the cost associated with acquiring incidental versus directed permits, NMFS evaluated different retention limits for different permit types (Tables C.5 and Table C.6). It should be noted that the current trip limit for LCS for directed permits is 4,000 lb dw per trip whereas incidental permit holders are allowed to retain five LCS or, on average, 182.1 lb dw per trip. This is approximately a 22:1 ratio in trip limits between directed and incidental permit holders (*i.e.*, directed permit holders can retain 22 LCS for every 1 shark an incidental permit holder can retain). However, given the reduced trip limits necessary to accommodate the reduced quotas, NMFS cannot maintain this current ratio. Therefore, NMFS based the incidental trip limit for the final rule on the status quo (on average, 3 non-sandbar LCS and 2 sandbar sharks per trip). The directed trip limit was determined by dividing the available quota (minus what incidental permit holders would harvest) over the number of historic trips taken by directed permit holders. For instance, in the preferred alternative suite 4, there were, on average, 347.3 incidental trips taken per year from 2003 to 2005 that landed non-sandbar LCS. Based on this level of incidental effort and a 3 non-sandbar LCS trip limit, it is estimated that incidental permit holders would harvest approximately 35,112 lb dw (or 15.9 mt dw) of non-sandbar LCS. This leaves 611.9 mt dw of non-sandbar LCS quota available for harvest by directed permit holders (627.8 mt dw – 15.9 mt dw = 611.9 mt dw) under the base quota. Given there were, on average, 1,107 trips taken per year by directed permit holders who landed non-sandbar sharks from 2003 to 2005, this would result in a 36 non-sandbar LCS per trip for

directed permit holders. However, under the adjusted quota, this leaves 562.4mt dw of non-sandbar LCS quota available for harvest by directed permit holders (578.3 mt dw – 15.9 mt dw = 562.4 mt dw). Given the average 1,107 trips taken by directed permit holders, this would result in a 33 non-sandbar LCS per trip for directed permit holders (see Table C.6).

NMFS chose the approach of dividing the available quota for incidental and directed permit holders over historical fishing effort to determine retention limits instead of the ratio approach as explained above because it would allow the entire non-sandbar LCS quotas to be harvested. In addition, as explained below, under the preferred alternative suite 4, NMFS prefers one retention limit for all regions. Therefore, the retention limits for directed permit holders under the base or adjusted non-sandbar LCS quotas would be the same in the Atlantic and Gulf of Mexico regions. Incidental permit holders would have a reduced retention limit, but it would also be the same in all regions. This would allow for easier enforcement by having the same retention limits in all regions. In addition, while historical fishing effort was used as a proxy for determining retention limits, it is uncertain how effort would be distributed among regions in the future. Therefore, NMFS divided the available quota over the total historical fishing effort in all regions to determine retention limits for the preferred alternative suite 4.

Table C.6 Retention limits based on dividing available quota over the average number of historical trips. *Italicized alternative suite 4 is the preferred alternative suite in the FEIS. Note: average sandbar weight is 40.5 lb dw; average non-sandbar LCS weight is 33.7 lb dw; average dusky weight is 74 lb dw (Cortés and Neer, 2005)*

Alternative Suite	Region	Non-Sandbar LCS Adjusted Quota (overharvest spread over 5 years) (mt dw)	Sandbar Adjusted Quota (mt dw) (overharvest spread over 5 years) (mt dw)	Retention Limits Based on Dividing Available Quota Over Average Number of Historical Trips	Total Dusky Mortality (mt dw)	Total Sandbar Mortality (mt dw)
1 (status quo)					33.1	594.4
2 (only directed permits)	One	624.2	79.4	51 non-sandbar / 5 sandbar†	8.6 (†14.3)	119.1 (†408.8)
	Two	GOM: 416.7 ATL: 198.9	87.9	GOM:68 non-sandbar/ 5 sandbar† ATL: 32 non-sandbar / 6 sandbar†	8.6 (†10.7)	127.6 (†340.2)
3 (same retention limits for all permits)	One	624.2	79.4	27 non-sandbar / 2 sandbar†	20.4 (†26.9)	114.7 (†297.7)
	Two	GOM: 416.7 ATL: 198.9	87.9	GOM:45 non-sandbar /3 sandbar† ATL: 15 non-sandbar / 3 sandbar	20.4 (†22.6)	123.2 (†191.4)
3 (different retention limits for different permits)	One	624.2	79.4	<i>(Directed)</i> 36 non-sandbar / 3 sandbar† <i>(Incidental)</i> 3 non-sandbar / 2 sandbar	20.4 (†26.2)	114.7 (†327)
	Two	GOM: 416.7 ATL: 198.9	87.9	<i>(Directed)</i> GOM: 63 non-sandbar/4 sandbar† ATL: 18 non-sandbar/ 3 sandbar <i>(Incidental)</i> 3 non-sandbar / 2 sandbar	20.4 (†22.5)	123.2 (†210.7)
4 (shark research fishery; same retention limits for all permits)	One	590.6*	79.4	26 non-sandbar†	9.0 (†14.3)	119.4 (†327.3)
	Two	GOM: 390.5* ATL: 187.8*	87.9	GOM: 42 non-sandbar† ATL: 14 non-sandbar	9.1 (†10.1)	127.9 (†214.3)

