



NOAA Technical Memorandum NMFS-SEFSC-727
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CHARACTERIZATION OF THE SHARK BOTTOM LONGLINE FISHERY: 2017

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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 (Morgan et al. 2009, Mathers et al. 2017 and references therein). Currently about 219 U.S. fishers are permitted to target sharks in the Atlantic Ocean and Gulf of Mexico, and an additional 264 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 5-10% outside the research fishery). Outside the research fishery, fishers are permitted to land other large coastal sharks (e.g. blacktip shark, *Carcharhinus limbatus*, and bull shark, *Carcharhinus leucas*). Herein, we report on observed fishing activities in the shark bottom longline fishery for the 2017 fishing season, including coverage of the 2017 Shark Research Fishery.

Methods

In November 2016, NMFS announced its request for applications for the Shark Research Fishery from commercial shark fishers with a directed or incidental permit for 2017. 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. Based on the temporal and spatial needs of the research objectives, the availability of qualified applicants, available funding and the available quota, five (5) qualified

applicants were selected for observer coverage. These vessels carried observers on 100% of trips. There are four (4) regions specifically for the research fishery in 2017: North Carolina, South Atlantic, Florida Keys, and Gulf of Mexico (Figure 1).

Observer coverage outside the shark research fishery depended on the time of year, available funding, 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 5-10% of trips. There are three fishing zones designated for bottom longline observer coverage outside of the research fishery: 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. Because no vessels fished the previous year in the northern Atlantic, vessels were selected from two fishing zones: 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. Upon receipt of the selection letter, the permit holder 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 2017, 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. The number of hooks permitted on board remained at 500 hooks total, which accounted for any lost hooks during a feeler set and provided fishers flexibility to use different types of hooks while fishing for non-HMS species within the same trip. In 2017 there were four fishing regions assigned by HMS to help manage interactions of dusky shark, *Carcharhinus obscurus*, throughout the research fishery (Figure 1). A bycatch quota of at least three (3) dead dusky shark interactions per region was implemented, with the exception of the South Atlantic region allowing six (6) due to the higher occurrence of dusky shark interactions in this region. Every vessel had the option to move between regions to allow some flexibility for the fisherman to avoid seasonal dusky shark areas where catches were high. If the total allowable number of dead dusky sharks in a specified region was observed, new guidelines to reduce soak times to less than 3 hours were enforced to decrease dusky shark mortality. In the North Carolina, Gulf of Mexico, and Florida Keys regions, if two (2) additional dusky shark interactions (alive or dead) occur, and in the South Atlantic region an additional six (6) or more

dusky shark interactions (alive or dead) occur, the region would be completely closed to fishing for the remainder of the year unless otherwise permitted by HMS.

Observers continued to opportunistically sample sharks for biological samples, ideally systematically sampling each n^{th} specimen. Observer discretion is advised as n might vary based on vessel, catch rates, weather conditions or other situations. These samples are used 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 blacktip sharks occurred to aid with upcoming assessments. Observers were still required to obtain trip weigh out forms, which were compared to shark dealer reports by quota monitoring personnel to manage the sandbar shark quota within the research fishery.

Results and Discussion

From January to December 2017, a total of 83 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 12 vessels with a total of 150 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 in March with five participants. One vessel fulfilled their individual sandbar quota in the month of June and was unable to fish for the remainder of the year. One vessel in the Gulf of Mexico region and one vessel in the southern Atlantic region withdrew from the Research Fishery, forfeiting their remaining quota, which was given to two new participants. There were a total of seven participants by the end of the year due to these circumstances. Gear characteristics varied by area (Gulf of Mexico or southern Atlantic) and target species (non-sandbar large coastal shark or sandbar shark). For the Shark Research Fishery, if less than three

vessels fished in each area, the observed data were summarized for the eastern Gulf of Mexico and southern Atlantic to protect vessel confidentiality. The data were grouped into two groups: a) Shark Bottom Longline Fishery trips in the southern Atlantic and the Gulf of Mexico, and b) Shark Research Fishery trips in the southern Atlantic and the Gulf of Mexico (Figure 2). No trips were observed in the northern Atlantic region.

a) Shark Bottom Longline Fishery - southern Atlantic and Gulf of Mexico

i) Gear and haul characteristics

There were 45 hauls on 22 trips observed targeting coastal sharks in the southern Atlantic and Gulf of Mexico. Trips averaged 2.0 days in length. The mainline length ranged from 0.7 to 13.9 km, with an average of 4.5 km. The bottom depth fished ranged from 1.5 to 48.8 m, with an average of 22.0 m. The number of hooks ranged from 44 to 657 hooks, with an average of 302 hooks fished. The most commonly used hook was the 9.0 J hook (37.0 %). The next commonly used hook was the 14.0 circle hook (26.1 %) followed by both the 15.0 circle hook and the 18.0 circle hook (15.2 %). The remaining 3 hauls employed the 16.0 circle hook (4.3 %) and the 17.0 circle hook (2.2 %). The predominant bait used was jacks (34.8 %). The average soak duration was 6.2 hr.

ii) Catch and bycatch

There were 2,058 individual animals caught on observed bottom longline hauls in the Gulf of Mexico and southern Atlantic (Table 2). Sharks comprised 95.8 % of the catch, teleost 3.9 %, and invertebrates and batoids both 0.1 %. Large coastal shark species (excluding sandbar shark) comprised 48.5 % of the shark catch and small coastal shark species comprised 48.6 %. Prohibited shark species were also caught, including sandbar shark. Pelagic and deep water species comprised 0.3 % of shark catch. King snake eel, *Ophichthus rex*, was the most frequent

species of teleost caught (1.7 %) and Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, was the most frequently caught species of shark (34.9 %). Length frequencies of shark species are presented in Figure 3.

iii) Protected resources interactions

There were no interactions with protected resources observed for bottom longline vessels fishing in the Gulf of Mexico and southern Atlantic.

b) Shark Research Fishery

i) Gear and haul characteristics

There were 104 hauls on 61 trips observed in the Shark Research Fishery in the Gulf of Mexico and the southern Atlantic. Trips averaged 2.0 days in length. The mainline length ranged from 0.3 to 10.0 km with an average of 4.4 km. The bottom depth fished ranged from 10.1 to 99.4 m with an average of 36.7 m, and the number of hooks ranged from 27 to 300 hooks with an average of 225 hooks fished. The most commonly used hook was the 16.0 circle hook (38.5 %) and the second most common hook was the 18.0 circle hook (23.1 %). Other hook types used were 8.0 J, 9.0 J, and 12.0 J hooks. The predominant bait used was jacks (34.6 %). The average soak duration was 5.1 hr.

