



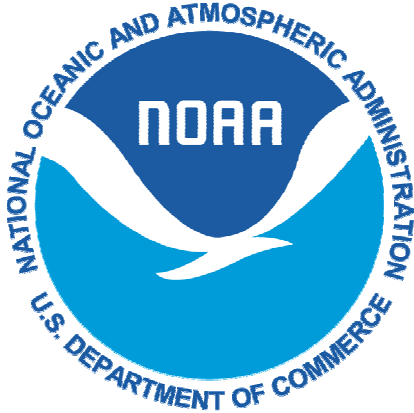
CHARACTERIZATION OF THE SHARK BOTTOM LONGLINE FISHERY: 2009

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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 and Carlson, 2007, Hale et al., 2007, Morgan et al. 2009, Hale et al., 2009). Currently 222 U.S. fishers are permitted to target sharks (excluding dogfish) in the Atlantic Ocean and Gulf of Mexico, and an additional 276 fishers are permitted to land sharks incidentally. Amendments to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan based on updated stock assessments have eliminated the major directed shark fishery in the U.S. Atlantic (NMFS, 2007). The amendments 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. 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 coverage level of 4-6% outside the research fishery). Outside the research fishery, fishers are permitted to land 33 non-sandbar large coastal sharks (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 2009 fishing season, including coverage of the 2009 shark research fishery.

## **Methods**

Vessels were selected from three fishing regions: northern Atlantic Ocean, southern Atlantic Ocean, and Gulf of Mexico. The northern Atlantic Ocean was defined from Virginia through Maine, the southern Atlantic Ocean was from the east coast of Florida through North Carolina and the Caribbean, and the Gulf of Mexico was defined from Texas through the west coast of Florida including the Florida Keys (NMFS, 2005). In October 2008, NMFS announced its request for applications for the shark research fishery from commercial shark fishers with a directed or incidental permit for 2009. 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, 7 qualified applicants were selected for observer coverage. These vessels carried observers on 100% of trips. Outside the research fishery, vessels targeting shark and possessing current valid directed shark fishing permits were randomly selected for coverage with a target coverage level of 4-6%. Because of the overlap with vessels targeting reef fish and shark within the same trip and vessels possessing directed shark permits (Hale and Carlson, 2007), observers also boarded trips regardless of the indicated target species. Thus, observers worked bottom longline trips that targeted grouper, snapper, and tilefish, as well as sharks.

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 Characteristic Log, Longline Haul Log, and Individual Animal Log. The Longline Gear Characteristic 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 Individual 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, finned, etc.).

On shark research fishery trips, observers were required to randomly sample sandbar sharks for biological samples for updates to life history studies, which was a research recommendation from the last large coastal shark stock assessment (SEDAR 11).

Observers were also required to obtain trip weighout forms which were compared to shark dealer reports by quota monitoring managers to manage the sandbar shark quota within the research fishery.

## **Results**

From January to December 2009, a total of 94 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 10 vessels with a total of 191 hauls (defined as setting gear, soaking gear for some duration of time, and retrieving gear) were observed (Table 1; Figure 1). Gear characteristics of trips varied by area (Gulf of Mexico or the U.S. Atlantic Ocean) and target species (grouper/snapper or grouper/tilefish, tilefish, non-sandbar large coastal

shark, sandbar shark). Because the universe of vessels covered was less than 3 vessels in each area, the observed data were combined for Gulf of Mexico and U.S. Atlantic Ocean to protect confidentiality of vessels. Additionally, the data were grouped by targets into four groups: a) trips targeting reef fish (shallow water grouper and snapper species or deep water grouper and snapper species and tilefish), b) trips targeting sandbar shark, c) trips targeting non-sandbar large coastal shark species, d) trips targeting mixed species within the same trip (sandbar shark and large coastal sharks or sandbar shark and tilefish) (Figure 1). No trips were observed in the northern U.S. Atlantic Ocean; therefore subsequent references to the “U.S. Atlantic Ocean” refer to the coastal waters off the southern U.S. Atlantic states from North Carolina to Florida (Richards, 1999).

*Gulf of Mexico reef fish targeted trips: gear and haul characteristics*

There were 70 hauls on 4 trips observed targeting shallow-water reef fish (mainly red grouper, *Epinephelus morio*) or deepwater grouper/tilefish (mainly yellowedge grouper, *Epinephelus flavolimbatus*, and tilefish, *Lopholatilus chamaeleonticeps*) in the Gulf of Mexico. The mainline length ranged from 2 to 12 km with an average of 8.1 km. The bottom depth fished ranged from 42 to 261 m with an average of 134.6 m, and the number of hooks ranged from 327 to 1590 hooks with an average of 1123 hooks fished. There were 34 sets shallower than 50 fathoms (< 91.4 m) depth (48.6%) and 36 sets deeper than 50 fathoms (> 91.4 m) depth (51.4%). Circle hooks sized 13.0 were the only hook utilized (100% of hauls). The average soak duration (the time from when the last hook entered the water until the first hook was hauled back) was 2.0 hr.

### *Gulf of Mexico reef fish targeted trips: catch and bycatch*

There were 6,636 individual animals caught on observed bottom longline hauls targeting reef fish in the Gulf of Mexico (Table 2). Teleosts comprised 89.6% of the catch, followed by sharks (10.2%), invertebrates (0.1%), and batoids (0.1%). Deepwater shark species comprised 48.2% of the shark catch, small coastal shark species comprised 45.0%, and large coastal sharks comprised 4.1%. Prohibited sharks including the bigeye sixgill shark, *Hexanchus vitulus* and the dusky shark, *Carcharhinus obscurus*, made up 2.7% of the catch. Red grouper was the most frequently caught species of teleost (35.6%), and smooth dogfish, *Mustelus canis*, was the most frequently caught species of shark (40.1%). Length frequencies of shark species are presented in Figure 2 (for species with  $n \geq 10$ ).

### *Gulf of Mexico reef fish targeted trips: protected species interactions*

No interactions with protected resources (sea bird, sea turtle, sawfish, or marine mammal) were observed for bottom longline vessels fishing in the Gulf of Mexico region targeting reef fish.

### *Gulf of Mexico and South Atlantic sandbar shark targeted trips: gear and haul characteristics*

There were 99 hauls on 78 trips observed targeting sandbar sharks in the Gulf of Mexico and the South Atlantic. All of the trips were targeting sandbar shark within the shark research fishery. The mainline length ranged from 0.6 to 15.0 km with an average of 6.9 km. The bottom depth fished ranged from 12.5 to 160 m with an average of 62.5 m, and the number of hooks ranged from 42 to 1067 hooks with an average of 403 hooks fished. The most commonly used hook was the 18.0 circle hook (52.5%) with 12.0 J



hooks used in 13.1% of hauls. There were 33 hauls (33.3%) that employed two different types of hooks, with 18.0 circle hooks used most commonly as the second hook (87.9%). The average soak duration was 20.3 hr.

