# Some Cautions on the Use of Pelagic Longline Logbook (PLL) Data to Assess the Abundance of Large Coastal Sharks (LCS)

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*Summary Abstract: We challenge four assumptions used in constructing the PLL Indices for blacktip sharks (Carcharhinus limbatus). These and our accompanying comment are:*

1) *CPUE reflects only change in abundance. We submit that the initial declines shown by the indices are too steep to be plausible if only change in abundance is involved.*

2) *Sampling covers the range of the fishery. The areas used in the analysis are too large to detect effects from closures of nearshore fishable grounds where most blacktip occur.*

3) *CPUE correctly reflects what was caught. There is a great difference in the species composition in catches reported in the PLL data and the Pelagic Observer Program data. Possible explanations are that other species were misidentified as blacktip shark, or that the PLL data include many inshore sets in the early years of the series.*

4) *Availability and catchability are constant over the period. Regulations implemented between 1992 and 1994 rather than a drastic decline in abundance can explain the steep decline in CPUE.*

**Background.** During discussion of DW-35 at the SEDAR Index Working Group, we expressed our concern over how the pelagic longline logbook data were used to construct indices of abundance, particularly for blacktip shark:

*"The group expressed concern that the trends observed for blacktip sharks and sandbar sharks (C. plumbeus) in **LCS05/06-DW-35** may reflect changes in targeting, reporting, and management actions. A recommendation was made that the dataset be reanalyzed (although a blacktip shark index across all areas is no longer needed), selecting sets/trips based on criteria, such as species composition of the catch or bottom depth, to help determine those that would be targeting large coastal sharks (or at least more likely to encounter them). A further recommendation was made to subset the data to boats that appeared to be consistently reporting sharks throughout the time period."*

Subsequently, DW-35 was reanalyzed and submitted as DW-35 v2. We believed that the revision still did not address all of our concerns, and we attached a minority statement to that effect to the Report of the Index Group. We elaborate further in this present paper.

**The problem.** The use of CPUE as an index of abundance implies that the underlying assumptions are valid. If any violations to the assumptions are identified, corrections have to be made, or at least any violation has to be shown not to have a significant effect on the magnitude and trend of the index. If these conditions are not met, we submit that the CPUE index should not be used to assess stock trends of abundance. This concept applies to all the

fishery dependent indices that will be used in the shark assessment, but our principal concern is with how well some assumptions are met in DW-35 v2.

The four assumptions of concern to us are:

1) **CPUE reflects only change in abundance**

In the blacktip cases in DW-35 v2, CPUE declines much more rapidly during the early years of exploitation than is expected if change in abundance were the only factor operating. The plot of CPUE for blacktip shark reproduced below indicates that abundance declines more than half in the first three years of the fishery.

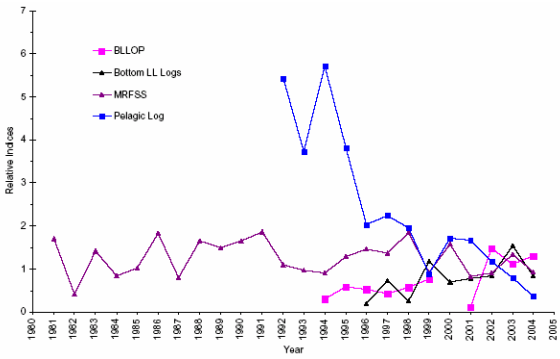



Figure 3.7. Fishery dependent catch rate series for blacktip sharks from the Gulf of Mexico. Solid lines indicate base case indices while dashed lines are for series to be used in sensitivity analysis. Series are scaled (each series is divided by the mean of the years within that series which overlap between all series) to appear on a common scale.

