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CHARACTERIZATION OF THE SHARK BOTTOM LONGLINE FISHERY: 2010

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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, Hale et al., 2010). Currently 213 U.S. fishers are permitted to target sharks (excluding dogfish) in the Atlantic Ocean and Gulf of Mexico, and an additional 260 fishers are permitted to land sharks incidentally. Amendments to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan 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 (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 4-6% outside the research fishery). Outside the research fishery, fishers are permitted to land 33 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*).

The commercial reef fish fishery is an important fishery in the Gulf of Mexico. It involves 843 permitted vessels that target groupers and snapper and other reef fish species. Of these permitted vessels, approximately 7% have both reef fish and directed

shark permits. Thus, overlap occurs among longline vessels in both shark directed and reef fish fisheries, necessitating observer coverage in both fisheries.

Herein, we report on fishing activities in the bottom longline fishery for the 2010 fishing season, including coverage of the 2010 shark research fishery.

Methods

In October 2009, NMFS announced its request for applications for the shark research fishery from commercial shark fishers with a directed or incidental permit for 2010. 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, nine (9) qualified applicants were selected for observer coverage. These vessels carried observers on 100% of trips. Outside the research fishery and depending on the time of year and fishing season, vessels that targeted shark or reef fish, possessed current valid directed shark and reef fish permits, and reported fishing with longline gear in the previous year were randomly selected for coverage with a target coverage level of 2-3% for shark directed trips and 8% for reef fish directed trips. 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).

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 alive, discarded dead, etc.).

On shark research fishery trips, observers were required to randomly sample sharks, especially sandbar and blacktip 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 2010, a total of 138 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 23 vessels with a total of 718 bottom longline hauls (defined as setting

gear, soaking gear for some duration of time, and retrieving gear) were observed (Table 1). Gear characteristics of trips varied by area (Gulf of Mexico or the U.S. Atlantic Ocean) and target species (grouper/snapper (reef fish), non-sandbar large coastal shark, or sandbar shark). In several cases, the universe of vessels covered was less than three vessels in each area and the observed data were combined for Gulf of Mexico and U.S. Atlantic Ocean to protect confidentiality of vessels. The data were grouped by targets into four groups: a) hauls targeting shallow water reef fish (70.5% of reef fish targeted sets were shallower than 50 fathoms (<91.4 m) depth), b) hauls targeting deep water reef fish (29.5% of reef fish targeted sets were deeper than 50 fathoms (>91.4 m) depth), c) hauls targeting sandbar shark, and d) hauls targeting non-sandbar large coastal shark species (Figure 1).[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).

a) Gulf of Mexico shallow water reef fish targeted trips

i) Gear and haul characteristics

There were 383 hauls on 19 trips observed targeting shallow-water reef fish (mainly red grouper, *Epinephelus morio*) in the Gulf of Mexico. Trips averaged 13.2 sea days in length. The mainline length ranged from 0.4 to 8 km with an average of 4.8 km. The bottom depth fished ranged from 34 to 91 m with an average of 67 m, and the number of hooks ranged from 30 to 774 hooks with an average of 629 hooks fished. Circle hooks sized 13.0 were used 60.4% of the time, while circle hooks sized 14.0 were used 22.7% of the time. There were 128 hauls (33.3%) that employed two different types

[1] Gear, catch and bycatch information relative to trips utilizing "buoy" gear are described in a separate report (Hale et al. in prep).

of hooks, with 13.0 circle hooks used most commonly as the second hook (60.9%). The average soak duration (the time from when the last hook entered the water until the first hook was hauled back) was 1.3 hr.

ii) Catch and bycatch

There were 16,281 individual animals caught on observed bottom longline hauls targeting shallow water reef fish in the Gulf of Mexico (Table 2). Teleosts comprised 87.3% of the catch, followed by sharks (12.2%), invertebrates (0.5%), and batoids (0.05%). Red grouper was the most frequently caught species of teleost (75.7%), and Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, was the most frequently caught species of shark (42.3%). Small coastal shark species comprised 65.5% of the shark catch, large coastal shark species comprised 31.6%, and deep water sharks comprised 2.5%. The prohibited dusky shark, *Carcharhinus obscurus*, made up 0.3% of the shark catch. Length frequencies of shark species are presented in Figure 2.

iii) 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 shallow water reef fish.

b) Gulf of Mexico deep water reef fish targeted trips

i) Gear and haul characteristics

There were 161 hauls on 10 trips observed targeting deepwater grouper and tilefish (mainly yellowedge grouper, *Epinephelus flavolimbatus*) in the Gulf of Mexico. Trips averaged 13.3 sea days in length. The mainline length ranged from 1.2 to 7.5 km with an average of 4.0 km. The bottom depth fished ranged from 91.5 to 279 m with an

average of 185.9 m, and the number of hooks ranged from 166 to 921 hooks with an average of 577.2 hooks fished. Circle hooks sized 13.0 were utilized in 52.8% of hauls, while 41.6% of hauls used circle hooks sized 14.0. There were 60 hauls (37.3%) that employed two different types of hooks, with 15.0 circle hooks used most commonly as the second hook (73.3%). The average soak duration (the time from when the last hook entered the water until the first hook was hauled back) was 2.6 hr.