ii) Catch and bycatch

There were 4,882 individual animals caught on observed bottom longline hauls within the Research Fishery (Table 3). Sharks comprised 99.02 % of the catch, followed by teleosts (0.8 %), turtles and invertebrates (0.06 %), and batoids (0.04 %). Sandbar shark comprised 63.4 % of the shark catch, other large coastal shark species comprised 29.0 % of the shark catch, and small coastal shark species comprised 4.4 %. Prohibited shark species were also caught including dusky shark (1.9 %) and sand tiger shark, *Carcharhias taurus* (1.2 %). Greater amberjack,

Seriola dumerili, was the most frequently caught species of teleost (0.4 %), and sandbar shark was the most frequently caught species of shark (62.8 %). Length frequencies of shark species are presented in Figure 4.

iii) Protected resources interactions

Interactions with protected resources were observed for the research fishery (Table 3). Three (3) loggerhead sea turtles, *Caretta caretta*, were caught, with 33.3 % released alive and 66.7 % released dead. There were no other protected resource interactions observed.

In August 2015, HMS implemented amendment 6 to the 2006 Consolidated HMS Fishery Management Plan which reduced the sandbar Shark Research Fishery quota from 116.6 mt dw (257,056 lb dw) in 2015 to 90.7 mt dw (199,943 lb dw) for 2016. This reduction was reallocated outside the research fishery to account for dead discards of sandbar sharks since the large coastal shark retention limits increased from 36 to 55 landed per trip, with a default of 45 (NMFS 2015). Some minor adjustments to the regional dusky shark quota were examined and implemented as needed. The regional dusky catch limit was designed to reduce the impact of this fishery on the dusky shark. In 2013, the new regulation did produce a decline in interactions (24 sharks from 93 hauls; 0.7% of the shark catch), but resulted in a loss of fishing activity from all months in all regions (Gulak et al. 2014). This year, the dusky shark quota did reduce dusky shark catch, from 4.5 % of shark catch in 2015 and 2.7 % in 2016, to 1.8 % in 2017. None of the regions exceeded the dead dusky cap to limit soak time or result in the closure of a region for the year, thus did not affect fishing opportunity.

To prevent dusky shark mortality, the North Carolina region has a limited soak time while any fishing is conducted within the Mid-Atlantic closed area. The Mid-Atlantic closed

area is an area off of North Carolina that is closed from January 1- July 31 to bottom longline fishing. This area is a nursery and pupping site for sandbar and dusky sharks. While fishing is permitted, research is also being conducted to evaluate the importance of the closed area and determine post-release survivorship for dusky sharks. Sampling in this area allowed for one (1) dusky shark to be tagged with a satellite pop-up archival transmitting (PAT) tag. In addition, eight (8) conventional dart tags were deployed on dusky sharks. This research is scheduled to continue in 2018.

The Shark Bottom Longline Observer Program collects and provides 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 and South Atlantic Ocean. Vessels observed total in parenthesis are unique vessels.

Fishery	Vessels Observed	Trips Observed	Hauls Observed	Hook Hours
Shark Bottom Longline Fishery	7	22	46	84077.35
Shark Research Fishery	7	61	104	135476.60
Total	14 (12)	83	150	219553.95

Table 2. Number caught (n) and disposition of catch in percentage for all observed hauls in the Shark Bottom Longline Fishery. Disposition of catch is divided into kept (K), discard dead (DD), discard alive (DA), and unknown (U).

Scientific Name	Common Name	n	%K	%DA	%DD	%U
<i>Rhizoprionodon terraenovae</i>	Atlantic Sharpnose Shark	719	90.0	0.1	9.9	0.0
<i>Carcharhinus limbatus</i>	Blacktip Shark	477	64.8	10.1	24.7	0.4
<i>Carcharhinus acronotus</i>	Blacknose Shark	206	20.9	47.6	31.6	0.0
<i>Galeocerdo cuvier</i>	Tiger Shark	176	60.8	37.5	0.6	1.1
<i>Ginglymostoma cirratum</i>	Nurse Shark	103	2.9	97.1	0.0	0.0
<i>Carcharhinus leucas</i>	Bull Shark	89	94.4	2.3	0.0	3.4
<i>Carcharhinus plumbeus</i>	Sandbar Shark	51	0.0	98.0	2.0	0.0
<i>Negaprion brevirostris</i>	Lemon Shark	44	93.2	0.0	0.0	6.8
<i>Ophichthus rex</i>	King Snake Eel	36	100.0	0.0	0.0	0.0
<i>Lutjanus campechanus</i>	Red Snapper	33	0.0	75.8	24.2	0.0
<i>Sphyrna mokarran</i>	Great Hammerhead Shark	32	78.1	21.9	0.0	0.0
<i>Sphyrna tiburo</i>	Bonnethead Shark	26	61.5	3.9	34.6	0.0
<i>Carcharhinus brevipinna</i>	Spinner Shark	23	100.0	0.0	0.0	0.0
<i>Sphyrna lewini</i>	Scalloped Hammerhead Shark	13	30.8	53.9	15.4	0.0
<i>Carcharhinus isodon</i>	Finetooth Shark	9	100.0	0.0	0.0	0.0
<i>Mustelus canis</i>	Smooth Dogfish	5	80.0	0.0	20.0	0.0
<i>Congridae</i>	Conger Eels	3	0.0	0.0	100.0	0.0
<i>Muraenidae</i>	Moray Eel Family	3	0.0	100.0	0.0	0.0
<i>Sciaenops ocellatus</i>	Red Drum	1	0.0	100.0	0.0	0.0
<i>Pogonias cromis</i>	Black Drum	1	0.0	100.0	0.0	0.0
<i>Porifera</i>	Sponges	1	0.0	100.0	0.0	0.0
<i>Sphyrna</i>	Hammerhead Shark	1	0.0	0.0	100.0	0.0
<i>Bagre marinus</i>	Gafftopsail Catfish	1	100.0	0.0	0.0	0.0
<i>Rhinoptera bonasus</i>	Cownose Ray	1	0.0	100.0	0.0	0.0
<i>Lutjanidae</i>	Snapper Family	1	0.0	0.0	100.0	0.0
<i>Anthozoa</i>	Coral	1	0.0	0.0	0.0	100.0
<i>Rachycentron canadum</i>	Cobia	1	100.0	0.0	0.0	0.0
<i>Carcharhinidae</i>	Requiem Shark	1	0.0	100.0	0.0	0.0

Table 3. Number caught (n) and disposition of catch in percentage for all observed hauls in the Shark Research Fishery. Disposition of catch is divided into kept (K), discard dead (DD), discard alive (DA), and unknown (U).