Alternative Suite	Region	Non-Sandbar LCS Adjusted Quota (overharvest spread over 5 years) (mt dw)	Sandbar Adjusted Quota (mt dw) (overharvest spread over 5 years) (mt dw)	Retention Limits Based on Dividing Available Quota Over Average Number of Historical Trips	Total Dusky Mortality (mt dw)	Total Sandbar Mortality (mt dw)
4 (shark research fishery; (different retention limits for different permits)	One	590.6*	79.4	(Directed) 34 non-sandbar† (Incidental) 3 non-sandbar	9.0 (†13.6)	119.4 (†361.5)
	Two	GOM: 390.5* ATL: 187.8*	87.9	(Directed) GOM: 60 non-sandbar† ATL: 18 non-sandbar (Incidental) 3 non-sandbar	9.1 (†9.9)	127.9 (†241.2)
4 (shark research fishery; regional quotas, one retention limit for 2 regions; different retention limit for different permits)	Two	GOM: 390.5* ATL: 187.8* (Total: 578.3)	87.9	(Directed) 33 non-sandbar† (Incidental) 3 non-sandbar	9.1 (†9.9)	127.9 (†365)

*Accounts for a separate non-sandbar LCS quota allocated to the research fishery

(†) Targeting of non-sandbar LCS with the indicated retention limit could result in sandbar and dusky mortality as shown in parentheses; numbers not in parentheses indicate mortality associated with targeting species other than non-sandbar LCS

Discards

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Estimated discards for the different alternative suites, based on one overall region are shown in Table 4.1 in Chapter 4.

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In the FEIS, based on the new analyses of retention limits, NMFS estimated discards according to discards reported in the HMS logbook and discards from the bottom longline and gillnet 2005 to 2006 observer reports. NMFS estimated the total mortality for dusky and sandbar sharks for the different alternative suites assuming 1) that fishermen would incidentally catch non-sandbar LCS as they targeted other species given the reduced trip limits, and 2) that fishermen may target non-sandbar LCS in one region if retention limits were high enough. By doing this NMFS established a range in the possible mortality of sandbar and dusky sharks as a result of different alternative suites and different retention limits (Table C.6).

Discards associated with incidental fishing for sharks – Since dusky sharks have been prohibited since 2000 and have not been a targeted species since then, NMFS used the estimates of dusky discards from the different fishing sectors as explained in Table 4.1 in Chapter 4 to estimate incidental catch and discards of dusky sharks. NMFS used the same estimates for sandbar sharks as shown in Table 4.1 in Chapter 4 with the exception of the “estimated dead discards on directed shark BLL gear” and the “total discards in South Atlantic region due to non-sandbar LCS retention limit.” Based on the re-calculation of retention limits as described above, NMFS estimated the discards associated with BLL gear when fishermen would incidentally capture sandbar sharks and/or non-sandbar LCS (*i.e.*, not target sandbar sharks and/or non-sandbar LCS) for the different alternative suites.

For alternative suite 4, NMFS first assumed that the reduced non-sandbar LCS trip limits would keep fishermen outside the shark research fishery from targeting non-sandbar LCS. Instead, the non-sandbar LCS retention limit would allow fishermen to keep non-sandbar LCS while they target other species, such as reef fish or the snapper-grouper complex. NMFS determined the level of discards a given retention limit could result in compared to what incidental fishermen kept while targeting other species. For instance, based on data collected by the shark BLL observer program from 2005 to 2007, fishermen with directed shark permits fishing for snapper-grouper kept, on average, 12 sharks per trip. Higher retention limits than this would presumably keep fishermen from having to discard sharks. In addition, fishermen that did not target sharks (*i.e.*, trips targeting snapper-groupers), on average, caught one sandbar shark per trip. The soak times on these trips are much shorter than soak times associated with shark targeted sets (Hale and Carlson, 2007; Hale *et al.* 2007). Therefore, it is anticipated that any sandbar sharks caught while fishermen targeted non-shark species could be released alive. In addition, even though recreational fishermen would not be allowed to retain sandbar sharks, NMFS estimated the sandbar shark mortality due to recreational fishing to be 27 mt dw per year due to potential post-release mortality and non-compliance. This level of mortality due to recreational fishing is amount based on the annual average landings of sandbar sharks under the