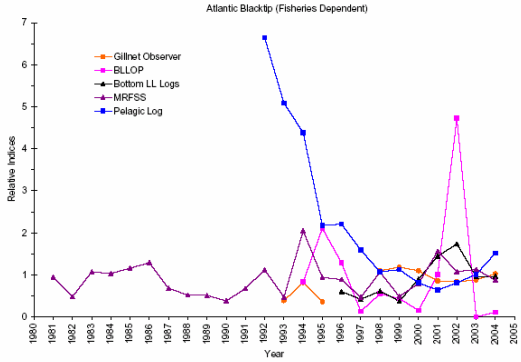



Figure 3.9. Fishery dependent catch rate series for blacktip sharks from the western Atlantic Ocean. Solid lines indicate base case indices while dashed lines are for series to be used in sensitivity analysis. Series are scaled (each series is divided by the mean of the years within that series which overlap between all series) to appear on a common scale.

Catch was about constant before, during and after this period, and such a steep decline several years into major exploitation and at the time that several regulations were imposed on the fishery suggests that some other factors may be contributing to the decline. If true, this is reason for major concern because most models that use CPUE to establish a trend are sensitive to a high point at the beginning of the time series. Since the MRFSS series (shown in the figures reproduced here – it was left in the figure in our version of the Report), is not to be included in the base case, the PLL series with its high point in 1992 followed by a steep decline may have a large influence on the modeling trend. We note that trend of the PLL series is remarkably different from the trends shown by the other indices for blacktip sharks. Why?

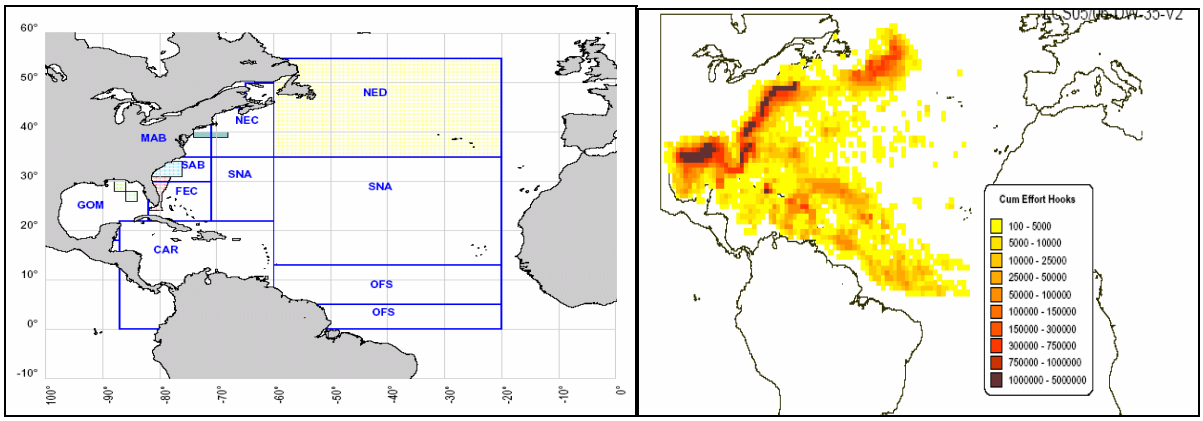
2) **Sampling covers the range of the fishery**

Blacktip shark, *C. limbatus* is a nearshore species. We have reason to believe that distance from land is a spatial factor affecting the apparent abundance and therefore CPUE for blacktip sharks. We do not believe using areas on the scale selected in DW-35 v2 for LCC addresses the concern raised during the Workshop discussion that blacktip sharks (and sandbar sharks) are nearshore species. That paper states:

"In summary for the PLL database use to generate standardized indices of abundance for LCC sharks the only change or modification introduced was the restriction of data to those vessels that have at least 4 or more years of LCC shark catches. Species catch association or bottom depth were not implemented based on the

analyses describe above."