Scientific Name	Common Name	N	%K	%DA	%DD	%U
<i>Carcharhinus plumbeus</i>	Sandbar Shark	3066	98.2	0.3	0.1	1.4
<i>Carcharhinus limbatus</i>	Blacktip Shark	500	98.0	0.4	1.4	0.2
<i>Galeocerdo cuvier</i>	Tiger Shark	336	22.0	75.0	1.2	1.8
<i>Sphyrna lewini</i>	Scalloped Hammerhead Shark	186	74.7	20.4	4.3	0.5
<i>Rhizoprionodon terraenovae</i>	Atlantic Sharpnose Shark	159	27.7	22.6	49.7	0.0
<i>Carcharhinus leucas</i>	Bull Shark	92	83.7	7.6	2.2	6.5
<i>Carcharhinus obscurus</i>	Dusky Shark	91	0.0	90.1	8.8	1.1
<i>Sphyrna mokarran</i>	Great Hammerhead Shark	89	68.5	23.6	2.3	5.6
<i>Ginglymostoma cirratum</i>	Nurse Shark	83	0.0	100.0	0.0	0.0
<i>Carcharias taurus</i>	Sand Tiger Shark	59	0.0	100.0	0.0	0.0
<i>Carcharhinus acronotus</i>	Blacknose Shark	54	20.4	55.6	24.1	0.0
<i>Negaprion brevirostris</i>	Lemon Shark	49	85.7	0.0	0.0	14.3
<i>Carcharhinus brevipinna</i>	Spinner Shark	36	100.0	0.0	0.0	0.0
<i>Carcharhinus falciformis</i>	Silky Shark	20	80.0	15.0	0.0	5.0
<i>Seriola dumerili</i>	Greater Amberjack	20	15.0	70.0	15.0	0.0
<i>Sphyrna</i>	Hammerhead Shark	10	0.0	90.0	0.0	10.0
<i>Lutjanus campechanus</i>	Red Snapper	8	0.0	75.0	25.0	0.0
<i>Elasmobranchii</i>	Sharks	4	50.0	0.0	50.0	0.0
<i>Sphyrna</i>	Barracudas	4	0.0	25.0	75.0	0.0
<i>Caretta caretta</i>	Loggerhead Sea Turtle	3	0.0	33.3	66.7	0.0
<i>Sphyrna barracuda</i>	Great Barracuda	2	0.0	0.0	100.0	0.0
<i>Muraenidae</i>	Moray Eel Family	2	0.0	100.0	0.0	0.0
<i>Porifera</i>	Sponges	1	0.0	100.0	0.0	0.0
<i>Sciaenops ocellatus</i>	Red Drum	1	0.0	100.0	0.0	0.0
<i>Dasyatis americana</i>	Southern Stingray	1	0.0	100.0	0.0	0.0
<i>Asteroidea</i>	Sea Stars	1	0.0	100.0	0.0	0.0
<i>Diplectrum formosum</i>	Sand Perch	1	0.0	100.0	0.0	0.0
<i>Gymnura</i>	Butterfly Ray	1	0.0	100.0	0.0	0.0
<i>Epinephelus itajara</i>	Goliath Grouper	1	0.0	100.0	0.0	0.0
<i>Echinodermata</i>	Sea Urchins	1	0.0	100.0	0.0	0.0
<i>Centropristis ocyurus</i>	Bank Sea Bass	1	100.0	0.0	0.0	0.0

Figure 1. The designated dusky shark bycatch quota regions are: North Atlantic (north of 36.31 N lat.), North Carolina (south of 36.30 N lat. and north of 34.0 N lat.), South Atlantic (south of 33.9 N lat. and north of 26.0 N lat.), the Florida Keys (south of 26.0 N lat. and east of 85.0 W long.), and the Gulf of Mexico (north of 26.0 N lat.).



Figure 2. Distribution of all observed hauls by target in 2017. (a) distribution of effort for the Shark Bottom Longline Fishery.

(a)