ii) Catch and bycatch

There were 4,308 individual animals caught on observed bottom longline hauls targeting reef fish in the Gulf of Mexico (Table 3). Teleosts comprised 89.7% of the catch, followed by sharks (9.1%), invertebrates (1.1%), and batoids (0.05%). Deepwater shark species comprised 80.7% of the shark catch, large coastal sharks comprised 8.5%, small coastal sharks comprised 1.4%, and pelagic sharks comprised 0.3%. Prohibited sharks including the bigeye sixgill shark, *Hexanchus vitulus* and the night shark, *Carcharhinus signatus*, made up 9.1% of the catch. Yellowedge grouper was the most frequently caught species of teleost (38.9%), and Cuban dogfish, *Squalus cubensis*, was the most frequently caught species of shark (49.7%). Length frequencies of shark species are presented in Figure 3.

iii) 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 deep water reef fish.

c) Gulf of Mexico and South Atlantic sandbar shark targeted trips

i) Gear and haul characteristics

There were 161 hauls on 105 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. Trips averaged 2.5 sea days in length. The mainline length ranged from 0.5 to 13.7 km with an average of 4.8 km. The bottom depth fished ranged from 4.5 to 232 m with an average of 39.8 m, and the number of hooks ranged from 31 to 1000 hooks with an average of 312.7 hooks fished. The most commonly used hook was the 18.0 circle hook (50.3%) with 12.0 J hooks used in 26.1% of hauls. There were 25 hauls (15.5%) that employed two different types of hooks, with 18.0 circle hooks used most commonly as the second hook (56%). The average soak duration was 12.8 hr.

ii) Catch and bycatch

There were 8,563 individual animals caught on observed bottom longline hauls targeting sandbar shark in the Gulf of Mexico and South Atlantic (Table 4). Sharks comprised 96.4% of the catch, followed by teleosts (2.1%), invertebrates (0.7%), and batoids (0.6%). Large coastal shark species comprised 82.8% of the shark catch, small coastal shark species comprised 13.9%, and deep water sharks comprised 0.1%. Prohibited shark species were also caught including the dusky shark, the Caribbean reef shark, *Carcharhinus perezi*, the sand tiger shark, *Carcharhias taurus*, and the great white shark, *Carcharodon carcharias* (3.2% of shark catch). Tilefish, *Lopholatilus chamaeleonticeps*, was the most frequently caught species of teleost (39.4%) and sandbar shark was the most frequently caught species of shark (50.4%). 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 South Atlantic regions targeting sandbar shark (Table 5). Nine (9) smalltooth sawfish and three (3) loggerhead sea turtles were observed caught in bottom longline gear. No sea bird or marine mammal interactions were observed.

d) Gulf of Mexico and South Atlantic large coastal shark targeted trips

i) Gear and haul characteristics

There were 13 hauls on 12 trips observed targeting large coastal shark in the Gulf of Mexico and South Atlantic. The mainline length ranged from 1.9 to 11.9 km with an average of 6.4 km. The bottom depth fished ranged from 9.0 to 76.0 m with an average of 26.5 m, and the number of hooks ranged from 156 to 671 hooks with an average of 421 hooks fished. The most commonly used hook was the 12.0 J hook (61.5%) with 18.0 circle hook used in 30.8% of hauls. There were two hauls (15.4%) that employed two different types of hooks, with 18.0 circle hooks and 19.0 circle hooks used as the second hook. The average soak duration was 15.9 hr.

ii) Catch and bycatch

There were 1,068 individual animals caught on observed bottom longline hauls targeting large coastal shark in the Gulf of Mexico and South Atlantic (Table 6). Sharks comprised 97.5% of the catch, followed by teleosts (2.2%), and batoids (0.2%). Large coastal shark species comprised 52.9% of the shark catch, small coastal shark species comprised 46.6%, and deep water sharks comprised 0.2% of the shark catch. Gafftopsail catfish, *Bagre marinus*, was the most frequently caught species of teleost (65.2%) and

Atlantic sharpnose shark was the most frequently caught species of shark (44.9%). Length frequencies of shark species are presented in Figure 5.

iii) Protected species interactions

Interactions with protected resources were observed for bottom longline vessels fishing in the Gulf of Mexico region targeting shark (Table 7). One (1) smalltooth sawfish and one (1) loggerhead sea turtle was observed caught in bottom longline gear. No sea bird or marine mammal interactions were observed.