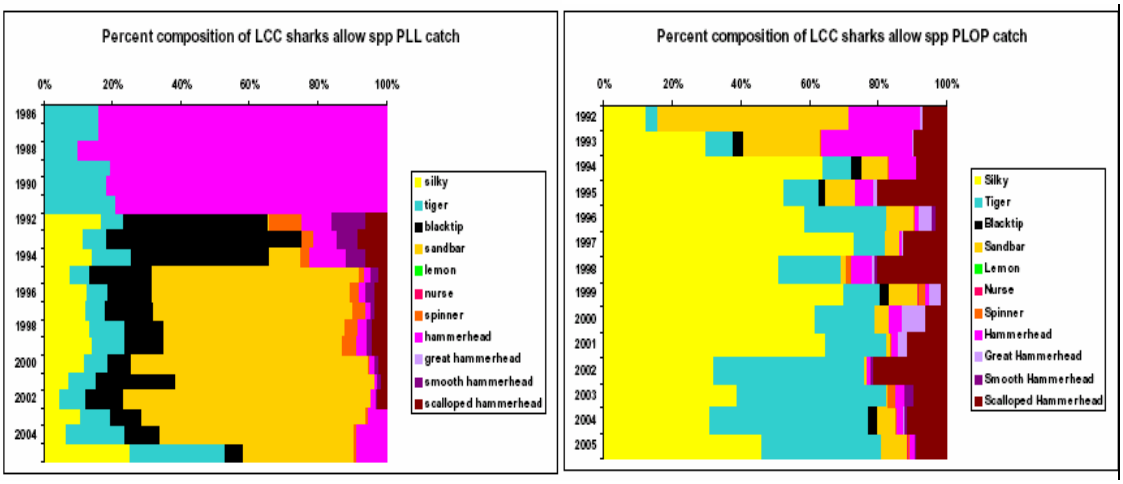
There was no attempt to treat blacktip sharks as a separate issue from the LCC and to limit the sets examined to area where *C. limbatus* is known to occur. For C. *limbatus* these would be only the inshore portions of Areas GOM, FEC, SAB and MAB shown in the figures below.