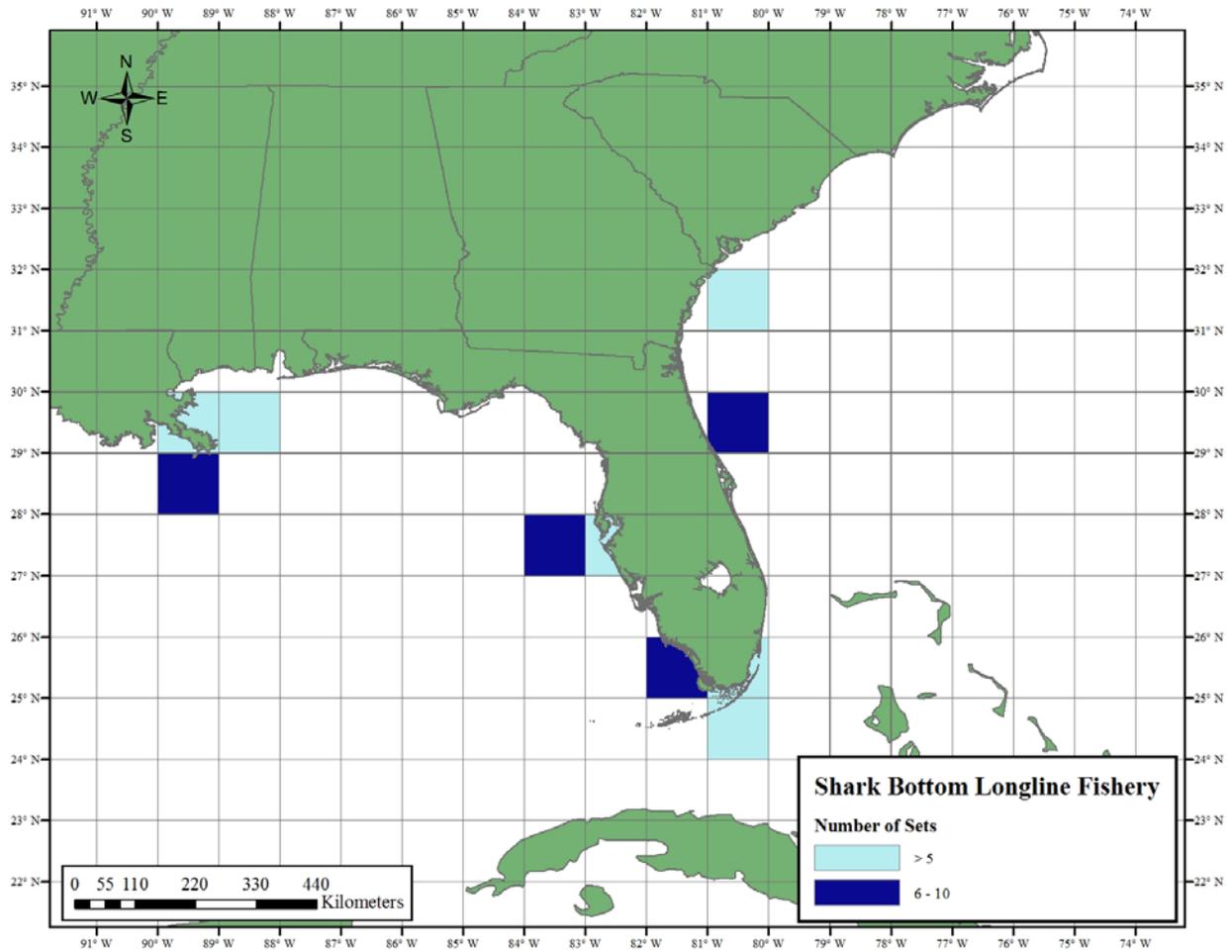


Figure 2 cont'd. Distribution of all observed hauls by target in 2017. (b) distribution of effort for the Shark Research Fishery.

(b)

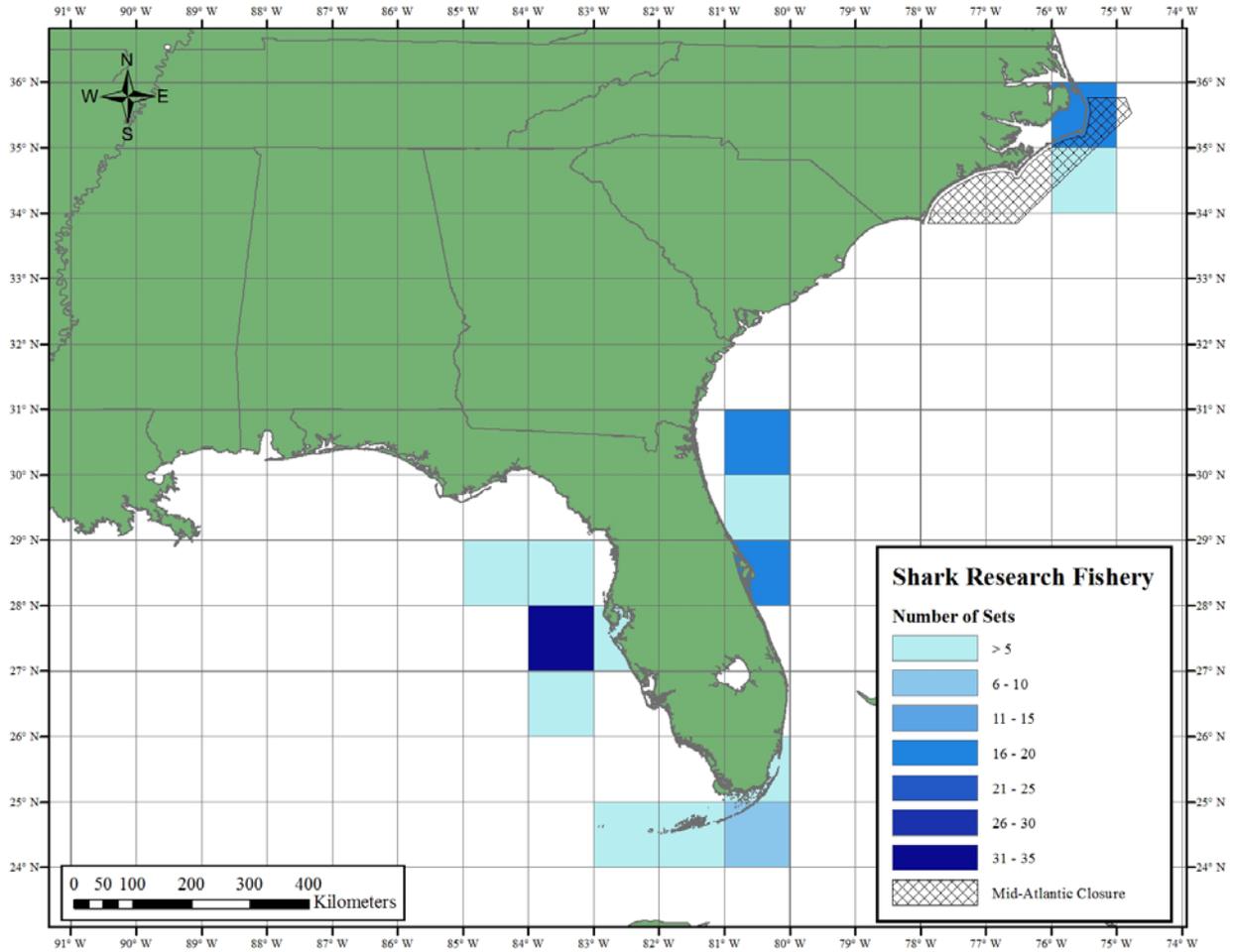
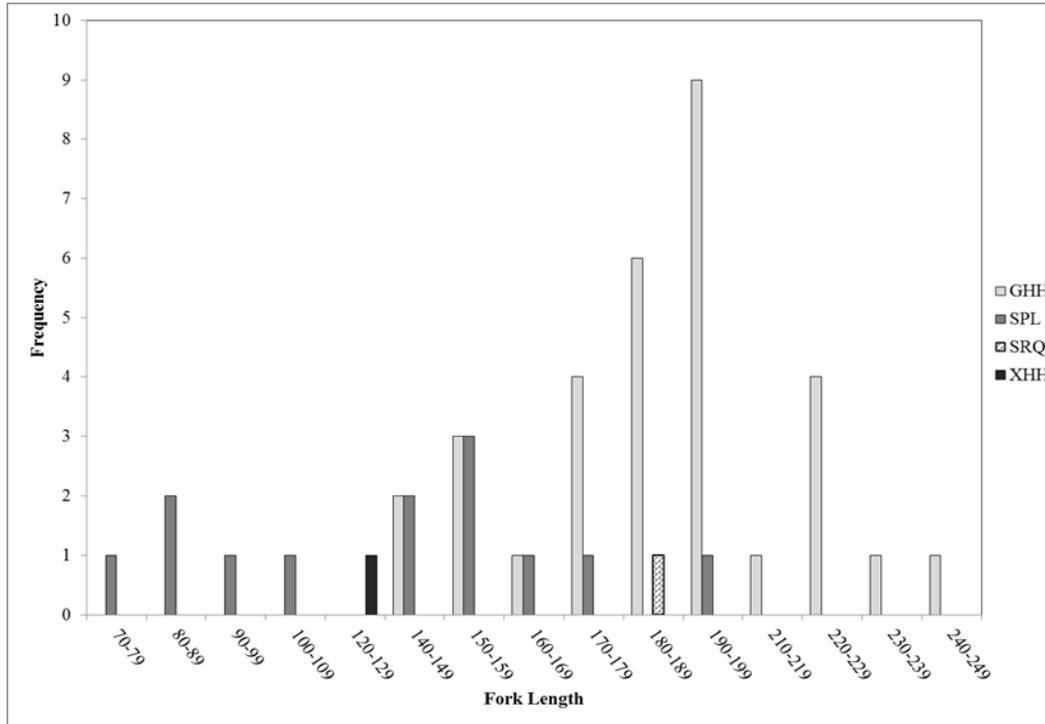