Discussion

In 2010 the shark bottom longline observer program covered vessels in the Gulf of Mexico and U.S. South Atlantic Ocean, with the majority of trips observed targeting sandbar shark in the shark research fishery. This effort was an increase over that obtained in 2009 (Hale et al., 2010). Research fishery data and biological samples were collected in every month in all areas. Samples of vertebrae and reproductive tracts from over 1200 sandbar sharks were collected by observers in 2008 - 2010 from the research fishery, and the resulting age and growth and reproductive analyses were presented at the June stock assessment data workshop for sandbar, dusky, and blacknose sharks (SEDAR 21; Hale and Baremore, in review and Baremore and Hale, in review). Due to the bycatch of sea turtles in the Gulf of Mexico reef fish fishery, observer coverage of this fishery was expanded in 2010. Although no sea turtle bycatch was observed by SBLOP in the reef fish fishery, the expanded coverage allowed for the collection of biological samples including otoliths and reproductive tracts.

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Table 1. Number of vessels, trips, hauls, and hook hours observed in the Gulf of Mexico (GOM) and southern U.S. Atlantic Ocean (SA) for all target species. The total number of unique vessels and trips are reported in brackets. Target species include shallow water reef fish (SWGRP), deep water grouper (DWGRP), large coastal shark (SHX), and sandbar shark (SSB).

Area and Target	Vessels Observed	Trips Observed	Hauls Observed	Hook Hours
GOM SWGRP	13	19	383	288602.7
GOM DWGRP	9	10	161	227669.9
GOM/SA SSB	8	105	161	4014.3
GOM/SA SHX	5	12	13	6671.3
Total	35 (23)	146 (138)	718	526958.2

Table 2. Number caught (n) and disposition of catch in percentage for all observed hauls targeting shallow water 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
Epinephelus morio	Red grouper	10755	59.5	7.2	33.2	0.1
Lutjanus campechanus	Red snapper	1197	32.9	12.2	54.6	0.3
Rhizoprionodon terraenovae	Atlantic sharpnose shark	837	1.7	9.7	88.5	0.1
Mycteroperca phenax	Scamp grouper	724	96.1	1.2	2.5	0.1
Mycteroperca microlepis	Gag grouper	437	96.1	1.6	2.3	0.0
Carcharhinus acronotus	Blacknose shark	347	2.9	7.2	89.9	0.0
Carcharhinus plumbeus	Sandbar shark	206	1.9	1.0	96.1	1.0
Lutjanus analis	Mutton snapper	192	99.0	0.0	1.0	0.0
Galeocerdo cuvier	Tiger shark	163	1.8	1.8	96.3	0.0
Carcharhinidae	Requiem shark family	119	1.7	1.7	96.6	0.0
Epinephelus drummondhayi	Speckled hind	105	45.7	3.8	50.5	0.0
Pagrus pagrus	Red porgy	82	70.7	6.1	23.2	0.0
Sphyraena barracuda	Great barracuda	75	2.7	9.3	88.0	0.0
Opsanus pardus	Leopard toadfish	62	71.0	4.8	24.2	0.0
Muraena retifera	Reticulate moray eel	55	90.9	7.3	1.8	0.0
Sphyrna lewini	Scalloped hammerhead shark	55	9.1	9.1	80.0	1.8
Elasmobranchii	Sharks	51	0.0	13.7	86.3	0.0
Carcharhinus limbatus	Blacktip shark	49	2.0	18.4	79.6	0.0
Ginglymostoma cirratum	Nurse shark	47	0.0	0.0	100.0	0.0
Mustelus canis	Smooth dogfish	45	4.4	6.7	88.9	0.0
Anthozoa	Coral	38	0.0	52.6	0.0	47.4
Calamus bajonado	Jolthead porgy	38	76.3	10.5	13.2	0.0
Echeneis naucrates	Sharksucker	38	2.6	0.0	97.4	0.0
Gymnothorax moring	Spotted moray eel	37	81.1	16.2	2.7	0.0
Serranidae	Grouper family	30	96.7	0.0	3.3	0.0
Carcharhinus falciformis	Silky shark	29	0.0	24.1	75.9	0.0
Euthynnus alletteratus	Little tunny	28	53.6	21.4	21.4	3.6
Balistes capriscus	Gray triggerfish	22	90.9	0.0	9.1	0.0
Seriola dumerili	Greater amberjack	22	77.3	4.5	18.2	0.0
Rhomboplites aurorubens	Vermillion snapper	22	45.5	27.3	27.3	0.0
Sparidae	Porgy family	18	38.9	5.6	50.0	5.6
Mycteroperca bonaci	Black grouper	17	100.0	0.0	0.0	0.0
Rachycentron canadum	Cobia	17	82.4	0.0	17.6	0.0
Thunnus sp.	Tunas	17	29.4	64.7	5.9	0.0
Porifera	Sponges	16	0.0	75.0	6.3	18.8
Synodontidae	Lizardfish family	15	33.3	20.0	46.7	0.0
Seriola zonata	Banded rudderfish	14	28.6	7.1	64.3	0.0
Serranidae	Seabass family	14	28.6	21.4	50.0	0.0
Sarda sarda	Bonito	13	100.0	0.0	0.0	0.0
Muraenidae	Moray eel family	13	84.6	7.7	7.7	0.0
Carcharhinus leucas	Bull shark	12	0.0	0.0	100.0	0.0
Lutjanus griseus	Gray snapper	12	100.0	0.0	0.0	0.0
Asteroidea	Sea stars	12	0.0	0.0	25.0	75.0
Sphyraenidae	Barracuda family	9	22.2	55.6	22.2	0.0
Thunnus atlanticus	Blackfin tuna	9	66.7	33.3	0.0	0.0