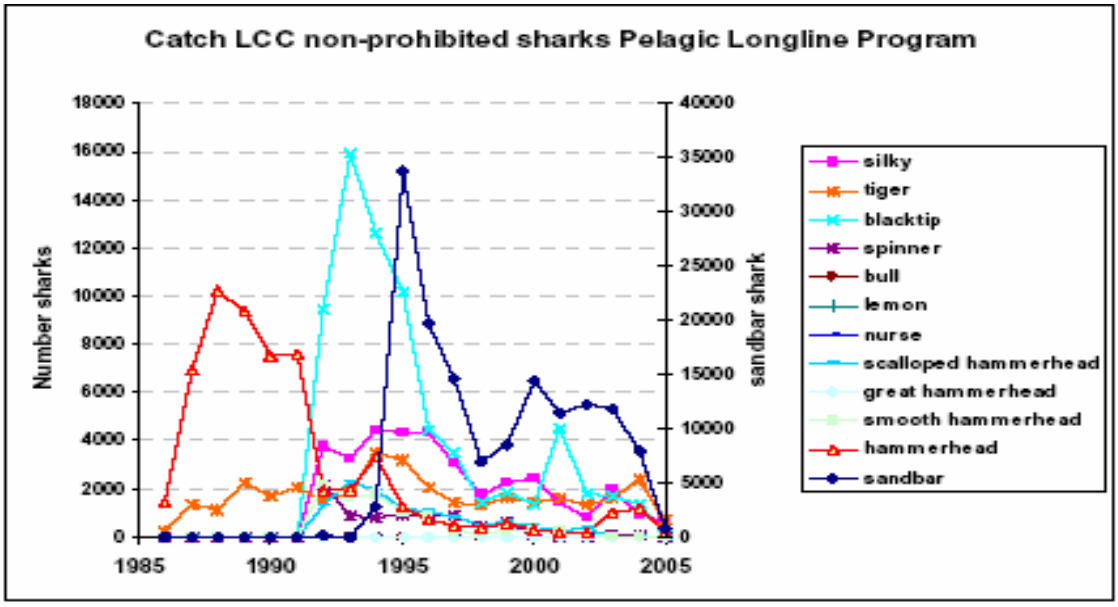

These figures are reproduced from DW-35 v2. The one on the left shows the areas used in analysis. The one to the right indicates that even for the four areas where C. *limbatus* (and C. *plumbeus*) are most likely to occur, most of the effort is outside the general range of blacktip with a substantial number of sets included in the analysis occurred offshore and north. This may lead to a problem in including the offshore set if LCS sharks with a liking for offshore waters and having black-tipped fins such as spinner (*C. brevipinna)* and silky sharks (*C. falciformis)* are taken and called "blacktip sharks". It would be useful to plot the locations for sets taking "blacktip shark" to see how they are distributed.

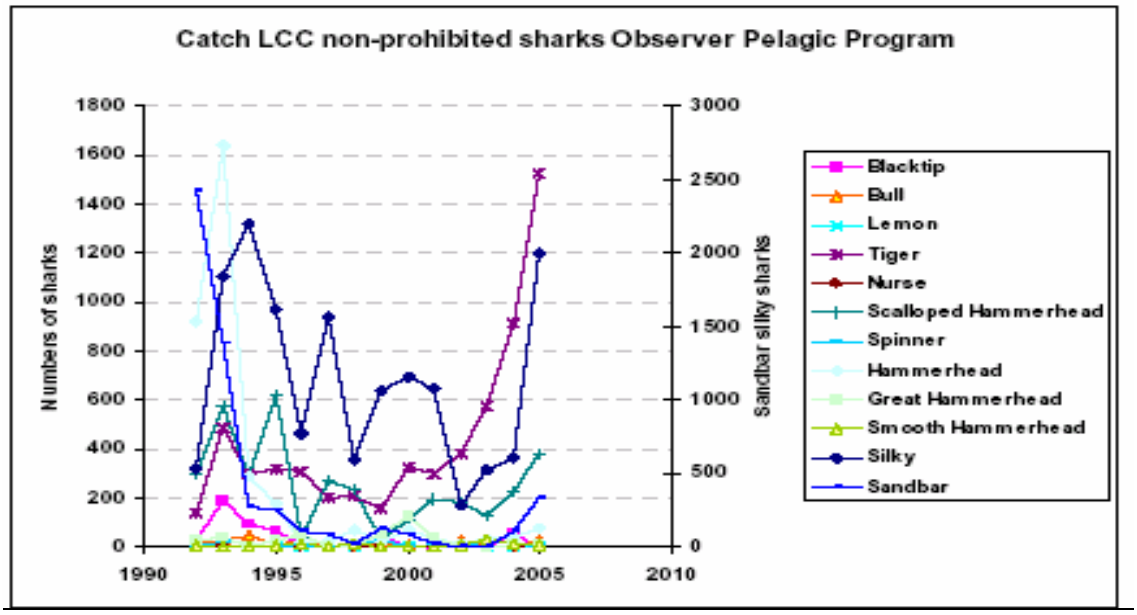
### 3) CPUE correctly reflects what was caught

Proper species identification in the case of the blacktip shark PLL index is a concern that must be addressed. The observed catch data (DW-35 v2, uncaptioned figure on p. 29 and reproduced below) shows a considerable difference in species catch composition between that reported in the logbook data and that observed by the PLOP. We wonder why this remarkable difference was not investigated as it has major implications for the study.




DW-35 v2 does not inform us if, or how, these two sets of data were combined. We presume from the relative scale on the two figure panels reproduced on next page that the PLOP coverage was about 10% of the total. We also assume that CPUE was estimated from the combined data because blacktip shark occur in only five of the years for the PLOP set and the index has estimates for all years. If this is the case, the results will be based about 90% on the PLL set. The question then is why the major difference in species composition? Of special interest are sandbar, silky and spinner sharks, and the pre-1992 catches for the PLL sets!