Figure 3. Length frequency (cm fork length) of (a) great hammerhead (GHH), scalloped hammerhead (SPL), requiem family, *Carcharhinidae*, (SRQ), and hammerhead (XHH) sharks; (b) lemon (LEM), nurse, (NUR), bull (SBU), and tiger (TIG) sharks observed caught on bottom longline sets in the Shark Bottom Longline Fishery.

(a)



(b)

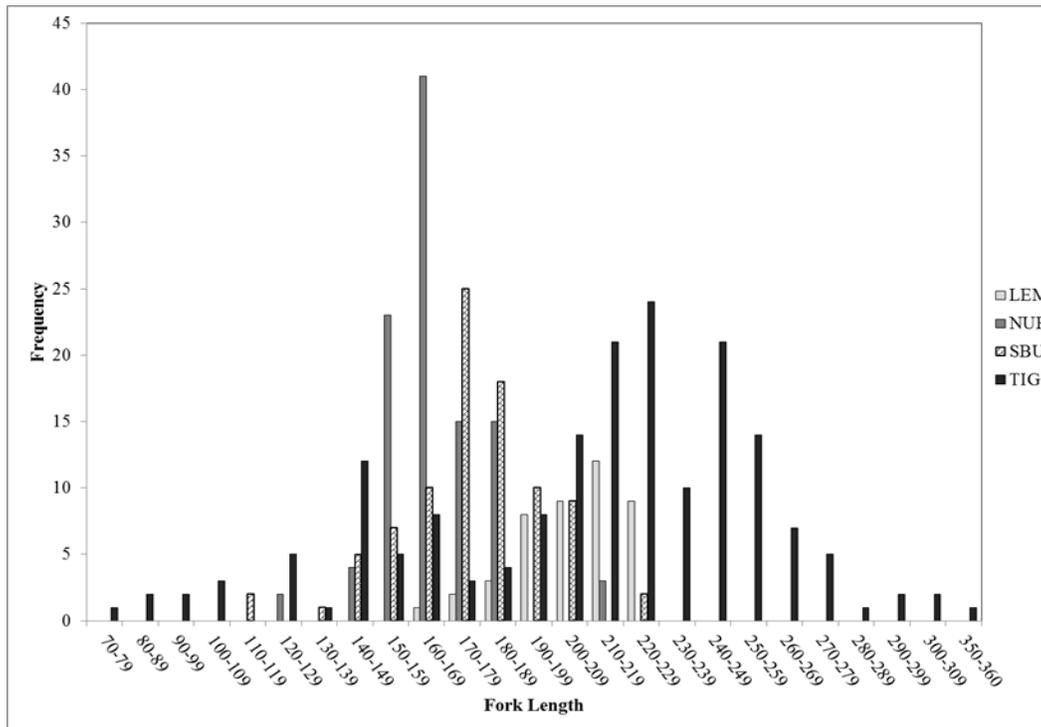
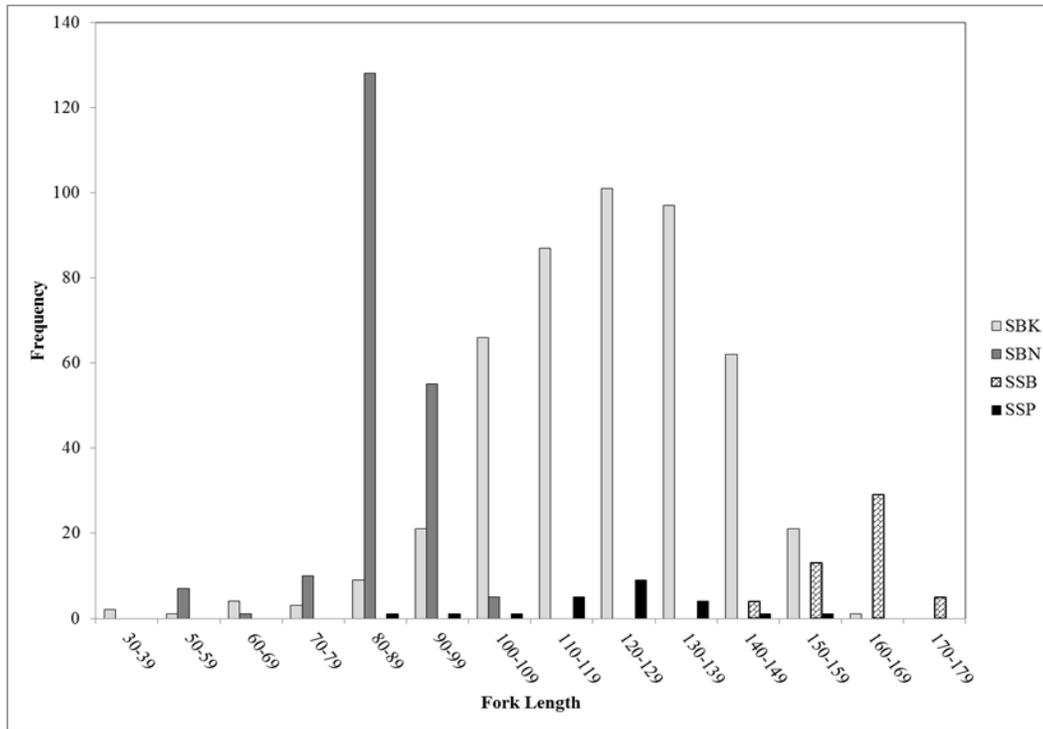


Figure 3 cont'd. Length frequency (cm fork length) of (c) blacktip (SBK), blacknose (SBN), sandbar (SSB), and spinner (SSP) sharks; (d) bonnethead (BHH), smooth dogfish (DGS), and finetooth (SFT), sharks observed caught on bottom longline sets in the Shark Bottom Longline Fishery.