*Gulf of Mexico and South Atlantic sandbar shark targeted trips: catch and bycatch*

There were 6,511 individual animals caught on observed bottom longline hauls targeting sandbar shark in the Gulf of Mexico and South Atlantic (Table 3). Sharks comprised 97.8% of the catch, followed by teleosts (1.8%), invertebrates (0.1%), and batoids (0.2%). Large coastal shark species comprised 89.4% of the shark catch, small coastal shark species comprised 8.0%, and deep water sharks comprised 0.3%. Prohibited shark species were also caught including the dusky shark, the Caribbean reef shark, *Carcharhinus perezi*, the night shark, *Carcharhinus signatus*, the sand tiger shark, *Carcharias taurus*, and the longfin mako shark, *Isurus paucus* (2.3% of shark catch). Red grouper was the most frequently caught species of teleost (55.4%) and sandbar shark was the most frequently caught species of shark (56.8%). Length frequencies of shark species are presented in Figure 3 (for species with  $n \geq 10$ ).

*Gulf of Mexico and South Atlantic sandbar shark targeted trips: protected species interactions*

Interactions with protected resources were observed for bottom longline vessels fishing in the Gulf of Mexico and South Atlantic regions targeting sandbar shark (Table 4). Five (5) smalltooth sawfish and two (2) loggerhead sea turtles were observed caught in bottom longline gear. No sea bird or marine mammal interactions were observed.

*Gulf of Mexico and South Atlantic large coastal shark targeted trips: gear and haul characteristics*

There were 9 hauls on 7 trips observed targeting mixed species (sandbar shark and large coastal shark, sandbar shark and tilefish) in the Gulf of Mexico and South Atlantic. The mainline length ranged from 0.4 to 13.0 km with an average of 5.5 km. The bottom depth fished ranged from 8.0 to 43.0 m with an average of 20.1 m, and the number of hooks ranged from 32 to 897 hooks with an average of 367 hooks fished. The most commonly used hook was the 12.0 J hook (44.4%) with 18.0 circle hook used in 33.3% of hauls. There were 3 hauls (33.3%) that employed two different types of hooks, with 18.0 circle hooks used as the second hook (100.0%). The average soak duration was 13.7 hr.

*Gulf of Mexico and South Atlantic large coastal shark targeted trips: catch and bycatch*

There were 479 individual animals caught on observed bottom longline hauls targeting large coastal shark in the Gulf of Mexico and South Atlantic (Table 5). Sharks comprised 96.2% of the catch, followed by teleosts (1.9%), invertebrates (1.1%), and batoids (0.8%). Large coastal shark species comprised 85.6% of the shark catch and small coastal shark species comprised 14%. Prohibited shark species including the Caribbean reef shark were also caught (0.4% of shark catch). Red grouper was the most frequently caught species of teleost (44.4%) and blacktip shark was the most frequently caught species of shark (30.6%). Length frequencies of shark species are presented in Figure 4 (for species with  $n \geq 10$ ).

*Gulf of Mexico and South Atlantic large coastal shark targeted trips: protected species interactions*

No interactions with protected resources were observed for bottom longline vessels fishing in the Gulf of Mexico region targeting shark.

*Gulf of Mexico and South Atlantic mixed species targeted trips: gear and haul characteristics*

There were 13 hauls on 5 trips observed targeting mixed species (sandbar shark and large coastal shark, sandbar shark and tilefish) in the Gulf of Mexico and South Atlantic. The mainline length ranged from 0.2 to 8.5 km with an average of 3.2 km. The bottom depth fished ranged from 6.0 to 225.0 m with an average of 109.3 m, and the number of hooks ranged from 20 to 546 hooks with an average of 237 hooks fished. The most commonly used hook was the 18.0 and 14.0 circle hook (69.2%) with 12.0 J hooks used in 30.8% of hauls. There were no hauls that employed two different types of hooks. The average soak duration was 11.8 hr.

*Gulf of Mexico and South Atlantic mixed species targeted trips: catch and bycatch*

There were 477 individual animals caught on observed bottom longline hauls targeting mixed species in the Gulf of Mexico (Table 6). Sharks comprised 64.6% of the catch, followed by teleosts (35.2%) and batoids (0.2%). Large coastal shark species comprised 95.4% of the shark catch, small coastal shark species comprised 2.0%, and deep water sharks comprised 0.6%. Prohibited shark species including the dusky shark, the Caribbean reef shark, and the sevengill shark, *Heptranchias perlo*, were also caught (2.0% of shark catch). Tilefish was the most frequently caught species of teleost (55.4%)

and sandbar shark was the most frequently caught species of shark (16.6%). Length frequencies of shark species are presented in Figure 5 (for species with  $n \geq 10$ ).

*Gulf of Mexico and South Atlantic mixed species targeted trips: protected species interactions*

No interactions with protected resources were observed for bottom longline vessels fishing in the Gulf of Mexico and South Atlantic region targeting mixed species. No sea turtle, sea bird, sawfish, or marine mammal interactions were observed.

**Discussion**

In 2009 the shark bottom longline observer program covered vessels in the Gulf of Mexico and U.S. South Atlantic Ocean, with the majority of trips and hauls observed targeting sandbar shark in the shark research fishery. In comparison to 2008, more trips on fewer vessels were made. The trip limit of 45 sandbar shark within the research fishery meant that the fishers set shorter lengths of mainline and fewer hooks on average. Additionally, many fishers within the research fishery set gear in order to catch both sandbar sharks and 33 non-sandbar large coastal sharks. The research fishery quota reached around 80% by June, and was closed in October to avoid any overages due to illegal landings outside the research fishery. Samples of vertebrae and reproductive tracts from over 1200 sandbar sharks were collected by observers in 2008 and 2009 from the research fishery, and age and growth and reproductive analyses are under way. Results from these analyses will be presented at the stock assessment data workshop for sandbar shark in 2010.

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Table 1. Number of trips, vessels, hauls, and hook hours observed in the Gulf of Mexico (GOM) and southern U.S. Atlantic Ocean (SA) for all target species. Target species include reef fish (GRP), a mix of tilefish and large coastal shark or large coastal shark and sandbar shark (MIX), large coastal shark (SHX), and sandbar shark (SSB).

Area and Target	Vessels Observed	Trips Observed	Hauls Observed	Hook Hours
GOM GRP	3	4	70	145481.8
GOM/SA SSB	6	78	99	713670.4
GOM/SA SHX	4	7	9	42283.4
GOM/SA MIX	3	5	13	33313.3
Total	10	94	191	934748.9

Table 2. Number caught (n) and disposition of catch in percentage for all observed hauls targeting reef fish in the Gulf of Mexico. Disposition of catch divided into kept (K), discard dead (DD), discard alive (DA), and unknown (U).