status quo. Thus, based on these assumptions, and on the adjusted sandbar shark quota for one or two regions (79.4 mt dw or 87.9 mt dw, respectively), NMFS calculated the total sandbar mortality associated with the different alternative suites (Table C.6). For instance, under the preferred alternative suite 4, it is estimated that there would be 9.1 mt dw of dusky discards (see Table 4.1 in Chapter 4). Total sandbar mortality would be 127.9 mt dw under the preferred alternative suite 4 (27 mt dw due to recreational anglers + 2.3 mt dw of discards by fishermen targeting non-shark species with BLL gear + 6.1 mt dw discards by fishermen with non-HMS permits + 4.3 mt dw of discards by fishermen using PLL gear + 0.3 mt dw of discards by fishermen within the shark research fishery + 87.9 mt dw of directed catch by fishermen in the shark research fishery) (Table C.6; Table 4.1 in Chapter 4). Under the base quota for sandbar sharks, total mortality would be slightly higher at 156.6 mt dw (27 mt dw due to recreational anglers + 2.3 mt dw of discards by fishermen targeting other non-shark species with BLL gear + 6.1 mt dw discards by fishermen with non-HMS permits + 4.3 mt dw of discards by fishermen using PLL gear + 0.4 mt dw of discards by fishermen within the shark research fishery + 116.6 mt dw of directed catch by fishermen in the shark research fishery). Dusky mortality would be 9.1 mt dw (see Table 4.1 in Chapter 4).

Discards associated with targeting sandbar sharks and/or non-sandbar LCS – NMFS also calculated the level of dusky and sandbar mortality in terms of landings and discards that could result if fishermen still continue to target sandbar sharks and/or non-sandbar LCS (Table C.6; mortality associated with targeting sandbar sharks and/or non-sandbar LCS is shown in parentheses). By doing this, NMFS was able to establish a range in possible landings and discards for dusky and sandbar sharks. NMFS did this for one region and for the Gulf of Mexico region, since the retention limits were higher in the Gulf of Mexico region than the Atlantic region. Again, NMFS used sandbar and dusky discards from the different fishing sectors as explained in Table 4.1 in Chapter 4, with the exception of the “estimated dead discards on directed shark BLL gear” and the “total discards in South Atlantic region due to non-sandbar LCS retention limit.” For dusky sharks, based on observer program reports, NMFS multiplied the average number of dusky sharks discarded on directed shark trips in the different regions (0.10 per trip in the Gulf of Mexico region and 0.33 per trip in the Atlantic region) by the number of trips taken in the different regions under the different alternative suites. This was added to the rest of dusky discards from other fishing sectors as described in Table 4.1. The total dusky landings and discards for each alternative suite if fishermen continue to target sharks are shown in Table C.6. Under the preferred alternative suite 4, it is estimated that a total of 9.9 mt dw of dusky sharks will be landed or discarded if fishermen continue to target non-sandbar LCS outside the research fishery (Table C.6).

For sandbar sharks, NMFS calculated the number of sandbar sharks that would be discarded per trip if fishermen targeted sandbar sharks and/or non-sandbar LCS in different regions as a result of the different non-sandbar LCS retention limits. Discards were based on the catch composition of sandbar to non-sandbar LCS as reported in the observer program reports (1:4 ratio in the Gulf of Mexico region, and 1:1.4 ratio in the Atlantic region) and how many sandbar sharks may be retained under each alternative suite. This was then multiplied by the number of trips taken under the different alternative suites, and then added to the rest of the sandbar discards in Table 4.1, in addition to the sandbar quota for one or two regions (79.4 mt dw or 87.9 mt dw), and recreational catch (27 mt dw). Total sandbar mortality associated with