(c)



(d)

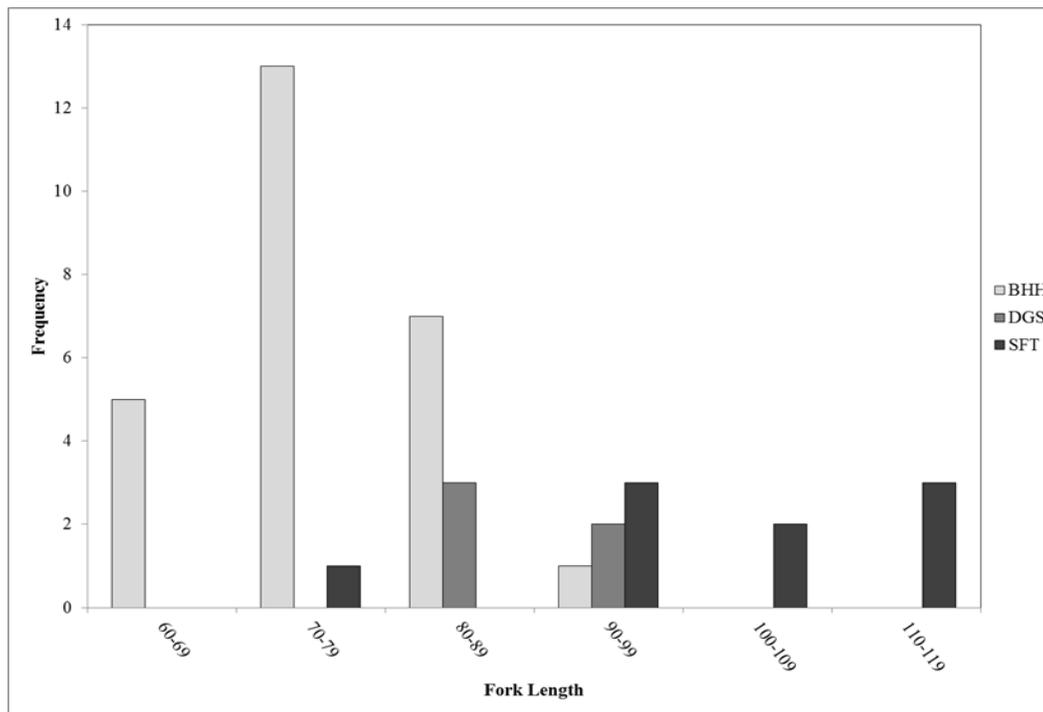


Figure 3 cont'd. Length frequency (cm fork length) of (e) Atlantic sharpnose shark (SAS) observed caught on bottom longline sets in the Shark Bottom Longline Fishery.

(e)

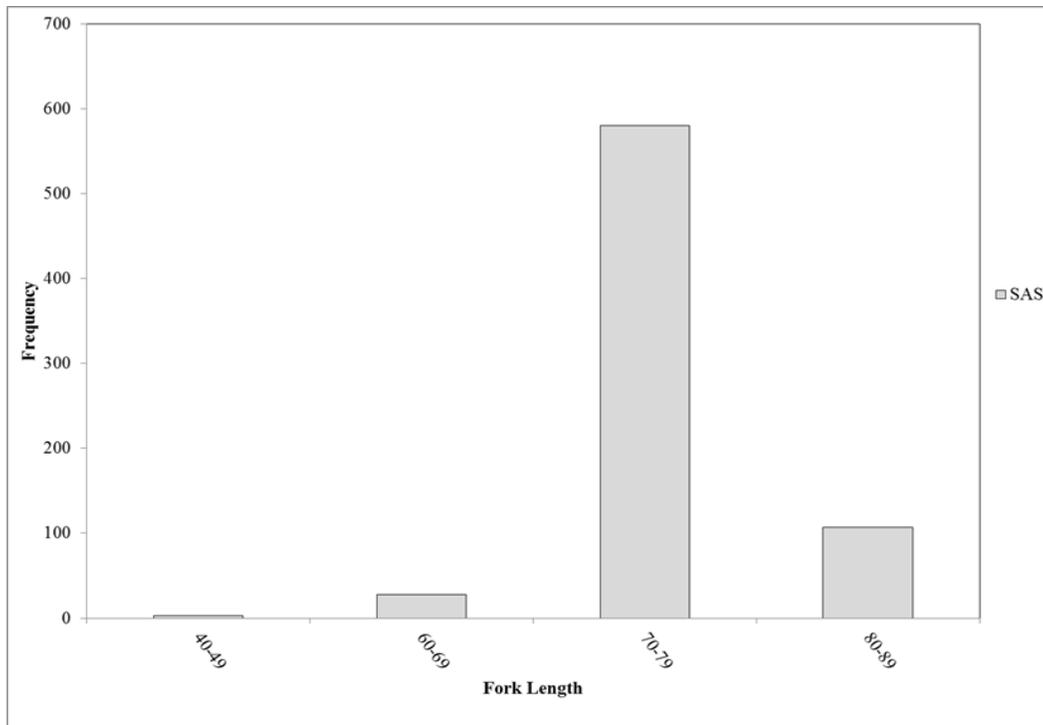
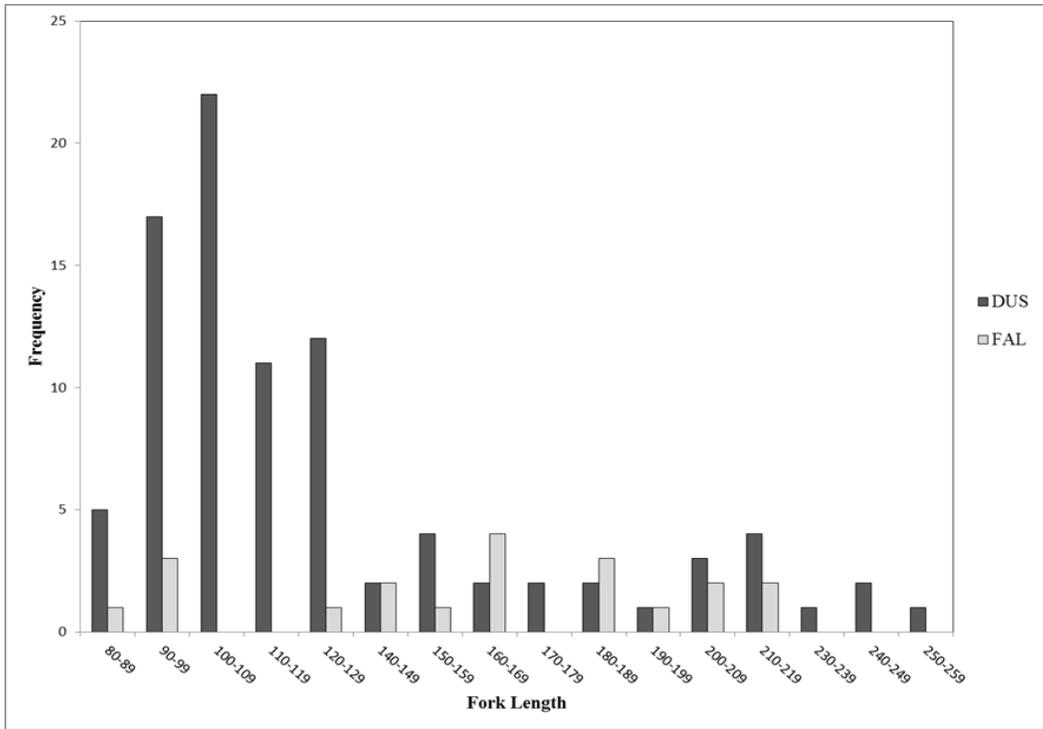