Scientific Name	Common Name	n	% K	% DD	% DA	% U
<i>Epinephelus morio</i>	Red grouper	2115	33.7	0.9	65.4	0.0
<i>Caulolatilus microps</i>	Blueline tilefish	1170	20.9	76.5	2.6	0.0
<i>Lopholatilus chamaeleonticeps</i>	Tilefish	898	0.0	1.8	98.2	0.0
<i>Epinephelus flavolimbatus</i>	Yellowedge grouper	885	99.3	0.6	0.1	0.0
<i>Squalus cubensis</i>	Cuban dogfish	273	0.0	2.9	97.1	0.0
<i>Carcharhinus acronotus</i>	Blacknose shark	195	0.5	3.6	95.9	0.0
<i>Ophichthus rex</i>	King snake eel	188	30.9	13.8	55.3	0.0
<i>Urophycis floridana</i>	Southern hake	136	89.7	0.0	10.3	0.0
<i>Lutjanus campechanus</i>	Red snapper	117	0.0	3.4	96.6	0.0
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	109	0.9	3.7	94.5	0.9
<i>Epinephelus niveatus</i>	Snowy grouper	70	92.9	7.1	0.0	0.0
<i>Mustelus canis</i>	Smooth dogfish	52	5.8	0.0	94.2	0.0
<i>Haemulon album</i>	Margate grunt	40	95.0	0.0	5.0	0.0
<i>Epinephelus drummondhayi</i>	Speckled hind	32	96.9	3.1	0.0	0.0
<i>Merluccius sp.</i>	Hakes	27	66.7	29.6	3.7	0.0
<i>Mycteroperca bonaci</i>	Black grouper	27	92.6	0.0	7.4	0.0
<i>Coryphaena hippurus</i>	Dolphinfish	19	100.0	0.0	0.0	0.0
<i>Echeneis naucrates</i>	Sharksucker	19	0.0	0.0	100.0	0.0
<i>Mycteroperca phenax</i>	Scamp grouper	19	100.0	0.0	0.0	0.0
Muraenidae	Moray eel family	18	33.3	16.7	50.0	0.0
<i>Seriola dumerili</i>	Greater amberjack	18	72.2	0.0	27.8	0.0
Tetraodontidae	Puffer family	18	0.0	0.0	100.0	0.0
<i>Carcharhinus falciformis</i>	Silky shark	16	0.0	6.3	93.8	0.0
<i>Neomerinthe hemingwayi</i>	Spinycheek scorpionfish	16	87.5	0.0	12.5	0.0
<i>Lutjanus griseus</i>	Gray snapper	11	90.9	0.0	9.1	0.0
<i>Lutjanus synagris</i>	Lane snapper	10	90.0	0.0	10.0	0.0
<i>Synodus foetens</i>	Inshore lizardfish	10	90.0	0.0	10.0	0.0
<i>Carcharhinus obscurus</i>	Dusky shark	9	0.0	0.0	100.0	0.0
<i>Hexanchus vitulus</i>	Bigeye sixgill shark	9	0.0	22.2	77.8	0.0
<i>Sarda sarda</i>	Bonito	9	100.0	0.0	0.0	0.0
Congridae	Conger eels	8	75.0	0.0	25.0	0.0
<i>Sphyraena barracuda</i>	Great barracuda	8	75.0	25.0	0.0	0.0
<i>Galeocerdo cuvier</i>	Tiger shark	5	0.0	0.0	60.0	40.0
<i>Remora remora</i>	Remora	5	0.0	0.0	100.0	0.0
<i>Pristipomoides aquilonaris</i>	Wenchman snapper	5	100.0	0.0	0.0	0.0
<i>Carcharhinus limbatus</i>	Blacktip shark	4	0.0	0.0	100.0	0.0
Elasmobranchii	Sharks	4	0.0	0.0	100.0	0.0
<i>Gymnothorax funebris</i>	Green moray eel	4	0.0	25.0	75.0	0.0
<i>Scianops ocellatus</i>	Red drum	4	0.0	0.0	100.0	0.0
<i>Seriola sp.</i>	Amberjacks	4	50.0	0.0	50.0	0.0
Serranidae	Seabass family	4	100.0	0.0	0.0	0.0
Asteroidea	Sea stars	3	0.0	0.0	100.0	0.0
Majidae	Spider crabs	3	0.0	0.0	100.0	0.0
<i>Opsanus pardus</i>	Leopard toadfish	3	66.7	33.3	0.0	0.0



Table 2 Continued.