Table 2. cont'd

Scientific name	Common Name	n	% K	% DD	% DA	% U
Synodus foetens	Inshore lizardfish	8	87.5	0.0	12.5	0.0
Lutjanus synagris	Lane snapper	8	50.0	12.5	37.5	0.0
Synodus intermedius	Sanddiver lizardfish	8	75.0	25.0	0.0	0.0
Majidae	Spider crabs	8	0.0	0.0	100.0	0.0
Epinephelus itajara	Goliath grouper	7	0.0	100.0	0.0	0.0
Carcharhinus obscurus	Dusky shark	6	0.0	33.3	66.7	0.0
Seriola sp.	Amberjacks	5	0.0	80.0	20.0	0.0
Congridae	Conger eels	5	60.0	0.0	40.0	0.0
Sphyrna sp.	Hammerhead sharks	5	0.0	20.0	80.0	0.0
Ophichthus ocellatus	Pale-spotted eel	5	80.0	0.0	20.0	0.0
Holocentrus sp.	Squirrelfishes	5	60.0	20.0	20.0	0.0
Epinephelus flavolimbatus	Yellowedge grouper	5	100.0	0.0	0.0	0.0
Coryphaena hippurus	Dolphinfish	4	0.0	100.0	0.0	0.0
Calappa flammea	Flame box crab	4	0.0	0.0	100.0	0.0
Osteichthyes	Unknown teleost	4	100.0	0.0	0.0	0.0
Paralichthys sp.	Flounders	3	0.0	33.3	66.7	0.0
Tetraodontidae	Puffer family	3	33.3	0.0	66.7	0.0
Remora remora	Remora	3	33.3	0.0	66.7	0.0
Echeneidae	Remora family	3	33.3	0.0	66.7	0.0
Rajiformes	Skates and rays	3	0.0	0.0	100.0	0.0
Trachinocephalus myops	Snakefish	3	100.0	0.0	0.0	0.0
Carcharhinus brevipinna	Spinner shark	3	0.0	0.0	100.0	0.0
Dasyatis sp.	Stingrays	3	0.0	0.0	100.0	0.0
Seriola rivoliana	Almaco jack	2	50.0	0.0	50.0	0.0
Anguilliformes	Eels	2	50.0	50.0	0.0	0.0
Sphyrna mokarran	Great hammerhead shark	2	0.0	50.0	50.0	0.0
Opsanus beta	Gulf toadfish	2	0.0	0.0	100.0	0.0
Caranx sp.	Jacks	2	100.0	0.0	0.0	0.0
Seriola fasciata	Lesser amberjack	2	100.0	0.0	0.0	0.0
Nephropidae	Lobsters	2	0.0	0.0	100.0	0.0
Haemulon album	Margate grunt	2	50.0	50.0	0.0	0.0
Calamus calamus	Saucereye porgy	2	50.0	0.0	50.0	0.0
Lutjanidae	Snapper family	2	100.0	0.0	0.0	0.0
Dasyatis americana	Southern stingray	2	0.0	0.0	100.0	0.0
Polychaeta	Worms	2	0.0	0.0	100.0	0.0
Lutjanus buccanella	Blackfin snapper	1	100.0	0.0	0.0	0.0
Sphyrna tiburo	Bonnethead shark	1	0.0	0.0	100.0	0.0
Decapoda	Crabs	1	0.0	0.0	100.0	0.0
Urophycis cirrata	Gulf hake	1	100.0	0.0	0.0	0.0
Merluccius sp.	Hakes	1	0.0	0.0	100.0	0.0
Carangidae	Jack family	1	0.0	100.0	0.0	0.0
Scomberomorus cavalla	King mackerel	1	100.0	0.0	0.0	0.0
Negaprion brevirostris	Lemon shark	1	0.0	0.0	100.0	0.0
Isurus sp.	Mako sharks	1	0.0	0.0	100.0	0.0
Lagodon rhomboides	Pinfish	1	100.0	0.0	0.0	0.0
Epinephelus adscensionis	Rock hind	1	0.0	0.0	0.0	100.0

