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## **Introduction**

Observations of the shark-directed bottom longline fishery in the Atlantic Ocean and Gulf of Mexico have been conducted since 1994 (e.g. Hale et al. 2012 and references therein). Currently about 214 U.S. fishers are permitted to target sharks (excluding dogfish) in the Atlantic Ocean and Gulf of Mexico, and an additional 258 fishers are permitted to land sharks incidentally. Amendments to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan implemented a shark research fishery, which allows NMFS to select a limited number of commercial shark vessels on an annual basis to collect life history data and catch data for future stock assessments (NMFS, 2007). Specifically, only commercial shark fishers participating in the research fishery are allowed to land sandbar sharks, *Carcharhinus plumbeus*, and must carry an observer on 100% of all trips (compared to a target coverage level of 2-3% outside the research fishery). Outside the research fishery, fishers are permitted to land 36 non-sandbar large coastal sharks per trip (including blacktip shark, *Carcharhinus limbatus*, bull shark, *Carcharhinus leucas*, lemon shark, *Negaprion brevirostris*, nurse shark, *Ginglymostoma cirratum*, silky shark, *Carcharhinus falciformis*, spinner shark, *Carcharhinus brevipinna*, tiger shark, *Galeocerdo cuvier*, great hammerhead shark, *Sphyrna mokarran*, scalloped hammerhead shark, *Sphyrna lewini*, and smooth hammerhead shark, *Sphyrna zygaena*).

Herein, we report on fishing activities in the bottom longline fishery for the 2013 fishing season, including coverage of the 2013 Shark Research Fishery.

## **Methods**

In November 2012, NMFS announced its request for applications for the Shark Research Fishery from commercial shark fishers with a directed or incidental permit for 2013. Commercial

shark fishers submitted applications to the Highly Migratory Species (HMS) Management Division. The HMS Management Division provided a list of qualified applicants to the Panama City Laboratory and based on the temporal and spatial needs of the research objectives, the availability of qualified applicants, and the available quota, six (6) qualified applicants were selected for observer coverage. These vessels carried observers on 100% of trips. Observer coverage outside the shark research fishery depended on the time of year and fishing seasons. Vessels were randomly selected for coverage if they possessed a valid directed shark permit, and reported fishing with longline gear in the previous year. Target observer coverage for these vessels is 2-3% of the trips. The eastern coastline of the USA was split into three fishing regions: northern Atlantic, southern Atlantic and Gulf of Mexico. References to the “northern Atlantic” refer to the coastal waters off the eastern U.S. states from Maine to Virginia, the “southern Atlantic” refers to the coastline from North Carolina to Florida, and the “Gulf of Mexico” refers to the coastline from the Florida Keys to Texas. Vessels were selected from two fishing regions: southern Atlantic and Gulf of Mexico.

Selection letters requiring observer coverage were issued to the permit holder via U.S. Certified mail approximately one month prior to the upcoming fishing season. Once the permit holder receives the selection letter, he or she is required to make contact with the observer coordinator and indicate intent to fish during the upcoming fishing season. If the permit holder intended to fish, the observer coordinator deployed an observer to the port of departure. Vessels were required to pass a Coast Guard Vessel Safety Examination as well as a safety evaluation by the observer prior to coverage.

While onboard the vessel, the observer completes three data forms: Longline Gear Log, Longline Haul Log, and Animal Log. The Longline Gear Log is used to record gear

characteristics. The Longline Haul Log is used to record the information on set and haulback, as well as environmental information. The Animal Log records all species caught, condition of the catch (e.g. alive, dead, damaged, or unknown), and the final disposition of the catch (e.g. kept, released alive, discarded dead, etc.).

In 2012, HMS Management Division changed the regulations for Shark Research Fishery trips to minimize unnecessary discard of dead sharks. Participants were allowed to harvest all non-prohibited species of sharks, including sandbar sharks only when an authorized sampler was onboard and the fishery was open. Fishers were required to land all catch of shark species that were legal under a directed shark permit (including sandbar shark, which is otherwise prohibited) unless they could be released alive. In 2013, HMS continued the 2012 amended model which allows one 150 hook ‘feeler’ set with a soak time of no more than two hours and one 300 hook set with no soak limit. A bycatch cap of five (5) dusky shark interactions per region was implemented for each of the six fishing regions (Figure 1). After the observation of five interactions with dusky sharks, the region would close for the remainder of the fishing year. Every vessel had the option to move between these areas to allow some flexibility for the fisherman to avoid seasonal dusky shark hotspots. The number of hooks permitted on board was also increased to account for any lost hooks during a feeler set and provide fishermen flexibility to use different types of hooks while fishing for non-HMS species within the same trip.