Scientific Name	Common Name	n	% K	% DD	% DA	% U
<i>Paralichthys sp.</i>	Flounders	3	66.7	0.0	33.3	0.0
<i>Thunnus atlanticus</i>	Blackfin tuna	3	100.0	0.0	0.0	0.0
<i>Balistes capricus</i>	Gray triggerfish	2	100.0	0.0	0.0	0.0
<i>Calamus bajonado</i>	Jolthead porgy	2	100.0	0.0	0.0	0.0
<i>Dasyatis americana</i>	Southern stingray	2	50.0	0.0	50.0	0.0
<i>Ginglymostoma cirratum</i>	Nurse shark	2	0.0	0.0	50.0	50.0
<i>Muraena retifera</i>	Reticulate moray eel	2	100.0	0.0	0.0	0.0
<i>Mycteroperca microlepis</i>	Gag grouper	2	100.0	0.0	0.0	0.0
<i>Rachycentron canadum</i>	Cobia	2	50.0	0.0	50.0	0.0
Scorpaenidae	Scorpionfish family	2	100.0	0.0	0.0	0.0
<i>Scyliorhinus retifer</i>	Chain catshark	2	0.0	50.0	50.0	0.0
<i>Synodus intermedius</i>	Sanddiver lizardfish	2	0.0	50.0	50.0	0.0
<i>Carcharhinus plumbeus</i>	Sandbar shark	1	0.0	0.0	100.0	0.0
<i>Caulolatilus cyanops</i>	Blackline tilefish	1	0.0	0.0	100.0	0.0
<i>Diplectrum formosum</i>	Sand perch	1	100.0	0.0	0.0	0.0
<i>Epinephelus cruentatus</i>	Graysby grouper	1	0.0	0.0	100.0	0.0
<i>Epinephelus itajara</i>	Goliath grouper	1	0.0	0.0	100.0	0.0
<i>Gymnothorax moring</i>	Spotted moray eel	1	0.0	100.0	0.0	0.0
<i>Lutjanus analis</i>	Mutton snapper	1	100.0	0.0	0.0	0.0
<i>Pagrus pagrus</i>	Red porgy	1	100.0	0.0	0.0	0.0
<i>Raja eglantera</i>	Clearnose skate	1	100.0	0.0	0.0	0.0
Rajiformes	Skates and rays	1	100.0	0.0	0.0	0.0
<i>Rhomboplites aurorubens</i>	Vermillion snapper	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 South Atlantic. Disposition of catch 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	3620	82.6	5.8	11.1	0.6
<i>Galeocerdo cuvier</i>	Tiger shark	726	20.4	10.2	68.7	0.7
<i>Sphyrna lewini</i>	Scalloped hammerhead shark	444	91.4	5.9	2.0	0.7
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	435	50.8	43.7	1.1	4.4
<i>Carcharhinus limbatus</i>	Blacktip shark	385	65.2	30.1	4.4	0.3
<i>Carcharhinus leucas</i>	Bull shark	166	91.6	0.0	6.6	1.8
<i>Ginglymostoma cirratum</i>	Nurse shark	110	1.8	0.0	98.2	0.0
<i>Sphyrna mokarran</i>	Great hammerhead shark	104	92.3	4.8	2.9	0.0
<i>Carcharhinus obscurus</i>	Dusky shark	94	0.0	54.3	45.7	0.0
<i>Carcharhinus acronotus</i>	Blacknose shark	71	52.1	45.1	2.8	0.0
<i>Carcharhinus falciformis</i>	Silky shark	64	79.7	14.1	0.0	6.3
<i>Carcharhinus brevipinna</i>	Spinner shark	44	70.5	25.0	4.5	0.0
<i>Carcharhinus signatus</i>	Night shark	42	0.0	100.0	0.0	0.0
<i>Negaprion brevirostris</i>	Lemon shark	32	87.5	0.0	3.1	9.4
<i>Epinephelus morio</i>	Red grouper	28	75.0	17.9	3.6	3.6
<i>Epinephelus niveatus</i>	Snowy grouper	19	94.7	5.3	0.0	0.0
Squalidae	Dogfish family	13	7.7	0.0	7.7	84.6
<i>Seriola dumerili</i>	Greater amberjack	12	66.7	16.7	16.7	0.0
<i>Epinephelus itajara</i>	Goliath grouper	8	12.5	25.0	62.5	0.0
<i>Lutjanus analis</i>	Mutton snapper	7	100.0	0.0	0.0	0.0
<i>Mustelus canis</i>	Smooth dogfish	7	42.9	42.9	14.3	0.0
<i>Mycteroperca microlepis</i>	Gag grouper	7	85.7	14.3	0.0	0.0
<i>Dasyatis sp.</i>	Stingrays	6	0.0	16.7	83.3	0.0
<i>Ophichthus rex</i>	King snake eel	6	100.0	0.0	0.0	0.0
Anguilliformes	Eels	5	60.0	40.0	0.0	0.0
Anthozoa	Coral	5	0.0	100.0	0.0	0.0
<i>Lutjanus campechanus</i>	Red snapper	5	100.0	0.0	0.0	0.0
<i>Carcharhinus perezii</i>	Caribbean reef shark	4	0.0	50.0	50.0	0.0
<i>Rachycentron canadum</i>	Cobia	4	100.0	0.0	0.0	0.0
<i>Seriola rivoliana</i>	Almaco jack	4	75.0	25.0	0.0	0.0
<i>Sphyaena barracuda</i>	Great barracuda	4	50.0	50.0	0.0	0.0
Asteroidea	Sea stars	3	0.0	0.0	100.0	0.0
<i>Carcharias taurus</i>	Sand tiger shark	3	0.0	0.0	100.0	0.0
<i>Epinephelus flavolimbatus</i>	Yellowedge grouper	3	100.0	0.0	0.0	0.0
<i>Mycteroperca bonaci</i>	Black grouper	3	100.0	0.0	0.0	0.0
Rajiformes	Skates and rays	3	0.0	0.0	100.0	0.0
Carcharhinidae	Requiem shark family	2	0.0	50.0	0.0	50.0
<i>Carcharhinus isodon</i>	Finetooth shark	2	50.0	0.0	50.0	0.0
<i>Dasyatis americana</i>	Southern stingray	2	0.0	0.0	100.0	0.0
<i>Coryphaena hippurus</i>	Dolphinfish	1	100.0	0.0	0.0	0.0
<i>Dasyatis sabina</i>	Atlantic stingray	1	0.0	0.0	100.0	0.0
Elasmobranchii	Sharks	1	0.0	0.0	0.0	100.0
<i>Isurus paucus</i>	Longfin mako shark	1	0.0	0.0	100.0	0.0
<i>Manta birostris</i>	Manta ray	1	0.0	0.0	100.0	0.0

Table 3 Continued.

Scientific Name	Common Name	n	% K	% DD	% DA	% U
<i>Opsanus pardus</i>	Leopard toadfish	1	0.0	0.0	100.0	0.0
<i>Remora remora</i>	Remora	1	0.0	0.0	100.0	0.0
Sphyrnaeidae	Barracuda family	1	100.0	0.0	0.0	0.0
<i>Sphyrna tiburo</i>	Bonnethead shark	1	100.0	0.0	0.0	0.0

Table 4. Number (n) of protected species interactions for all observed hauls targeting sandbar shark in the Gulf of Mexico and South Atlantic. Disposition of catch divided into released dead (RD), released alive (RA), and unknown (U).

Scientific Name	Common Name	n	% RD	% RA	% U
<i>Caretta caretta</i>	Loggerhead sea turtle	2	100.0	0.0	0.0
<i>Pristis pectinata</i>	Smalltooth sawfish	5	0.0	100.0	0.0

Table 5. Number caught (n) and disposition of catch in percentage for all observed hauls targeting large coastal shark in the Gulf of Mexico and South Atlantic. Disposition of catch divided into kept (K), discard dead (DD), discard alive (DA), and unknown (U).

Scientific Name	Common Name	n	% K	% DD	% DA	% U
<i>Carcharhinus limbatus</i>	Blacktip shark	141	78.0	16.3	5.7	0.0
<i>Ginglymostoma cirratum</i>	Nurse shark	111	0.9	0.0	98.2	0.9
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	53	37.7	54.7	5.7	1.9
<i>Sphyrna lewini</i>	Scalloped hammerhead shark	32	93.8	0.0	0.0	6.3
<i>Negaprion brevirostris</i>	Lemon shark	28	89.3	0.0	7.1	3.6
<i>Galeocerdo cuvier</i>	Tiger shark	27	7.4	7.4	85.2	0.0
<i>Carcharhinus leucas</i>	Bull shark	25	96.0	0.0	4.0	0.0
<i>Sphyrna mokarran</i>	Great hammerhead shark	20	95.0	5.0	0.0	0.0
<i>Carcharhinus acronotus</i>	Blacknose shark	10	80.0	10.0	10.0	0.0
<i>Carcharhinus plumbeus</i>	Sandbar shark	7	0.0	14.3	85.7	0.0
<i>Epinephelus morio</i>	Red grouper	5	80.0	20.0	0.0	0.0
Anthozoa	Coral	4	0.0	100.0	0.0	0.0
Carcharhinidae	Requiem shark family	3	0.0	0.0	0.0	100.0
<i>Carcharhinus perezi</i>	Caribbean reef shark	2	0.0	100.0	0.0	0.0
<i>Dasyatis americana</i>	Southern stingray	2	0.0	0.0	100.0	0.0
<i>Gymnothorax funebris</i>	Green moray eel	2	100.0	0.0	0.0	0.0
<i>Cancer spp.</i>	Cancer crabs	1	0.0	0.0	100.0	0.0
<i>Carcharhinus brevipinna</i>	Spinner shark	1	0.0	100.0	0.0	0.0
<i>Epinephelus itajara</i>	Goliath grouper	1	0.0	0.0	100.0	0.0
Muraenidae	Moray eel family	1	0.0	100.0	0.0	0.0
<i>Myliobatis sp.</i>	Eagle rays	1	0.0	0.0	100.0	0.0
Rajiformes	Skates and rays	1	0.0	0.0	100.0	0.0
<i>Sphyrna tiburo</i>	Bonnethead shark	1	0.0	100.0	0.0	0.0