Table 2. cont'd

Scientific name	Common Name	n	% K	% DD	% DA	% U
Diplectrum formosum	Sand perch	1	0.0	100.0	0.0	0.0
Malacanthus plumieri	Sand tilefish	1	0.0	0.0	100.0	0.0
Echinodermata	Sea urchins	1	0.0	0.0	0.0	100.0
Lutjanus vivanus	Silk snapper	1	100.0	0.0	0.0	0.0
Paralichthys lethostigma	Southern flounder	1	0.0	0.0	100.0	0.0
Urophycis floridana	Southern hake	1	100.0	0.0	0.0	0.0
Cephalopoda	Squid	1	100.0	0.0	0.0	0.0
Acanthocybium solanderi	Wahoo	1	0.0	100.0	0.0	0.0
Haemulon plumieri	White grunt	1	100.0	0.0	0.0	0.0
Echeneis neucratoides	Whitefin sharksucker	1	0.0	0.0	100.0	0.0
Labridae	Wrasse family	1	0.0	100.0	0.0	0.0
Mycteroperca interstitialis	Yellowmouth grouper	1	100.0	0.0	0.0	0.0
Ocyurus chrysurus	Yellowtail snapper	1	100.0	0.0	0.0	0.0
Antennariidae	Frogfish family	1	100.0	0.0	0.0	0.0

Table 3. Number caught (n) and disposition of catch in percentage for all observed hauls targeting deep water 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
Epinephelus flavolimbatus	Yellowedge grouper	1502	94.4	1.1	4.5	0.1
Lopholatilus chamaeleonticeps	Tilefish	448	85.9	2.7	11.2	0.2
Ophichthus rex	King snake eel	409	98.0	0.0	0.2	1.7
Caulolatilus microps	Blueline tilefish	362	33.1	13.5	52.8	0.6
Epinephelus niveatus	Snowy grouper	202	80.7	3.0	16.3	0.0
Squalus cubensis	Cuban dogfish	195	0.0	15.4	84.6	0.0
Muraenidae	Moray eel family	162	70.4	11.1	17.3	1.2
Urophycis floridana	Southern hake	117	65.0	9.4	23.1	2.6
Mustelus canis	Smooth dogfish	98	2.0	2.0	94.9	1.0
Pagrus pagrus	Red porgy	81	92.6	2.5	4.9	0.0
Epinephelus morio	Red grouper	65	95.4	1.5	3.1	0.0
Epinephelus drummondhayi	Speckled hind	64	78.1	7.8	14.1	0.0
Brotula barbata	Bearded brotula	59	94.9	1.7	1.7	1.7
Mycteroperca phenax	Scamp grouper	58	96.6	0.0	3.4	0.0
Lutjanus campechanus	Red snapper	47	4.3	29.8	66.0	0.0
Neomerinthe hemingwayi	Spinycheek scorpionfish	43	93.0	2.3	4.7	0.0
Mycteroperca microlepis	Gag grouper	38	100.0	0.0	0.0	0.0
Hexanchus vitulus	Bigeye sixgill shark	31	0.0	19.4	80.6	0.0
Congridae	Conger eels	31	100.0	0.0	0.0	0.0
Seriola dumerili	Greater amberjack	28	64.3	0.0	35.7	0.0
Muraena retifera	Reticulate moray eel	28	82.1	7.1	10.7	0.0
Majidae	Spider crabs	27	3.7	0.0	88.9	7.4
Carcharhinidae	Requiem shark family	18	0.0	11.1	88.9	0.0
Ophichthus ocellatus	Pale-spotted eel	15	93.3	0.0	6.7	0.0
Holothuroideae	Sea cucumber	15	100.0	0.0	0.0	6.7
Merluccius sp.	Hakes	13	100.0	0.0	0.0	0.0
Anguilliformes	Eels	12	41.7	8.3	50.0	0.0
Sphyrna lewini	Scalloped hammerhead shark	11	0.0	0.0	90.9	9.1
Elasmobranchii	Sharks	11	0.0	9.1	81.8	9.1
Seriola sp.	Amberjacks	10	0.0	10.0	90.0	0.0
Euthynnus alletteratus	Little tunny	10	30.0	60.0	10.0	0.0
Etelis oculatus	Queen snapper	10	90.0	10.0	0.0	0.0
Coryphaena hippurus	Dolphinfish	9	55.6	44.4	0.0	0.0
Carcharhinus falciformis	Silky shark	8	0.0	25.0	75.0	0.0
Carcharhinus plumbeus	Sandbar shark	6	0.0	0.0	100.0	0.0
Rhizoprionodon terraenovae	Atlantic sharpnose shark	5	0.0	60.0	40.0	0.0
Anthozoa	Coral	5	0.0	40.0	0.0	60.0
Tetraodontidae	Puffer family	5	0.0	0.0	100.0	0.0
Lutjanus vivanus	Silk snapper	5	100.0	0.0	0.0	0.0
Galeocerdo cuvier	Tiger shark	5	0.0	0.0	100.0	0.0
Sphyraena barracuda	Great barracuda	4	25.0	25.0	50.0	0.0
Thunnus sp.	Tunas	4	50.0	25.0	25.0	0.0
Paralichthys sp.	Flounders	3	66.7	0.0	33.3	0.0
Synodontidae	Lizardfish family	2	50.0	50.0	0.0	0.0
Pontinus longispinis	Longspine scorpionfish	2	50.0	0.0	50.0	0.0