At this point, and without additional analyses, there is not much one can do except speculate that there may be several explanations, or combinations of explanations for the differences in the two data sets. Misidentification of spinner and silky sharks as blacktip sharks in the PLL set is one.

**4) Availability and catchability are constant over the period.**

A number of state and federal regulations were implemented during the period covered by the PLL indices. Those that might have some effect on catch rates are shown in Figure 1.

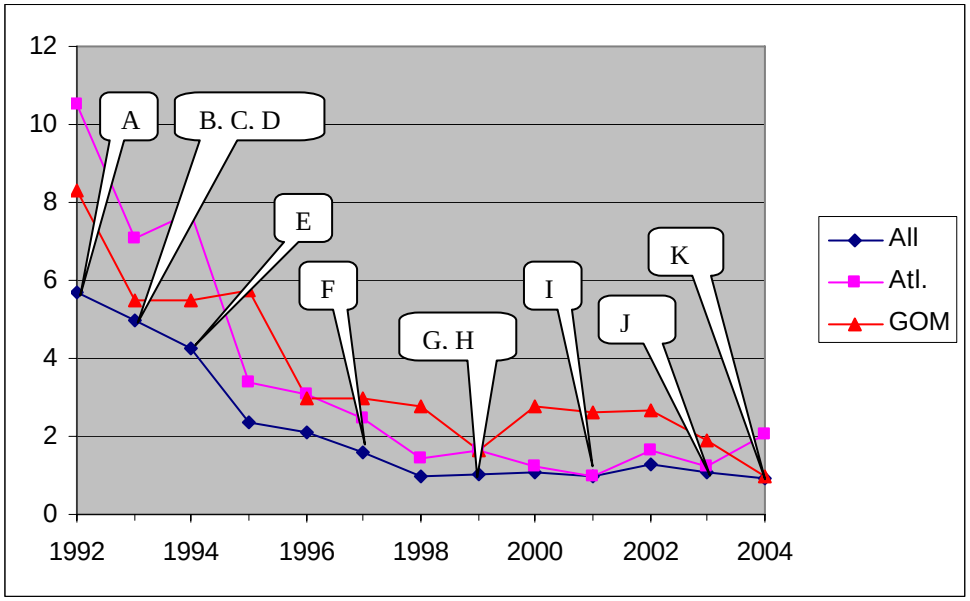


**Figure 1. Standardized Blacktip CPUE relative to lowest value in each series**

Legend for Callouts

A. April 1992, Florida implemented commercial bag limit regulation of two large sharks per vessel in state waters – 3-miles on East coast, and 9-miles on West coast

B. April 26, 1993, the NMFS announced final rules for Atlantic Shark Fishery Management Plan (ASFMP) – LCS quota set at ca 6m lbs, finning prohibited

C. May 1993, fishing for LCS closed in federal waters to July 1, 1993

D. July 30, 1993, fishing closed until January 1, 1994.

E. January 1, 1994, NMFS implements a 4000-pound dressed weight (DW) LCS trip limit.

F. April 7, 1997, NMFS announced that LCS quota would be reduced to 3m lb.

G. June 25, 1999, Judge freezes LCS quota at 1997 level – 3m lbs

H. July 1, 1999, NMFS implements shark limited access permit (LAP) system

I. March 1, 2001, NMFS sets two time/area closures implemented for pelagic longline fishing outside state waters: East Florida Coast closed between 24°– 31°N, and partial closure (February-April) Georgia & South Carolina (31° – 34°N)