the different alternative suites and different retention limits if fishermen continue to target sharks is shown in Table C.6. For instance, in the Gulf of Mexico under alternative suite 2, fishermen would be able to retain 68 non-sandbar LCS and five sandbar sharks per trip. Based on the 1:4 ratio of sandbars to non-sandbar LCS in the Gulf of Mexico region, this would result in 17 sandbar sharks being caught per trip. Since five sandbar sharks could be retained, 12 would be discarded per trip. Since, on average, there were 397.3 directed trips in the Gulf of Mexico, 87.6 mt dw of sandbar sharks would be discarded. When this is added to other discards from other fisheries and mortality due to recreational fishing, the total sandbar mortality could be 340.2 mt dw (Table C.6). Under the preferred alternative suite 4, it is estimated that 365 mt dw of sandbar shark mortality may result if fishermen continued to direct on non-sandbar LCS outside the research fishery (236.8 mt dw of discards from BLL fishing + 87.9 mt dw harvested in the research fishery + 13.1 mt dw discarded in other fisheries + 27 mt dw mortality due to recreational fishing) (Table C.6). Since this would be above the 158.3 mt dw recommended TAC from the sandbar shark assessment, NMFS would have to take additional steps to lower sandbar shark mortality if fishermen continue to target non-sandbar LCS after these management measures are implemented.

C.2 Final management actions regarding quotas, regions, overharvests, and retention limits

As mentioned in chapters 2 and 4, NMFS prefers alternative suite 4 at this time. This would establish a small shark research fishery where different shark species could be harvested, and fishermen operating outside the research fishery would be allowed to retain non-sandbar LCS, pelagic sharks, and small coastal sharks (SCS). However, NMFS would change some of the measures in the FEIS within alternative suite 4 from what were proposed in the DEIS. As described above, NMFS would establish regional non-sandbar LCS quotas (an Atlantic and Gulf of Mexico region) for the preferred alternative suite 4 (whereas only one region was considered in the DEIS). This is based, in part, on public comment as well as the results of the blacktip shark assessment, the fact that the ASMFC is developing an interstate shark management plan that would implement measures in state waters of the Atlantic, and accounting for overharvests that occurred in 2007. In addition, NMFS would use HMS shark dealer reports to set the non-sandbar LCS quota based on recommendations from the SEFSC. NMFS would establish a separate non-sandbar LCS base quota for the shark research fishery of 50 mt dw. This would allow the shark research fishery to continue even if the non-sandbar LCS quota outside the research fishery is fulfilled. In addition, 43.1 mt dw of quota would be set aside for the shark research and display quota. This results in a base non-sandbar LCS quota of 439.5 mt dw in the Gulf of Mexico region and 188.3 mt dw in the Atlantic region (Table C.1 and Table C.7). However, based on the TAC from the sandbar stock assessment, NMFS would use the proposed 116.6 mt dw sandbar quota in the DEIS as the base quota for sandbar sharks.

Due to overharvests during the 2007 fishing year (Table C.1), NMFS would adjust these base quotas to account for the overharvests. Because of the large amount of overharvests that occurred in 2007, and because sandbar sharks would rebuild within the same timeframe if NMFS spread out the 2007 overharvest over one or five years, NMFS has decided to spread out the overharvests over five years to allow for a small sandbar research fishery and non-sandbar LCS fishery (Table C.2). This would result in an adjusted quota of sandbar sharks of 87.9 mt dw for five years (Table C.7). Based on this adjusted sandbar quota, the adjusted non-sandbar quota for

the shark research fishery would be 37.5 mt dw (Table C.3). This would allow the shark research fishery to continue even if the non-sandbar LCS quota outside the research fishery is fulfilled. The research fishery itself would continue until both the sandbar and non-sandbar LCS quota established for the research fishery were 80 percent filled (*i.e.*, if the non-sandbar LCS quota within the research fishery reached 80 percent, non-sandbar LCS retention in the research fishery would end, but sandbar sharks could continue to be retained until that sandbar quota reached 80 percent). However, if such a non-sandbar LCS quota is not adequate for the research fishery, NMFS would adjust the quota through a framework action. The resulting adjusted non-sandbar LCS quota outside the research fishery would be 390.5 mt dw in the Gulf of Mexico region and 187.8 mt dw in the Atlantic region (or a total of 578.3 mt dw of non-sandbar LCS quota) (Table C.6 and Table C.7). After the overharvests have been accounted for, unless new management measures are in place, the base quotas would then be implemented (as of January 1, 2013).