Observers continued to randomly sample sharks for biological samples for updates to life history studies. Vertebrae were collected from sandbar shark, blacktip shark and other select species to maintain time series of age distribution from within the fishery. Increased sampling of vertebrae and reproductive tissue of bull sharks and lemon sharks occurred to aid with upcoming stock assessments. Observers were still required to obtain trip weighout forms which were

compared to shark dealer reports by quota monitoring personnel to manage the sandbar shark quota within the research fishery.

## **Results**

From February to December 2013, a total of 61 trips (defined as from the time a vessel leaves the port until the vessel returns to port and lands catch, including multiple hauls therein) on 9 vessels with a total of 113 bottom longline hauls (defined as setting gear, soaking gear for some duration of time, and retrieving gear) were observed (Table 1). The Shark Research Fishery commenced with six participants, however in April, a seventh vessel was selected by HMS to substitute a vessel that withdrew from the fishery. Gear characteristics of trips varied by area (Gulf of Mexico or southern Atlantic) and target species (non-sandbar large coastal shark, or sandbar shark). The universe of vessels in the Shark Research Fishery was less than three vessels in each area and the observed data were combined for the Gulf of Mexico and southern Atlantic to protect confidentiality of vessels. The data were grouped by targets into two groups: a) non-sandbar large coastal shark species in the southern Atlantic, and b) hauls targeting sandbar shark in the Gulf of Mexico and southern Atlantic (Figure 2). No trips were observed in the northern Atlantic region.

### *a) Southern Atlantic large coastal shark targeted trips (non-research shark fishery)*

#### *i) Gear and haul characteristics*

There were 20 hauls on 7 trips observed targeting large coastal shark in the southern Atlantic. Trips averaged 1.5 days in length. The mainline length ranged from 0.6 to 7.4 km with an average of 2.8 km. The bottom depth fished ranged from 5.0 to 25.0 m with an average of 18.3 m, and the number of hooks ranged from 26 to 254 hooks with an average of 100 hooks



fished. The most commonly used hook was the 18.0 circle hook (75.0%). There were two hauls (10.0%) that employed a 16.0 circle hook and a 12.0 J hook as the second hook. The average soak duration was 2.4 hr.

*ii) Catch and bycatch*

There were 404 individual animals caught on observed bottom longline hauls targeting large coastal shark in the southern Atlantic (Table 2). Sharks comprised 90.8% of the catch, and teleost (9.2%). Small coastal shark species comprised 44.7% of the shark catch, large coastal shark species (excluding sandbar shark) comprised 54.0%, and sandbar sharks comprised 0.8%. One (1) sand tiger shark *Carcharias taurus* was observed. Red drum, *Scianops ocellatus*, was the only species of teleost caught (9.2%) and blacktip shark was the most frequently caught species of shark (41.1%). Length frequencies of shark species are presented in Figure 3.

*iii) Protected species interactions*

No protected species were observed caught in bottom longline gear targeting large coastal sharks in the southern Atlantic.

*b) Gulf of Mexico and southern Atlantic Shark Research Fishery*

*i) Gear and haul characteristics*

There were 93 hauls on 54 trips observed in the Shark Research Fishery in the Gulf of Mexico and the southern Atlantic. All of the trips targeted sandbar shark. Trips averaged 2.3 days in length. The mainline length ranged from 1.9 to 21.5 km with an average of 6.9 km. The bottom depth fished ranged from 11 to 89 m with an average of 35.5 m, and the number of hooks ranged from 70 to 300 hooks with an average of 213 hooks fished. The most commonly used hook was the 18.0 circle hook (61.3%) with 9.0 J hooks used in 38.7% of hauls. There were 37 hauls (39.8%) that employed two different types of hooks, with 9.0 J hooks used most commonly

as the second hook (51.4%). There were 4 hauls (4.3%) that employed three hook types with 9.0 J hook as the first, 18.0 circle hook as the second and 12.0 J as the third. The average soak duration was 6.0 hr.