Table 3. cont'd

Scientific name	Common name	n	% K	% DD	% DA	% U
Carcharhinus signatus	Night shark	2	0.0	0.0	100.0	0.0
Dipturus garricki	San Blas skate	2	0.0	0.0	100.0	0.0
Acanthocybium solanderi	Wahoo	2	100.0	0.0	0.0	0.0
Mycteroperca bonaci	Black grouper	1	100.0	0.0	0.0	0.0
Thunnus atlanticus	Blackfin tuna	1	100.0	0.0	0.0	0.0
Carcharhinus limbatus	Blacktip shark	1	0.0	100.0	0.0	0.0
Cancer sp.	Cancer crabs	1	0.0	0.0	100.0	0.0
Serranidae	Grouper family	1	0.0	100.0	0.0	0.0
Paralichthys albigutta	Gulf flounder	1	100.0	0.0	0.0	0.0
Urophycis cirrata	Gulf hake	1	0.0	0.0	100.0	0.0
Isurus sp.	Mako sharks	1	0.0	100.0	0.0	0.0
Lophius sp.	Monkfish anglerfish	1	0.0	100.0	0.0	0.0
Fistularia petimba	Red Cornetfish	1	0.0	0.0	100.0	0.0
Echeneidae	Remora family	1	0.0	0.0	100.0	0.0
Synodus intermedius	Sanddiver lizardfish	1	100.0	0.0	0.0	0.0
Serranidae	Seabass family	1	100.0	0.0	0.0	0.0
Echeneis naucrates	Sharksucker	1	100.0	0.0	0.0	0.0
Gymnothorax moring	Spotted moray eel	1	100.0	0.0	0.0	0.0
Xiphius gladius	Swordfish	1	100.0	0.0	0.0	0.0
Epinephelus nigritus	Warsaw grouper	1	100.0	0.0	0.0	0.0
Thunnus albacares	Yellowfin tuna	1	100.0	0.0	0.0	0.0

Table 4. 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
Carcharhinus plumbeus	Sandbar shark	4157	69.1	7.7	22.3	1.0
Galeocerdo cuvier	Tiger shark	988	34.9	5.0	58.8	1.3
Rhizoprionodon terraenovae	Atlantic sharpnose shark	891	35.6	60.5	3.9	0.0
Carcharhinus limbatus	Blacktip shark	565	60.0	29.6	7.8	2.7
Ginglymostoma cirratum	Nurse shark	335	0.9	1.5	96.1	1.5
Carcharhinus acronotus	Blacknose shark	239	16.7	76.2	6.3	0.8
Carcharhinus leucas	Bull shark	219	76.3	0.5	21.0	2.3
Sphyrna lewini	Scalloped hammerhead shark	212	81.1	10.8	6.1	1.9
Carcharhinus obscurus	Dusky shark	192	0.0	67.2	32.3	0.5
Sphyrna mokarran	Great hammerhead shark	149	81.9	18.1	0.0	0.0
Negaprion brevirostris	Lemon shark	107	89.7	0.0	6.5	3.7
Lopholatilus chamaeleonticeps	Tilefish	71	70.4	0.0	0.0	29.6
Carcharhinus brevipinna	Spinner shark	61	80.3	14.8	3.3	1.6
Carcharhias taurus	Sand tiger shark	60	5.0	0.0	95.0	0.0
Asteroidea	Sea stars	52	0.0	0.0	100.0	0.0
Carcharhinus falciformis	Silky shark	32	56.3	40.6	3.1	0.0
Epinephelus morio	Red grouper	21	33.3	28.6	38.1	0.0
Dasyatis americana	Southern stingray	19	0.0	10.5	89.5	0.0
Sphyrna tiburo	Bonnethead shark	15	40.0	60.0	0.0	0.0
Epinephelus itajara	Goliath grouper	14	7.1	42.9	50.0	0.0
Urophycis floridana	Southern hake	13	84.6	0.0	7.7	7.7
Anthozoa	Coral	8	0.0	100.0	0.0	0.0
Dasyatis centroura	Roughtail stingray	8	12.5	0.0	87.5	0.0
Elasmobranchii	Sharks	8	0.0	37.5	25.0	37.5
Dasyatis sp.	Stingrays	8	12.5	0.0	87.5	0.0
Raja eglanteria	Clearnose skate	6	0.0	0.0	100.0	0.0
Sphyraena barracuda	Great barracuda	6	50.0	33.3	0.0	16.7
Seriola dumerili	Greater amberjack	6	83.3	16.7	0.0	0.0
Rajiformes	Skates and rays	6	0.0	0.0	100.0	0.0
Mustelus canis	Smooth dogfish	6	33.3	33.3	33.3	0.0
Rachycentron canadum	Cobia	5	60.0	40.0	0.0	0.0
Carcharodon carcharias	Great white shark	5	0.0	40.0	60.0	0.0
Sphyrna zygaena	Smooth hammerhead shark	5	100.0	0.0	0.0	0.0
Batrachoididae	Toadfish family	5	20.0	20.0	60.0	0.0
Centropristis striata	Black seabass	4	75.0	0.0	25.0	0.0
Carcharhinus perezi	Caribbean reef shark	4	0.0	50.0	50.0	0.0
Anguilliformes	Eels	4	0.0	50.0	25.0	25.0
Muraenidae	Moray eel family	4	0.0	75.0	25.0	0.0
Lutjanus analis	Mutton snapper	4	100.0	0.0	0.0	0.0
Epinephelus niveatus	Snowy grouper	4	50.0	50.0	0.0	0.0
Seriola rivoliana	Almaco jack	3	66.7	33.3	0.0	0.0
Scianops ocellatus	Red drum	3	0.0	33.3	66.7	0.0
Sphyraenidae	Barracuda family	2	50.0	50.0	0.0	0.0
Mycteroperca bonaci	Black grouper	2	50.0	50.0	0.0	0.0