J. January 1, 2003 NMFS sets LCS quota in two parts, ridgeback (RB) & non-ridgeback (NRB) – total quota 3.5m lbs

K. January 1, 2004 NMFS sets re-aggregated LCS complex quota at 2.2m lbs

The PLL series comprises logbook data from several groups of vessels that were affected to different degrees by the regulations. One group of smaller vessels, and some large ones, based in the south are more inclined to target sharks and fish closer to shore. Another group consists of mainly high seas tuna and swordfish boats based in the Atlantic. Another group of Vietnamese fishermen is based out of the GOM. Each of these groups (and others – this is not an exhaustive list), has its own market and fishing operation and having chiefly the PLL in common. As a result, the closure by Florida in 1992 of state waters had little effect on operations for the high seas tuna and swordfish or the Vietnamese, but shut the Florida inshore longline boats out of areas where LCS catches, particularly blacktip sharks, were high. The closure was in effect for the last three quarters in 1992 and all of 1993 and subsequent years.

Following this closure, the NMFS ASFMP came into force during the spring of 1993 and effectively removed directed shark trips for the latter half of that year, and most of the second and fourth quarter thereafter for a decade plus. The ASFMP also removed the incentive to target shark for fins only. In 1994, the LCS 4000-pound DW trip limit came into effect and effectively removed the remaining large boats from the inshore shark fishery in areas outside of Florida state waters. The cumulative effect of these regulations was to remove effort from the regions where blacktip shark is most abundant. This is consistent with the change in species composition noted in section # 3 above. Because the area definition for the GLM uses the broad PLL area definitions, the analysis in DW-35 v2 cannot distinguish the effect on CPUE from the loss of the productive nearshore region from a real change in abundance.

**Conclusions and recommendations**

We believe we have identified areas that need to be investigated thoroughly before the PLL Index can be used in the base case. By its very nature, the PLL data are of limited use for assessing nearshore members of the LLC such as blacktip, sandbar, bull, lemon and nurse sharks. To have a representative index for the LCC sharks, targeted sets need to be treated separate from sets that catch LCC sharks incidental to tuna and swordfish. This is a difficult task, as the logbook reports for targeting do not always accurately report the actual operation, and separation might better be made based on depth and distance from shore. A first step would be to plot the locations of catches for the species. This exercise also may be useful in investigating why there is such a differences in species composition between the PLL data set and the PLOP data set.

Examination of the PLL and PLOP data base also should look at what boats were involved in the two data sets (including the number of boats in the pre-1992 data), and home port and vessel size to determine which ones are distant water boats, and which belong to the short trip group. Other information of interest is where and when the observed sets took place and which ones caught blacktip and sandbar sharks. The graphics (relative importance of blacktip shark) suggest that much of the PLL data base was nearshore in 1992 with some moving out in 1993-4 following the finning prohibition, which would tend to favor targeting sandbar. Until this work has been completed we recommend that this Index be used only in a sensitivity case and not in the base case.

## ANNEX I
## State & Federal Regulatory Actions for the Atlantic Large Coastal Shark from 1992 through 2005, with comments on how they affected the fishery

(Note: (Letters) relate to callouts in Fig. 1)

1. (A) Beginning April 1992, the State of Florida implemented a commercial bag limit regulation of two large sharks per vessel that effectively closed Florida state waters to commercial shark fishing. The area affected was out to three miles on the East coast, and offshore to nine miles on the West coast of Florida. This action had a negative effect on the Blacktip shark fishery on both coasts, whether fishing with longline or gillnets. Florida accounted for over half of the large coastal shark (LCS) landings each year since the early 1980's until this action took place.
2. (B) On April 26, 1993, the NMFS announced in the Federal Register, final rules, of the Atlantic Shark Fishery Management Plan (ASFMP), for the US territorial waters from Maine to Texas and some portions of the Caribbean Sea. An annual commercial LCS quota was set at just under six million (6,000,000) pounds dressed weight (DW) by NMFS science and management. By some industry accounts this action caused a reduction of about 100% to 200%, 12-18 million pounds DW, in annual commercial LCS species peak fishing mortalities.
3. (C) (D) During the middle of May 1993, commercial shark fishing for LCS was closed in federal waters for the first time ever, until July 1, 1993, due to the first biannual LCS quota having been estimated as being caught. By July 30, 1993, the second biannual LCS

quota had been quickly met, due to a large amount of Blacktip sharks being landed around the Mississippi River and this led to a five-month closure until January 1, 1994. A prohibition on landing fins without an accompanying carcass went into effect July 1, 1993