Table 6. Number caught (n) and disposition of catch in percentage for all observed hauls targeting mixed species (tilefish and large coastal shark or large coastal shark and sandbar shark) in the Gulf of Mexico and South Atlantic. Disposition of catch 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	203	98.0	0.0	0.0	2.0
<i>Lopholatilus chamaeleonticeps</i>	Tilefish	151	100.0	0.0	0.0	0.0
<i>Sphyrna lewini</i>	Scalloped hammerhead shark	63	100.0	0.0	0.0	0.0
<i>Urophycis floridana</i>	Southern hake	10	100.0	0.0	0.0	0.0
<i>Ginglymostoma cirratum</i>	Nurse shark	7	0.0	0.0	100.0	0.0
<i>Sphyrna mokarran</i>	Great hammerhead shark	7	85.7	0.0	0.0	14.3
<i>Galeocerdo cuvier</i>	Tiger shark	5	60.0	0.0	40.0	0.0
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	4	50.0	25.0	0.0	25.0
<i>Carcharhinus leucas</i>	Bull shark	3	100.0	0.0	0.0	0.0
<i>Carcharhinus obscurus</i>	Dusky shark	3	0.0	100.0	0.0	0.0
Anguilliformes	Eels	2	100.0	0.0	0.0	0.0
<i>Carcharhinus falciformis</i>	Silky shark	2	100.0	0.0	0.0	0.0
<i>Carcharhinus limbatus</i>	Blacktip shark	2	100.0	0.0	0.0	0.0
<i>Carcharhinus perezii</i>	Caribbean reef shark	2	0.0	100.0	0.0	0.0
<i>Scyliorhinus retifer</i>	Chain catshark	2	0.0	0.0	100.0	0.0
Carcharhinidae	Requiem shark family	1	0.0	0.0	0.0	100.0
<i>Carcharhinus acronotus</i>	Blacknose shark	1	100.0	0.0	0.0	0.0
<i>Dasyatis sp.</i>	Stingrays	1	0.0	0.0	100.0	0.0
<i>Epinephelus itajara</i>	Goliath grouper	1	0.0	0.0	100.0	0.0
<i>Epinephelus morio</i>	Red grouper	1	100.0	0.0	0.0	0.0
<i>Epinephelus niveatus</i>	Snowy grouper	1	100.0	0.0	0.0	0.0
<i>Heptranchias perlo</i>	Sevengill shark	1	0.0	0.0	100.0	0.0
<i>Lutjanus analis</i>	Mutton snapper	1	100.0	0.0	0.0	0.0
Muraenidae	Moray eel family	1	100.0	0.0	0.0	0.0
<i>Negaprion brevirostris</i>	Lemon shark	1	100.0	0.0	0.0	0.0
<i>Sphyrna tiburo</i>	Bonnethead shark	1	100.0	0.0	0.0	0.0