Figure 4. Length frequency (cm fork length) of (a) dusky (DUS) and silky (FAL) sharks; (b) sandbar shark (SSB) observed caught on bottom longline sets in the Shark Research Fishery.

(a)



(b)

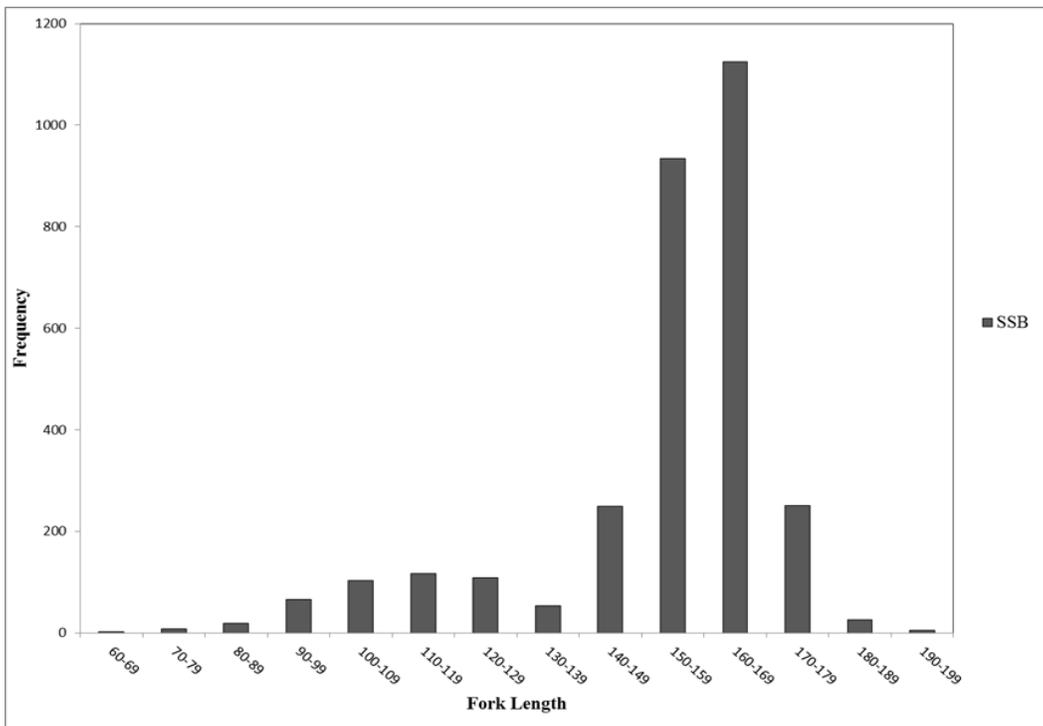
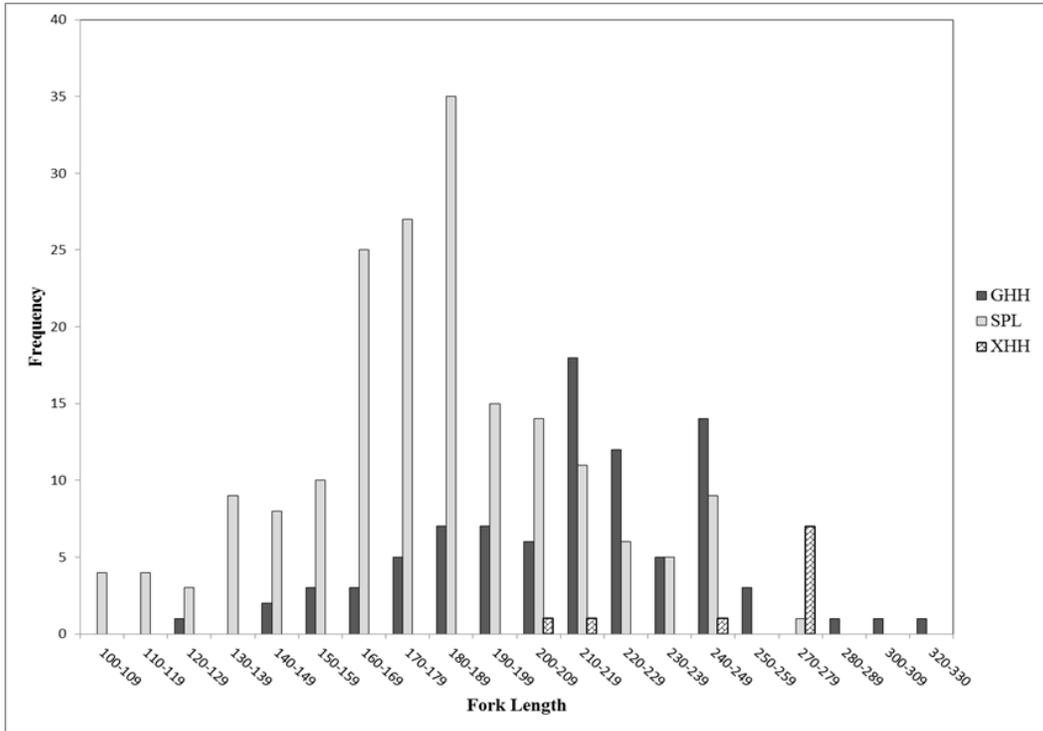