Table 4. cont'd

Scientific Name	Common Name	n	% K	% DD	% DA	% U
Cancer sp.	Cancer crabs	2	0.0	0.0	100.0	0.0
Alopias vulpinus	Common thresher shark	2	100.0	0.0	0.0	0.0
Carcharhinus isodon	Finetooth shark	2	0.0	100.0	0.0	0.0
Sphyrna sp.	Hammerhead sharks	2	0.0	50.0	0.0	50.0
Ophichthus ocellatus	Pale-spotted eel	2	0.0	50.0	50.0	0.0
Gymnothorax moring	Spotted moray eel	2	0.0	100.0	0.0	0.0
Scyliorhinus retifer	Chain catshark	1	0.0	0.0	100.0	0.0
Rhinoptera bonasus	Cownose ray	1	0.0	0.0	100.0	0.0
Squalus cubensis	Cuban dogfish	1	0.0	0.0	100.0	0.0
Lutjanus cyanopterus	Cubera snapper	1	100.0	0.0	0.0	0.0
Mollusca	Molluscs	1	0.0	0.0	100.0	0.0
Lutjanus campechanus	Red snapper	1	0.0	100.0	0.0	0.0
Remora remora	Remora	1	0.0	0.0	100.0	0.0
Echeneidae	Remora family	1	0.0	0.0	100.0	0.0
Epinephelus drummondhayi	Speckled hind	1	0.0	100.0	0.0	0.0
Porifera	Sponges	1	0.0	100.0	0.0	0.0

Table 5. 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
Pristis pectinata	Smalltooth sawfish	9	0.0	100.0	0.0
Caretta caretta	Loggerhead sea turtle	3	33.3	66.7	0.0

Table 6. 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
Rhizoprionodon terraenovae	Atlantic sharpnose shark	467	21.8	77.1	1.1	0.0
Ginglymostoma cirratum	Nurse shark	196	0.0	0.5	99.5	0.0
Galeocerdo cuvier	Tiger shark	140	71.4	1.4	25.0	2.1
Carcharhinus limbatus	Blacktip shark	72	93.1	5.6	0.0	1.4
Sphyrna lewini	Scalloped hammerhead shark	50	88.0	12.0	0.0	0.0
Carcharhinus plumbeus	Sandbar shark	44	0.0	20.5	79.5	0.0
Negaprion brevirostris	Lemon shark	20	80.0	0.0	0.0	20.0
Carcharhinus acronotus	Blacknose shark	18	0.0	77.8	22.2	0.0
Bagre marinus	Gafftopsail catfish	15	73.3	26.7	0.0	0.0
Carcharhinus leucas	Bull shark	13	84.6	15.4	0.0	0.0
Sphyrna mokarran	Great hammerhead shark	11	100.0	0.0	0.0	0.0
Scianops ocellatus	Red drum	4	0.0	0.0	100.0	0.0
Carcharhinus brevipinna	Spinner shark	4	100.0	0.0	0.0	0.0
Elasmobranchii	Sharks	3	0.0	100.0	0.0	0.0
Raja eglanteria	Clearnose skate	2	100.0	0.0	0.0	0.0
Rachycentron canadum	Cobia	2	50.0	50.0	0.0	0.0
Epinephelus itajara	Goliath grouper	2	0.0	0.0	100.0	0.0
Mustelus canis	Smooth dogfish	2	0.0	50.0	50.0	0.0
Sphyrna sp.	Hammerhead sharks	1	0.0	100.0	0.0	0.0