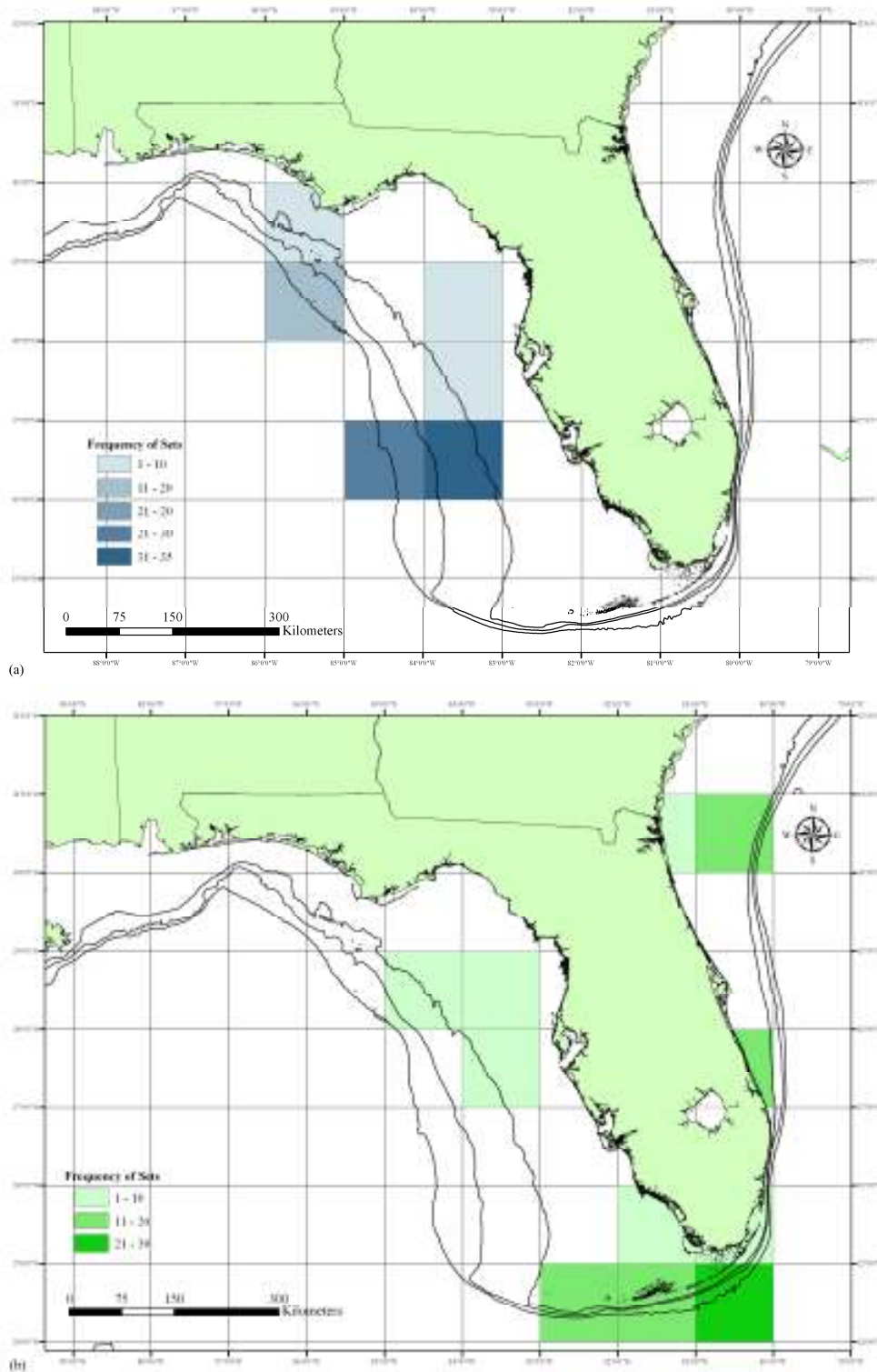
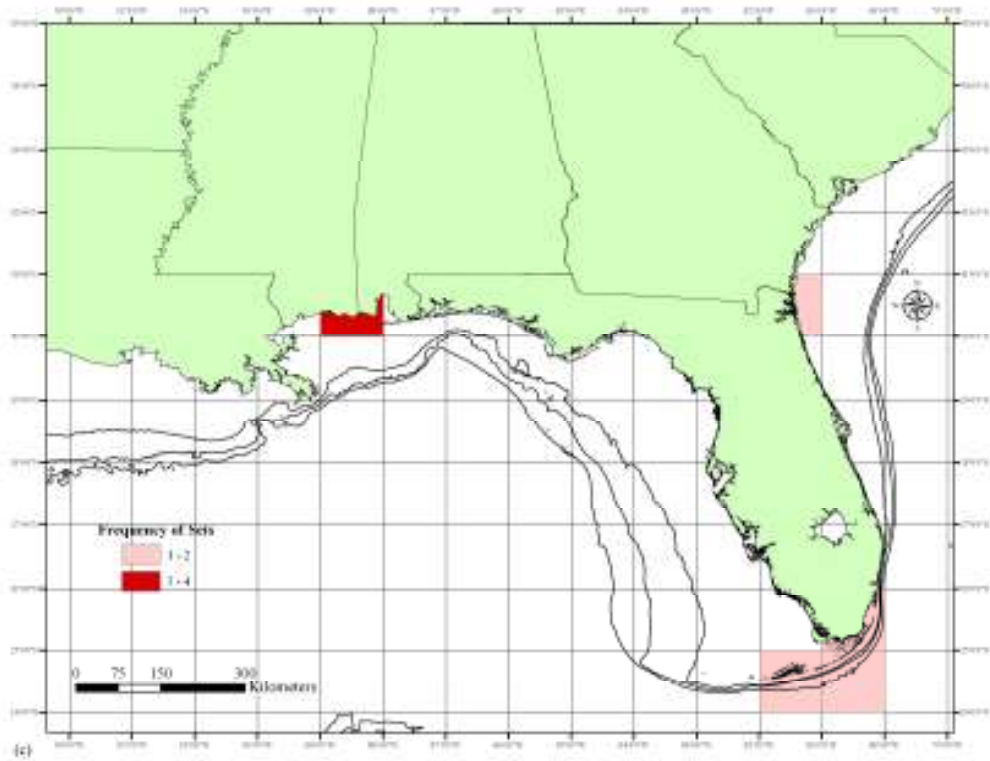
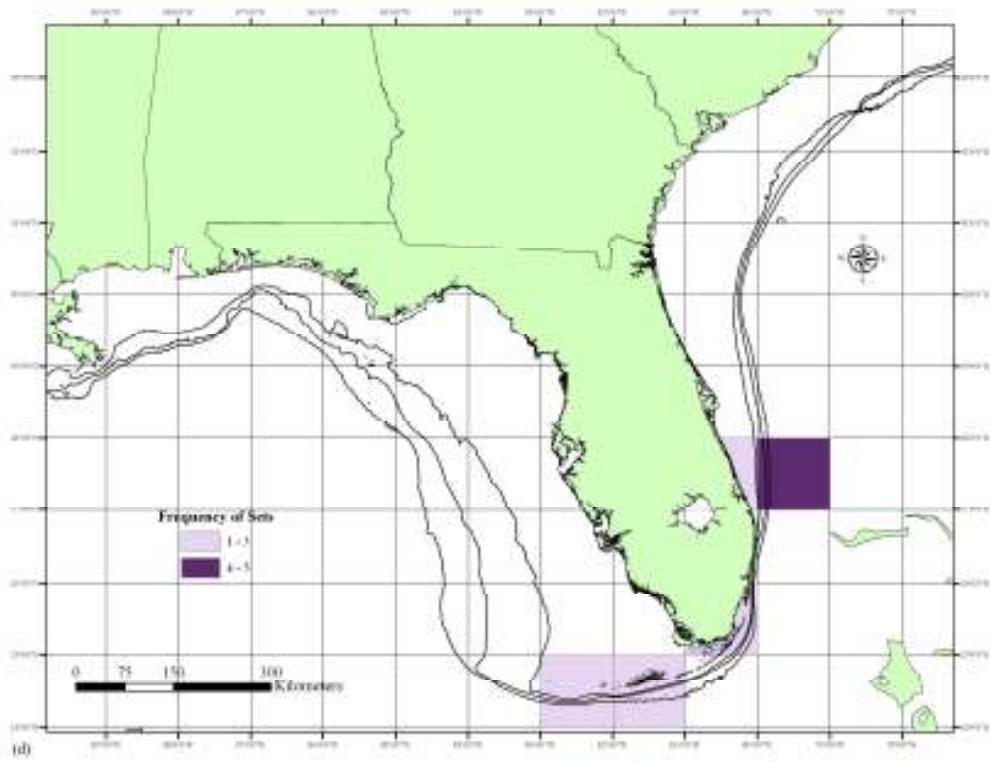


Figure 1. Distribution of all observed hauls by target in the Gulf of Mexico and U.S. Atlantic Ocean in 2009. (a) Frequency of sets targeting reef fish, (b) frequency of sets targeting sandbar shark, (c) frequency of sets targeting large coastal sharks, (d) frequency of sets targeting mixed species.



(c)



(d)