4. (E) Beginning on January 1, 1994, a 4000-pound DW LCS trip limit was implemented by the NMFS to reduce the "shark derby" effect of July 1993. This made fishing for LCS by larger boats economically difficult due to the small trip limit when compared to their pre-FMP LCS landings. These big boats affected by the trip limit for LCS were PLL long distance boats and Gulf of Mexico grouper boats. A handful of those boats would still bring in the LCS trip limit at the end of their other fishing trip.
5. A scheduled 1995 rebuilding plan increase of over a million pounds DW for the LCS category was canceled by NMFS as a precautionary action. The LCS annual quota remained at just under six million pounds DW instead of increasing to over seven million pounds DW.
6. The State of Florida passed a constitutional gillnet ban during 1995 that affected both the fresh bait market for the longline shark fishery and caused a major catch reduction on the Blacktip shark gillnet fishery located on the east coast of Florida.
7. About 1994 a concern grew over the age-to-maturity status of the Sandbar shark population. This issue peaked during 1996 that led to calls to reduce the LCS commercial quota by 50%. The majority of the members of the Shark Operations Team (OT), that was established by the Atlantic Shark FMP regulations met in an August 1996 meeting and felt that a 50% reduction was too draconian of an action so early in the ASFMP regime.
8. (F) On April 7, 1997, the NMFS announced that the LCS quota would be reduced by 50%. This set the LCS commercial quota at just under three million (3,000,000) pounds DW. The NMFS claimed that this action would <u>NOT</u> have a significant economic impact on the US Atlantic commercial shark fishery.
9. NMFS also established a new prohibited shark species category during the April 1997 rulemaking. They shifted five LCS species from their normal category to the new grouping. These shark species were the Whale, Basking, Sand Tiger, Bigeye Sand Tiger and Great White sharks.
10. On May 2, 1997, a coalition of US Atlantic shark industry participants filed a lawsuit challenging the LCS quota reduction in the Tampa, Florida federal court. Judge Steven Merryday was given charge of the case. Judge Merryday let the LCS quota reduction stay in place to be conservation minded, while he learned the bona fides of the lawsuit over the next several months. This LCS quota reduction was seen as a NMFS 1996 Shark Evaluation Workshop (SEW) design to promote the rebuilding increases of Atlantic shark populations.
11. Judge Merryday remanded the NMFS during February 1998 to do an economic assessment for the LCS quota reduction, due by May 1998. Based on some "new" information the NMFS concluded in that court ordered report that the 50% LCS commercial quota reduction would have a serious economic effect on the shark fishing industry, but they were not sure what they could do to remedy the situation, because the NMFS wanted to keep the reduced LCS quota in place.