*ii) Catch and bycatch*

There were 3,730 individual animals caught on observed bottom longline hauls targeting sandbar shark in the Gulf of Mexico and southern Atlantic (Table 3). Sharks comprised 98.7% of the catch, followed by teleosts (1.0%) and batoids (0.3%). Large coastal shark species (excluding sandbar) comprised 40.8% of the shark catch, sandbar shark comprised 47.5% and small coastal shark species comprised 10.3%. Prohibited shark species were also caught including the sand tiger shark (0.8% of shark catch), and the dusky shark, *Carcharhinus obscurus*, (0.7%). One (1) Caribbean reef shark, *Carcharhinus perezii*, was observed. Red grouper, *Epinephelus morio*, was the most frequently caught species of teleost (0.6%) and sandbar shark was the most frequently caught species of shark (47.5%). Length frequencies of shark species are presented in Figure 4.

*iii) Protected species interactions*

Interactions with protected resources were observed for bottom longline vessels fishing in the Gulf of Mexico and southern Atlantic (Table 3). Two (2) smalltooth sawfish, *Pristis pectinata* were observed and released alive. No sea bird, sea turtles or marine mammal interactions were observed.

## **Discussion**

In 2013, the shark bottom longline observer program covered vessels in the Gulf of Mexico and southern Atlantic, with the majority of trips observed targeting sandbar shark in the

Shark Research Fishery. Catch data and biological samples collected through the Shark Research Fishery continues to provide much needed life history information for stock assessment.

Major changes made to the Shark Research Fishery in 2013 included the implementation of the regional dusky shark bycatch cap. The regional catch limit was designed to reduce the impact of this fishery on the dusky shark. In 2012, 252 dusky sharks, *C. obscurus*, were caught in 81 hauls, making up 8.7% of the shark catch (Gulak et al. 2013). The new regulation did result in a decline in interactions (24 sharks from 93 hauls; 0.7% of the shark catch), but potentially may result in a loss of fishing activity from all months in all regions. Participants, eager to avoid dusky interactions, avoided fishing in months when dusky sharks were more commonly encountered. Even so, the North Carolina region, an area known for high dusky interactions in previous years, was closed by June. Consequently, HMS amended the original permit in September to allow fishing in this region with an additional four dusky interactions but only on the basis that the main set soak time would not exceed 3 hours. Two regions (east and west coast of Florida) filled their bycatch cap and closed in December.

The Shark Bottom Longline Observer Program and Shark Research Fishery collect and provide vital data on temporal and spatial catch, release mortality, bycatch species, and updates to quota monitoring. Continued observer funding will permit the program to maintain this important time series.

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Table 1. Number of vessels, trips, hauls, and hook hours observed in the Gulf of Mexico (GOM) and southern Atlantic Ocean (SA) for all target species. The total number of unique vessels is reported in brackets. Target species include large coastal shark (SHX), and sandbar shark (SSB).

Area and Target	Vessels Observed	Trips Observed	Hauls Observed	Hook Hours
SA SHX	3	7	20	8818.3
GOM/SA SSB	7	54	93	133481.5
Total	10 (9)	61	113	142299.8

Table 2. Number caught (n) and disposition of catch in percentage for all observed hauls targeting large coastal shark in the southern Atlantic. Disposition of catch is divided into kept (K), discard dead (DD), discard alive (DA), and unknown (U).

<b>Scientific name</b>	<b>Common Name</b>	<b>n</b>	<b>% K</b>	<b>% DD</b>	<b>% DA</b>	<b>% U</b>
<i>Carcharhinus limbatus</i>	Blacktip shark	151	88.1	10.6	0.0	1.3
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	140	72.9	27.1	0.0	0.0
<i>Scianops ocellatus</i>	Red drum	37	0.0	5.4	91.9	2.7
<i>Carcharhinus isodon</i>	Finetooth shark	21	52.4	47.6	0.0	0.0
<i>Carcharhinus brevipinna</i>	Spinner shark	15	100.0	0.0	0.0	0.0
<i>Carcharhinus leucas</i>	Bull shark	12	100.0	0.0	0.0	0.0
<i>Ginglymostoma cirratum</i>	Nurse shark	10	0.0	0.0	100.0	0.0
<i>Galeocerdo cuvier</i>	Tiger shark	5	20.0	0.0	80.0	0.0
<i>Carcharhinus acronotus</i>	Blacknose shark	3	33.3	66.7	0.0	0.0
<i>Carcharhinus plumbeus</i>	Sandbar shark	3	0.0	33.3	66.7	0.0
<i>Negaprion brevirostris</i>	Lemon shark	3	100.0	0.0	0.0	0.0
<i>Carcharias taurus</i>	Sand tiger shark	1	0.0	0.0	100.0	0.0
<i>Elasmobranchii</i>	Sharks	1	0.0	100.0	0.0	0.0
<i>Sphyrna lewini</i>	Scalloped hammerhead shark	1	0.0	0.0	100.0	0.0
<i>Sphyrna mokarran</i>	Great hammerhead shark	1	0.0	0.0	100.0	0.0