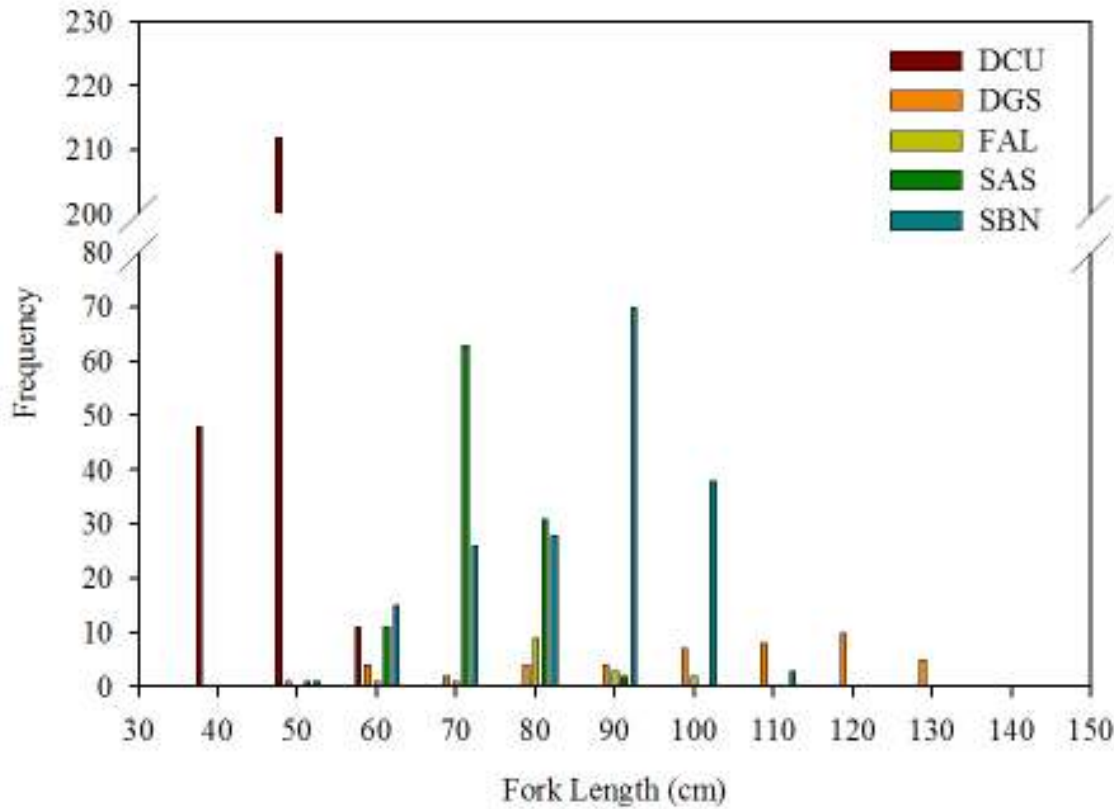


Figure 2. Length frequency (cm fork length) of sharks ( $n \geq 10$ ) observed caught on bottom longline sets targeting reef fish in the Gulf of Mexico and U.S. Atlantic Ocean. DCU = Cuban dogfish, DGS = Smooth dogfish, FAL = Silky shark, SAS = Atlantic sharpnose shark, and SBN = Blacknose shark.

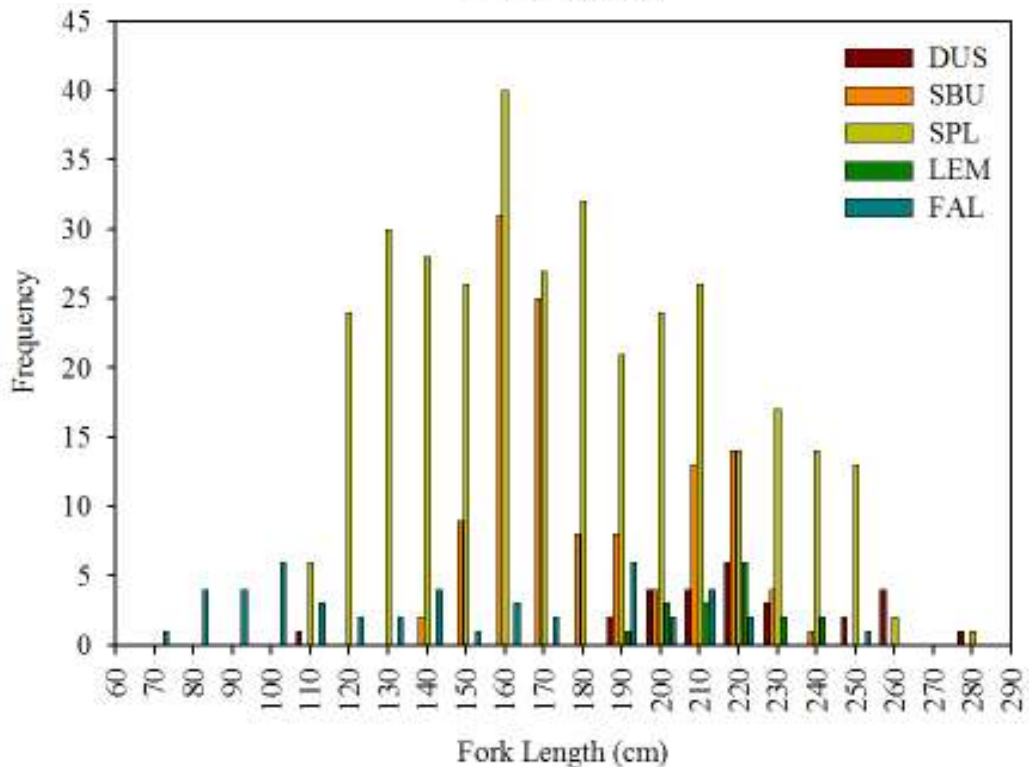
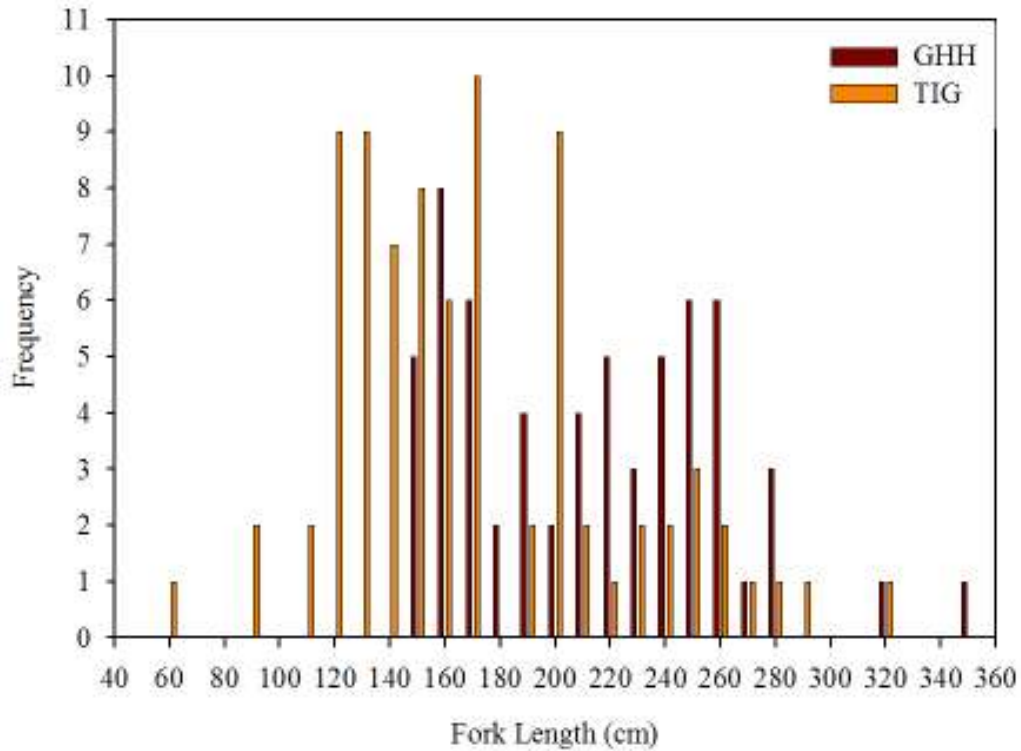


Figure 3. Length frequency (cm fork length) of sharks ( $n \geq 10$ ) observed caught on bottom longline sets targeting sandbar shark in the Gulf of Mexico and U.S. Atlantic Ocean. GHH = Great hammerhead shark, TIG = Tiger shark, DUS = Dusky shark, SBU = Bull shark, SPL = Scalloped hammerhead shark, LEM = Lemon shark, and FAL = Silky shark