Figure 4 cont'd. Length frequency (cm fork length) of (c) great hammerhead (GHH), scalloped hammerhead (SPL), and hammerhead (XHH) sharks; (d) lemon (LEM), bull (SBU), sand tiger (SST), and tiger (TIG) sharks observed caught on bottom longline sets in the Shark Research Fishery.

(c)



(d)

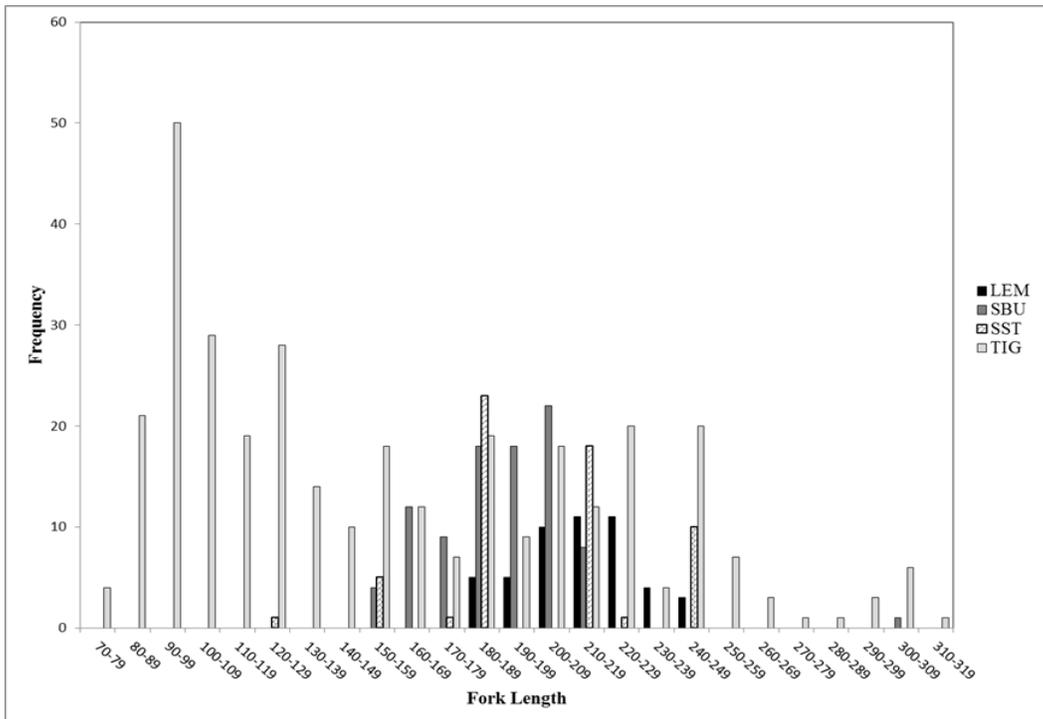
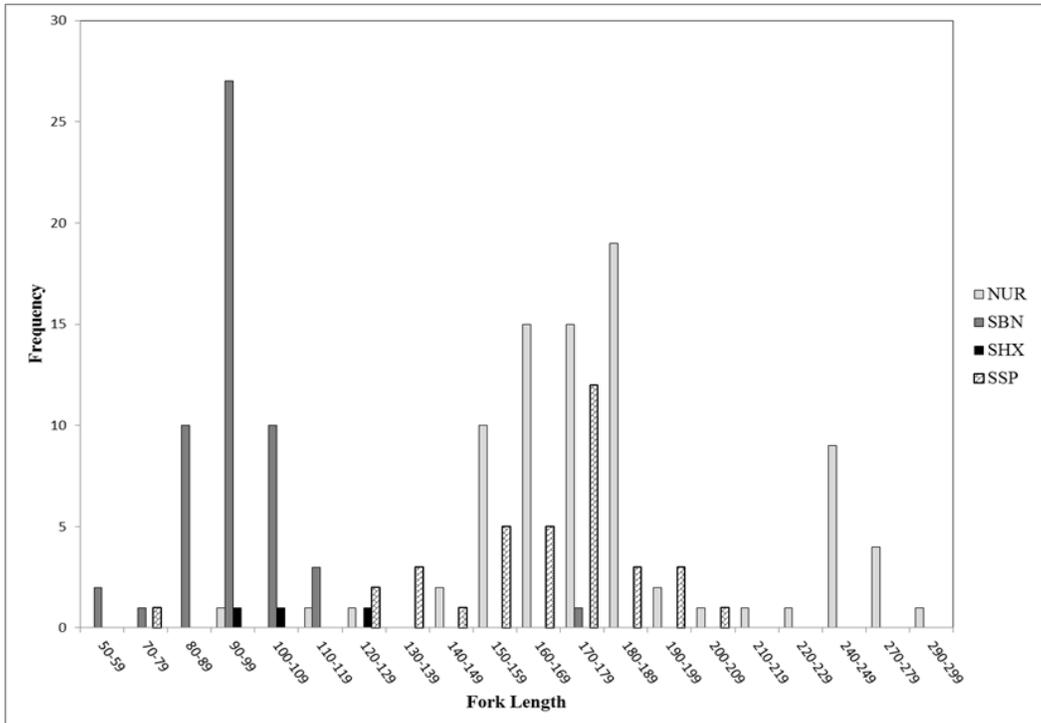


Figure 4 cont'd. Length frequency (cm fork length) of (e) nurse (NUR), blacknose (SBN), *Elasmobranchii* (SHX), and spinner (SSP) sharks; (f) Atlantic sharpnose (SAS), and blacktip (SBK) sharks observed caught on bottom longline sets in the Shark Research Fishery.

(e)



(f)