Table 3. Number caught (n) and disposition of catch in percentage for all observed hauls targeting sandbar shark in the Gulf of Mexico and southern Atlantic. Disposition of catch is divided into kept (K), discard dead (DD), discard alive (DA), and unknown (U).

Scientific Name	Common Name	n	% K	% DD	% DA	% U
<i>Carcharhinus plumbeus</i>	Sandbar shark	1748	98.2	0.2	0.1	1.5
<i>Galeocerdo cuvier</i>	Tiger shark	520	31.9	0.8	65.8	1.5
<i>Carcharhinus limbatus</i>	Blacktip shark	370	97.0	2.7	0.0	0.3
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	250	28.4	64.8	6.8	0.0
<i>Ginglymostoma cirratum</i>	Nurse shark	187	0.5	0.0	99.5	0.0
<i>Carcharhinus leucas</i>	Bull shark	139	96.4	0.0	0.0	3.6
<i>Carcharhinus acronotus</i>	Blacknose shark	124	78.2	20.2	1.6	0.0
<i>Sphyrna mokarran</i>	Great hammerhead shark	89	78.7	6.7	11.2	3.4
<i>Sphyrna lewini</i>	Scalloped hammerhead shark	77	87.0	3.9	9.1	0.0
<i>Carcharhinus brevipinna</i>	Spinner shark	63	95.2	3.2	0.0	1.6
<i>Negaprion brevirostris</i>	Lemon shark	40	97.5	0.0	0.0	2.5
<i>Carcharias taurus</i>	Sand tiger shark	29	0.0	0.0	100.0	0.0
<i>Carcharhinus obscurus</i>	Dusky shark	24	4.2 <sup>1</sup>	29.1	66.7	0.0
<i>Epinephelus morio</i>	Red grouper	23	47.8	21.7	30.5	0.0
<i>Carcharhinus falciformis</i>	Silky shark	13	69.2	15.4	15.4	0.0
<i>Carcharhinus isodon</i>	Finetooth shark	4	75.0	0.0	25.0	0.0
<i>Dasyatis sp.</i>	Stingrays	4	0.0	0.0	100.0	0.0
<i>Rachycentron canadum</i>	Cobia	3	100.0	0.0	0.0	0.0
<i>Sphyrna sp.</i>	Hammerhead sharks	3	66.7	0.0	33.3	0.0
<i>Epinephelus itajara</i>	Goliath grouper	2	0.0	0.0	50.0	50.0
<i>Lutjanus campechanus</i>	Red snapper	2	0.0	0.0	50.0	50.0
<i>Ophichthus rex</i>	King snake eel	2	0.0	100.0	0.0	0.0
<i>Pristis pectinata</i>	Smalltooth sawfish	2	0.0	0.0	100.0	0.0
<i>Rajiformes</i>	Skates and rays	2	0.0	0.0	100.0	0.0
<i>Rhinoptera bonasus</i>	Cownose ray	2	0.0	0.0	100.0	0.0
<i>Sphyrna tiburo</i>	Bonnethead shark	2	50.0	0.0	50.0	0.0
<i>Carcharhinus perezii</i>	Caribbean reef shark	1	0.0	100.0	0.0	0.0
<i>Lutjanus analis</i>	Mutton snapper	1	0.0	100.0	0.0	0.0
<i>Lutjanus cyanopterus</i>	Cubera snapper	1	100.0	0.0	0.0	0.0
<i>Mycteroperca microlepis</i>	Gag grouper	1	0.0	0.0	100.0	0.0
<i>Seriola sp.</i>	Amberjacks	1	0.0	0.0	100.0	0.0
<i>Sphyaena barracuda</i>	Great barracuda	1	0.0	100.0	0.0	0.0

<sup>1</sup> one (1) dusky shark was initially identified as a silky shark, *Carcharhinus falciformis*.