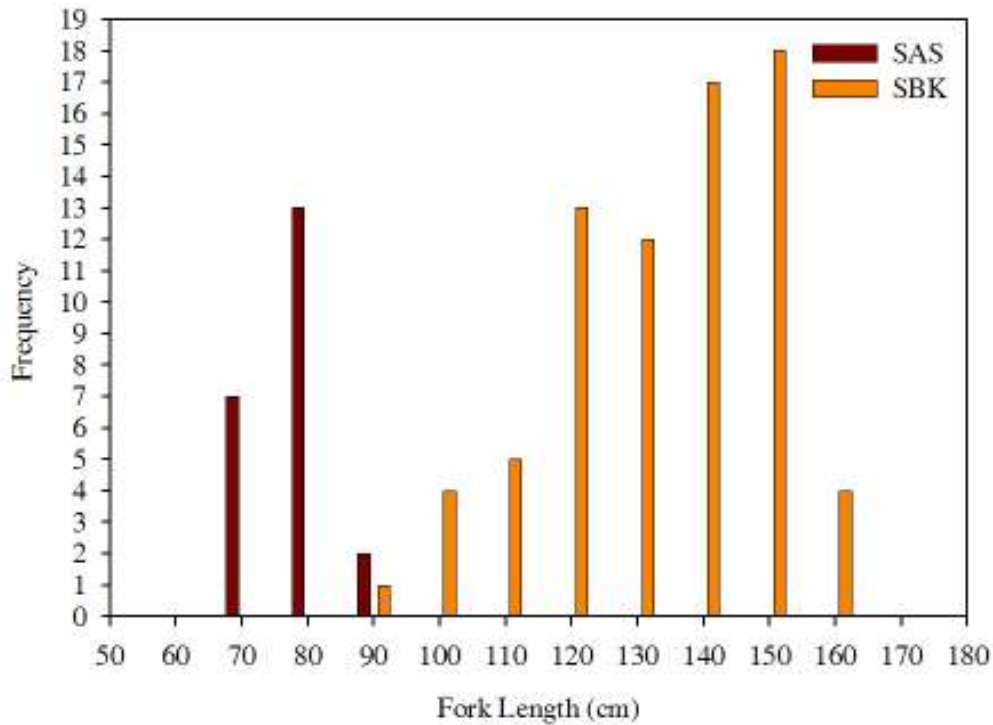
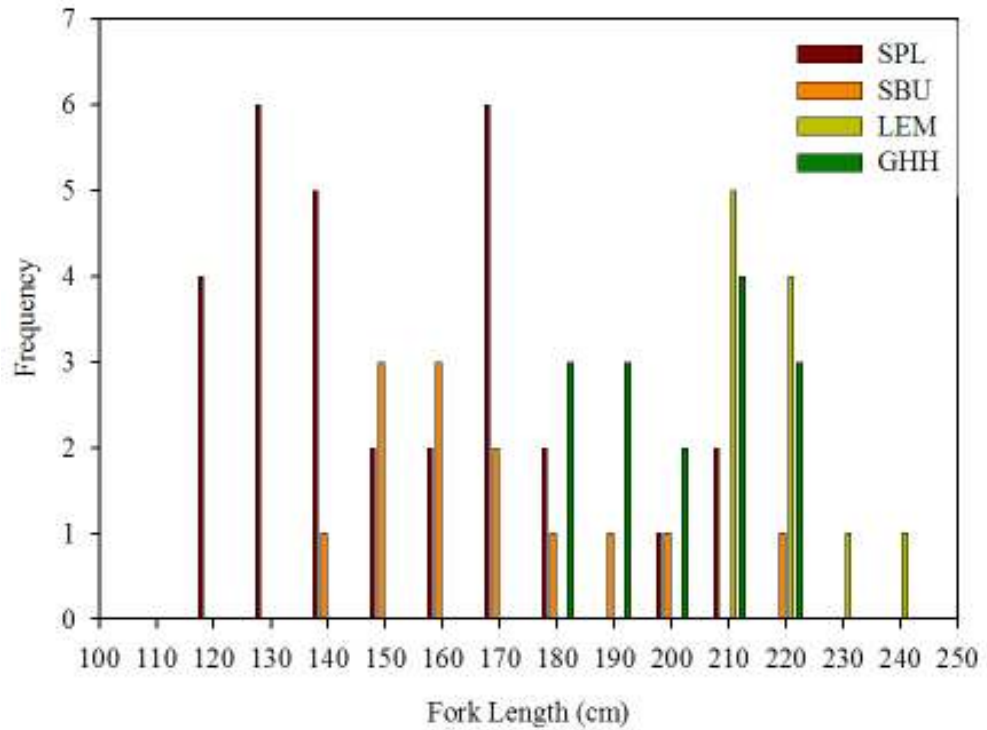


Figure 4. Length frequency (cm fork length) of sharks ( $n \geq 10$ ) observed caught on bottom longline sets targeting large coastal shark in the Gulf of Mexico and U.S. Atlantic Ocean. SPL = Scalloped hammerhead shark, SBU = Bull shark, LEM = Lemon shark, GHH = Great hammerhead shark, SAS = Atlantic sharpnose shark, and SBK = Blacktip shark

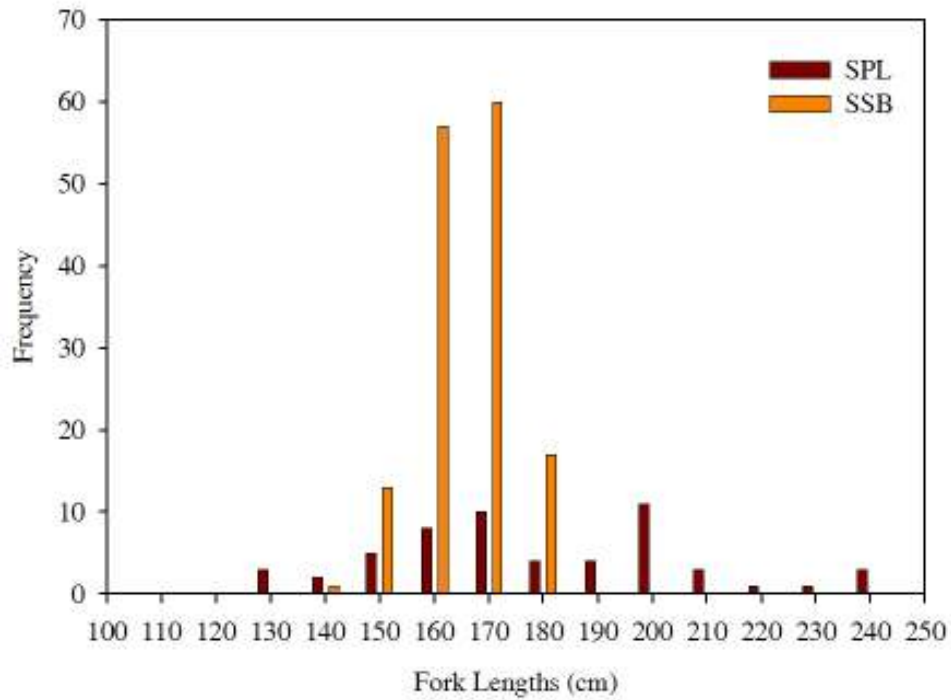


Figure 5. Length frequency (cm fork length) of sharks ( $n \geq 10$ ) observed caught on bottom longline sets targeting mixed species in the Gulf of Mexico and U.S. Atlantic Ocean. SPL = Scalloped hammerhead shark and SSB = Sandbar shark.