In addition, based on public comment and to preserve differences among directed and incidental permit holders, NMFS would set separate retention limits based on permit type; directed permit holders would be allowed a higher retention limit than incidental permit holders. This would afford directed permit holders, who presumably paid more for their directed shark permit and rely on shark products for a larger part of their income, a higher retention limit than if all permit holders had the same retention limit. However, while NMFS would implement regional quotas for non-sandbar LCS and different retention limits for directed and incidental permit holders, NMFS would not implement regional non-sandbar LCS retention limits. Instead, directed permit holders would have the same retention of non-sandbar LCS whether they fish in the Atlantic or the Gulf of Mexico. Similarly, incidental permit holders would have the same retention limit in all regions (Table C.7). This would allow for easier enforcement by having the same retention limits in all regions. In addition, while historical fishing effort was used as a proxy for determining retention limits, it is uncertain how effort would be distributed among regions in the future. Therefore, NMFS spread the total amount of adjusted non-sandbar LCS quota (578.3 mt dw) among the number of historical trips taken in all regions. Based on this, NMFS would keep the retention limit for incidental permit holders according to status quo at 3 non-sandbar LCS per trip and establish a trip limit of 33 non-sandbar LCS for directed permit holders based on the adjusted non-sandbar LCS quotas (see Table C.6 and Table C.7). Trip limits under the non-sandbar LCS base quota, 627.8 mt dw for all regions, would be 36 non-sandbar LCS per trip for directed permit holders and 3 non-sandbar LCS per trip for incidental permit holders (Table C.7)

NMFS also estimated discards of dusky sharks and sandbar sharks under the preferred alternative suite 4. Assuming fishermen would not target non-sandbar LCS based on the reduced trip limits (on average, directed shark holders landed 69 sandbar sharks and 35 non-sandbar LCS per trip under the status quo; therefore, a 33 or 36 non-sandbar LCS trip limit for directed permit holders would be approximately one quarter of what they landed under the status quo). NMFS assumes fishermen would catch dusky and sandbar sharks and non-sandbar LCS in an incidental manner as they target other species. Therefore, the level of total sandbar mortality is expected to stay below the TAC of 158.3 mt dw. NMFS estimates total sandbar landings and discards to be approximately 127.9 mt dw per year given the adjusted quotas and retention limits (Table C.6). Dusky shark discards are expected to decrease by over 70 percent from 33.1 mt dw per year (under the status quo) to an average of 9.1 mt dw per year. However, if fishermen continue to

target non-sandbar LCS and sandbar shark discards result in sandbar mortality above the recommended sandbar shark TAC, NMFS may consider reducing non-sandbar LCS trip limits, as appropriate.

Table C.7 Overview of quotas and retention limits under the base and adjusted quotas for the preferred alternative suite 4.

	Sandbar Quota (mt dw)	Non-sandbar LCS Quota Inside Research Fishery (mt dw)	Non-sandbar LCS Quota Outside Research Fishery (mt dw)	Retention Limits for Directed Permit Holders (Outside Research Fishery)	Retention Limits for Incidental Permit Holders (Outside Research Fishery)
Base Quotas (as of January 1, 2013)					
Atlantic	116.6	50	188.3	36 non-sandbar LCS/vessel/trip	3 non-sandbar LCS/vessel/trip
Gulf of Mexico			439.5		
Adjusted Quotas (from 2008 until December 31, 2012)					
Atlantic	87.9	37.5	187.8	33 non-sandbar LCS/vessel/trip	3 non-sandbar LCS/vessel/trip
Gulf of Mexico			390.5		

Appendix C References

- Cortés, E. and J.A. Neer. 2005. Updated catches of Atlantic sharks. LCS05/06-DW-16. NMFS, Southeast Fisheries Science Center, Panama City, Florida. 58 p.
- Hale, L.F. and J.K. Carlson. 2007. Characterization of the Shark Bottom Longline Fishery: 2005-2006. National Oceanic and Atmospheric Administration Technical Memorandum. NMFS-SEFSC-554. 25pp.
- Hale, L.F., L.D. Hollensead, and J. K. Carlson. 2007. Characterization of the shark bottom longline fishery: 2007. NOAA Technical Memorandum NMFS-SEFSC 564, 25 pp.
- NMFS. 2006. SEDAR 11 Stock Assessment Report: Large Coastal Shark Complex, Blacktip and Sandbar Shark. Highly Migratory Species Management Division, 1315 East West Highway, Silver Spring, MD 20910. 257 pp.
- NMFS. 2007. Draft Amendment 2 to the Consolidated Highly Migratory Species Fishery Management Plan. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, 1315 East West Highway, Silver Spring, MD. Public Document. 450 pp.