Figure 1. Dusky shark bycatch cap regions





Figure 2. Distribution of all observed hauls by target in 2013. (a) Distribution of effort targeting large coastal sharks in the southern Atlantic, (b) distribution of effort targeting sandbar sharks in the Gulf of Mexico and southern Atlantic.

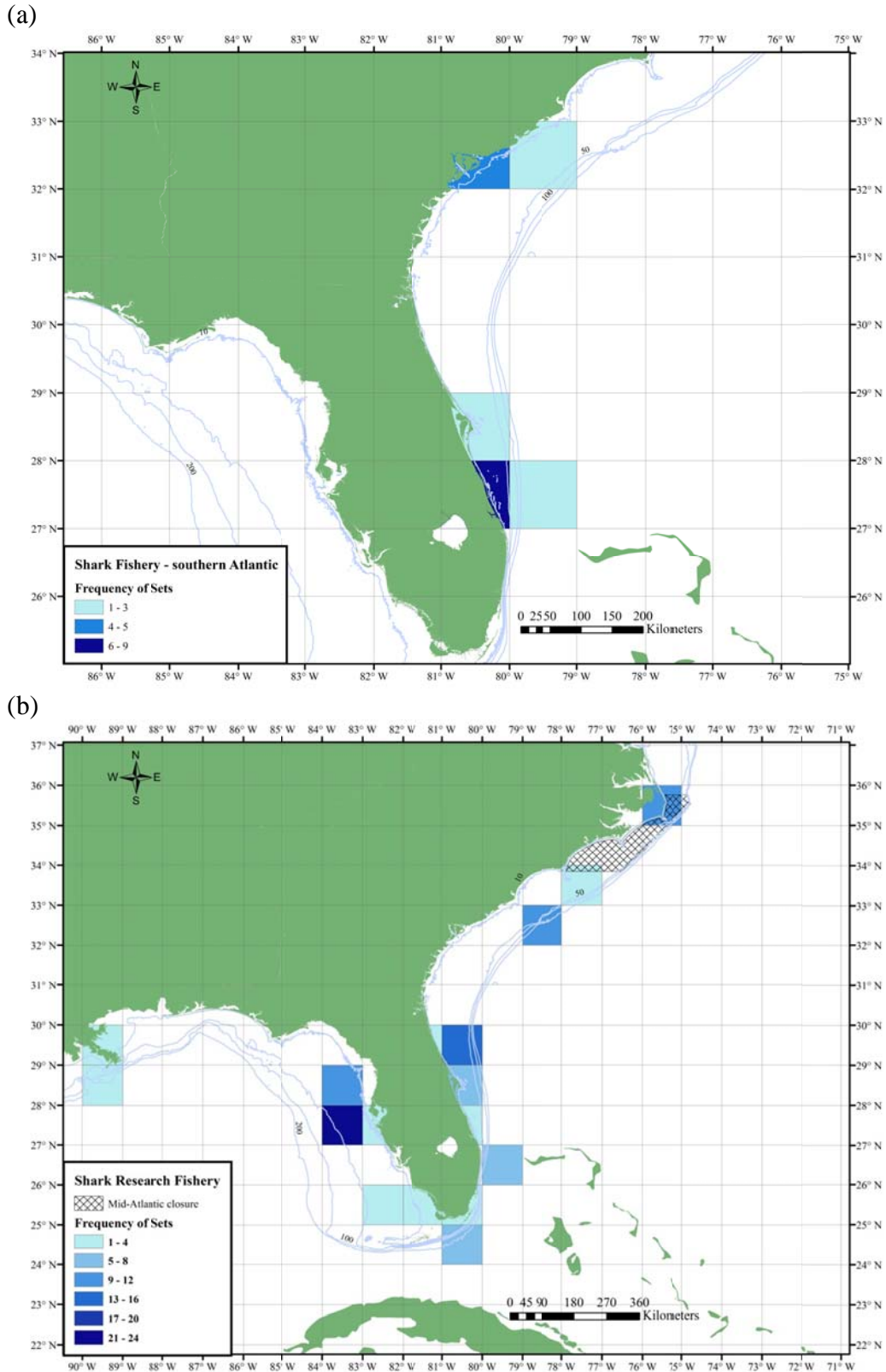
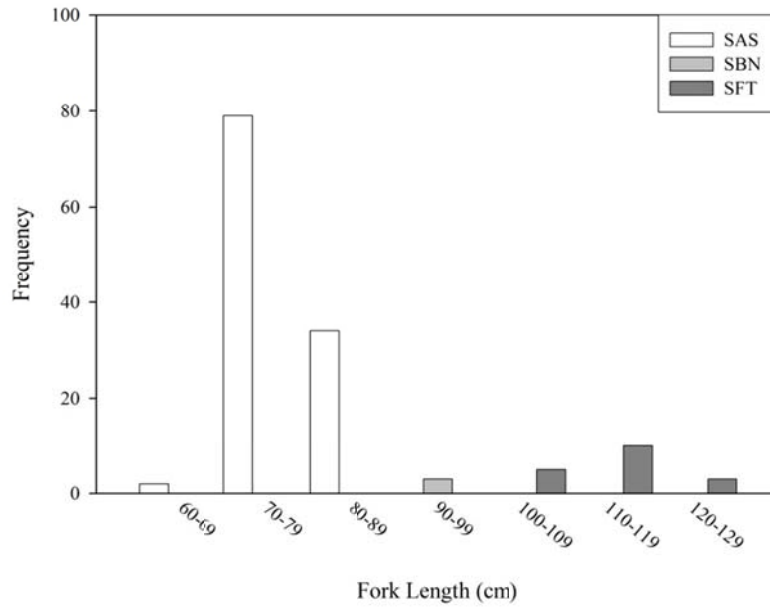