12. By the end of the 1998 SEW LCS assessment, the “new” modeling results set the stage during early 1999 to bring about a call for a further 60% reduction to the remaining LCS commercial quota of 3 million pounds DW.
13. (G) The NMFS announced final rules in the Federal Register on May 28, 1999 that would fold the ASFMP into the new Highly Migratory Species (HMS) FMP regime. The new rulemaking included another major reduction to the commercial LCS quota based on the new 1998 SEW LCS assessment results. The 1997 shark lawsuit was still being negotiated in federal court and was not settled. On June 25, 1999, the shark industry coalition filed a second lawsuit against NMFS that Judge Merryday was charged with handling in addition to the previous effort. Judge Merryday froze the LCS quota on June 30, 1999 at the 1997 landing levels of 3 million pounds DW, until he could work things out legally between the shark industry plaintiffs and the NMFS.
14. (H) Beginning July 1, 1999, the NMFS implemented a limited access permit (LAP) system for sharks. This reduced the federal shark permits from the @ peak of 2256 total shark permits, down to around @ 250 directed shark limited access permits (DSLAP) and @ 350 incidental shark limited access permits (ISLAP) currently.
15. NMFS also expanded the prohibited species category during the 1999 HMS FMP rulemaking, including an additional six LCS species. They were the Narrowtooth, Caribbean Reef, Bignose, Night, Galapagos and the Dusky shark. Judge Merryday allowed this commercial regulation to be implemented during the year 2000. Dusky shark landings fell significantly, affecting the annual LCS landings.
16. Significant impacts were felt by the shark gillnet industry fishing for Blacktip sharks on the Florida east coast due to the Atlantic Large Whale Take Reduction Plan regulations beginning during the early part of the 2000’s.
17. (I) Effective on March 1, 2001, two time/area closures were implemented for pelagic longline fishing. The larger of the two pelagic longline closures is called the East Florida Coast closed area and ranges from just offshore of state waters, beginning at 31 degrees North, and southward to 24 degrees North. This is a year round closure. A partial time/area closure offshore of Georgia & South Carolina called the Charleston Bump closed area also began March 1, 2001 and ended April 30, 2001. In subsequent years following, the effective dates for the closure are from February 1 until April 30 each year. This closed area is defined from 34 degrees North, southward to 31 degrees North. This action greatly reduced the bycatch of LCS species in offshore longline fisheries for swordfish and tuna, and eliminated the decades old tradition of floating pelagic longline gear nearshore for Blacktip sharks, particularly near the mid-Florida east coast. About 68 vessels were virtually eliminated from the swordfish fleet when the 2001 restriction on PLL was put in place. They mostly tied up in south Florida and were what we called day boats.
18. (J) The December 2002 NMFS emergency rule set the 2003 LCS quota in two parts, as a separate ridgeback (RB) & non-ridgeback (NRB) categories that totaled @ 3.5 million pound DW together.
19. (K) For the 2004 fishing season, the LCS complex was reaggregated by NMFS under the December 2003 HMS FMP Amendment # 1 rulemaking and the NMFS regime lowered the LCS quota applied to commercial sector to 2.2 million pounds DW. Under a species specific “alternative”, the NMFS could have set a five million plus pound DW LCS quota for 2004. NMFS stated in their public response that both the shark fishermen and shark

dealers were not able to accurately identify enough of the shark species that were being caught and landed annually.

20. This lowest ever LCS quota of 2.2 million pounds DW has now been carried over to the 2005 & 2006 seasons until certification workshops for both shark dealers, shark boat owners and shark boat captains are set up by NMFS and completed, probably to be scheduled during late 2006 after the consolidated HMS FMP becomes final rule. NMFS is also awaiting the results of the 2006 LCS SEW that are due by the summer of 2006.
21. Included in Amendment # 1, beginning January 2004, the shark administration was divided into three different management regions. The North Atlantic (NA), Virginia / North Carolina State line north to Canada. The South Atlantic (SA), Virginia / North Carolina State line south to the south side of Key West, Florida and including the US territorial waters in the Caribbean Sea region. The Gulf of Mexico (GoM) region from the north side of Key West, Florida west to the Texas / Mexico border.
22. Also in Amendment # 1, beginning January 1, 2005, the trimester seasons replaced the biannual seasons for Atlantic sharks.
23. In addition, a closed area was implemented for bottom longline shark fishing offshore of NC state waters, out to @ 60 fathoms on January 1, 2005 and ending on July 31, 2005. The same NC time/area closure regulations are being continued during the 2006 and possibly the 2007 shark seasons. This has had a large reduction in the number of juvenile and adult Sandbar sharks being caught annually from the Mid-Atlantic Bight (MAB) region. Vessel Monitoring Systems (VMS) are required by shark fishing vessels in this closed area.