Figure 3. Length frequency (cm fork length) of (a) Atlantic sharpnose (SAS), blacknose (SBN) and finetooth (SFT) sharks, (b) lemon (LEM), bull (SBU), sandbar (SSB) and tiger (TIG) sharks observed caught on bottom longline sets targeting large coastal shark in the southern Atlantic.

(a)



(b)

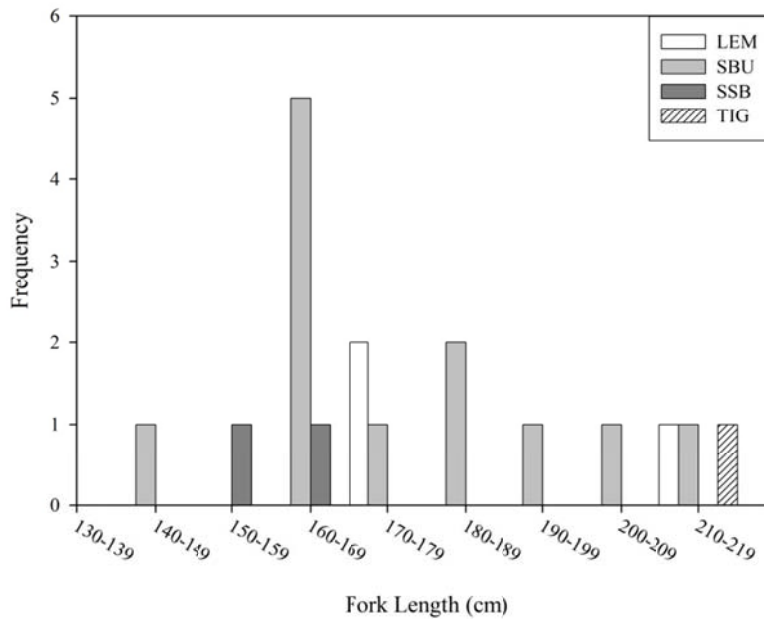


Figure 3 cont'd. Length frequency (cm fork length) of (c) blacktip (SBK) and spinner (SSP) sharks observed caught on bottom longline sets targeting large coastal shark in the southern Atlantic.

(c)

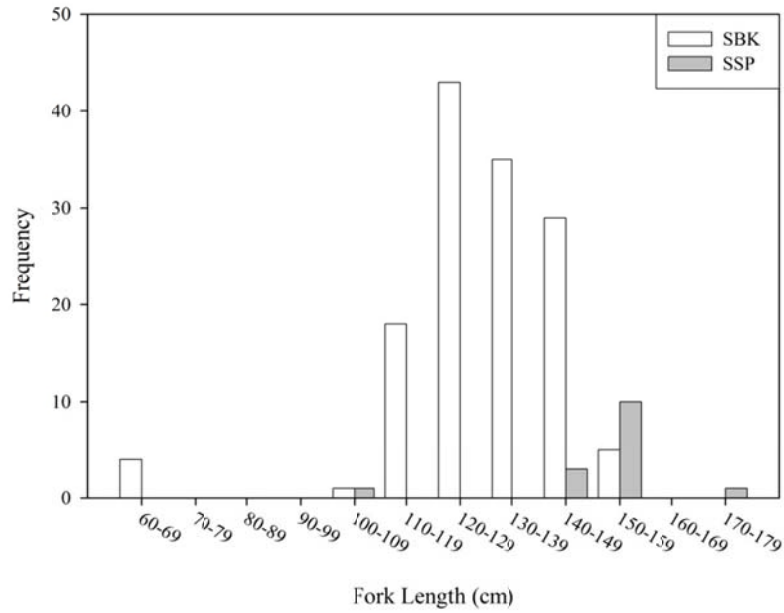
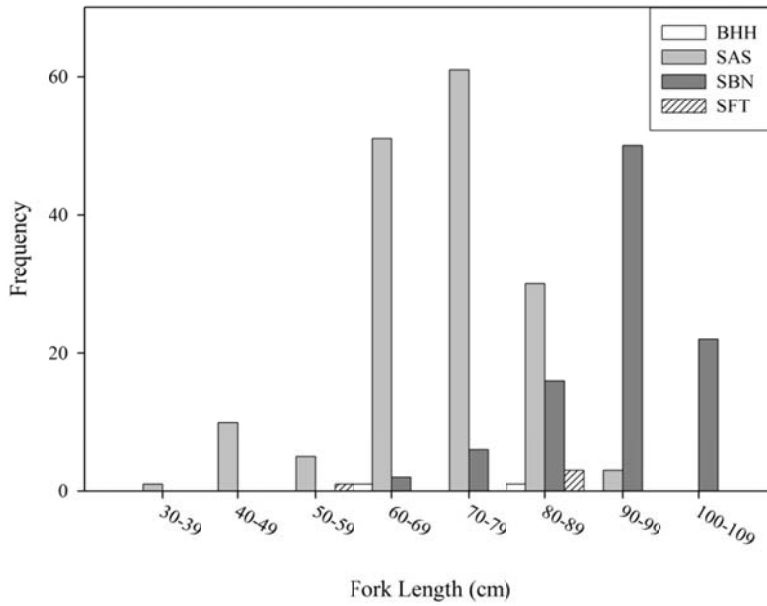


Figure 4. Length frequency (cm fork length) of (a) bonnethead (BHH), Atlantic sharpnose (SAS), blacknose (SBN) and finetooth (SFT) sharks, (b) dusky (DUS) and silky (FAL) sharks observed caught on bottom longline sets targeting sandbar shark in the Gulf of Mexico and southern Atlantic.

(a)



(b)

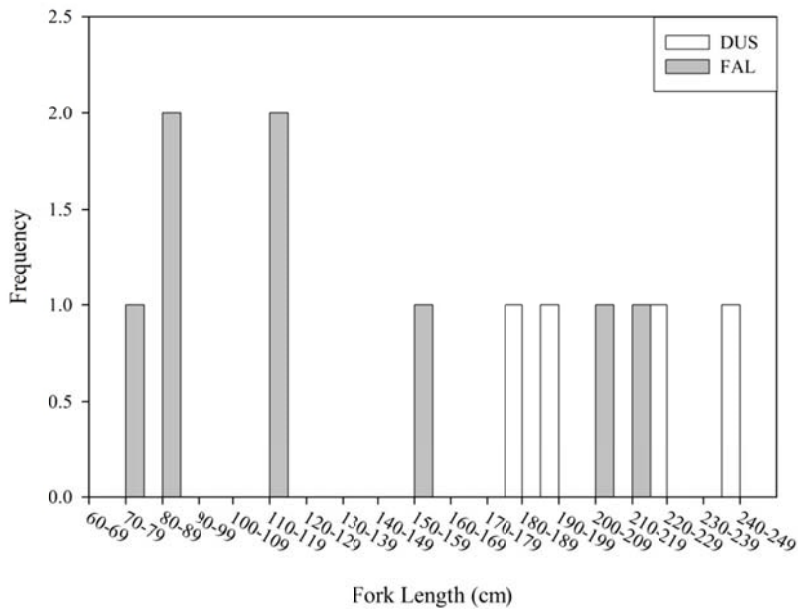
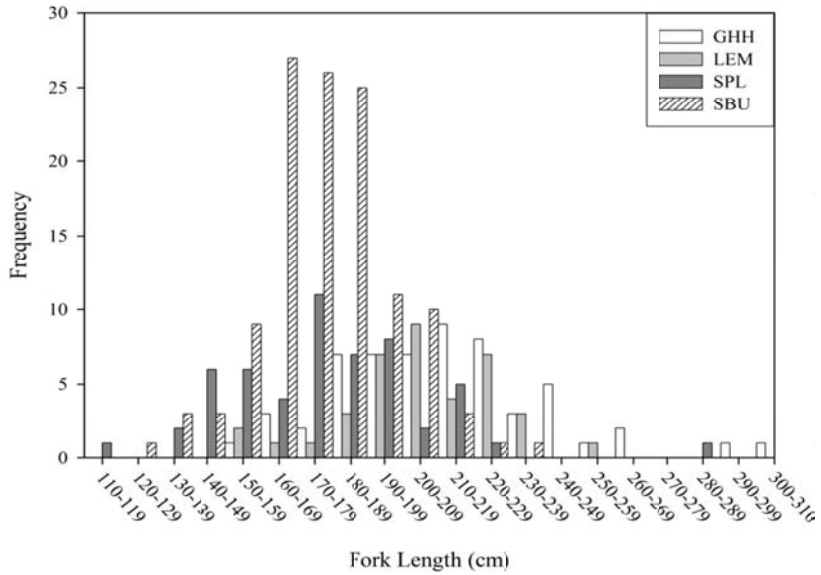


Figure 4 cont'd. Length frequency (cm fork length) of (c) great hammerhead (GHH), lemon (LEM) scalloped hammerhead (SPL), bull (SBU) sharks, (d) blacktip (SBK), spinner (SSP) and tiger (TIG) sharks observed on bottom longline sets targeting sandbar shark in the Gulf of Mexico and southern Atlantic.

(c)



(d)

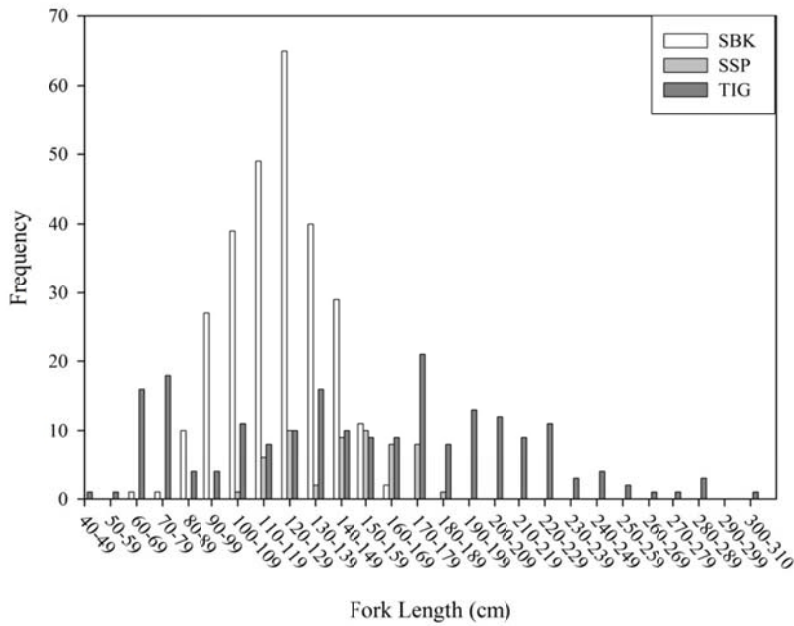


Figure 4 cont'd. Length frequency (cm fork length) of (e) sandbar (SSB) sharks observed caught on bottom longline sets targeting sandbar shark in the Gulf of Mexico and southern Atlantic.

(e)