Table 7. Number (n) of protected species interactions for all observed hauls targeting large coastal 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
Caretta caretta	Loggerhead sea turtle	1	100.0	0.0	0.0
Pristis pectinata	Smalltooth sawfish	1	0.0	100.0	0.0

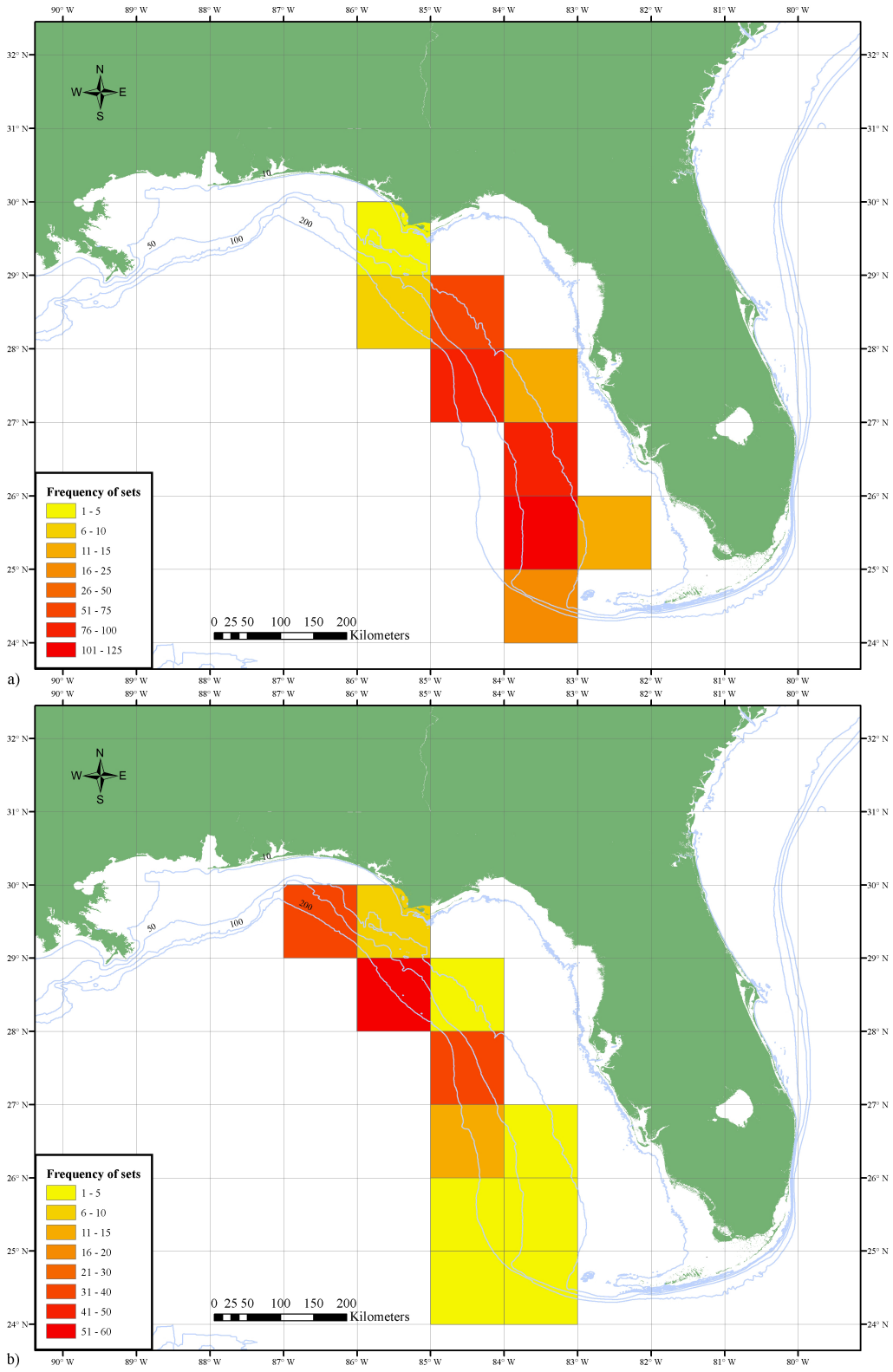


Figure 1. Distribution of all observed hauls by target in the Gulf of Mexico and U.S. Atlantic Ocean in 2010. (a) Frequency of sets targeting shallow water reef fish, (b) frequency of sets targeting deep water reef fish

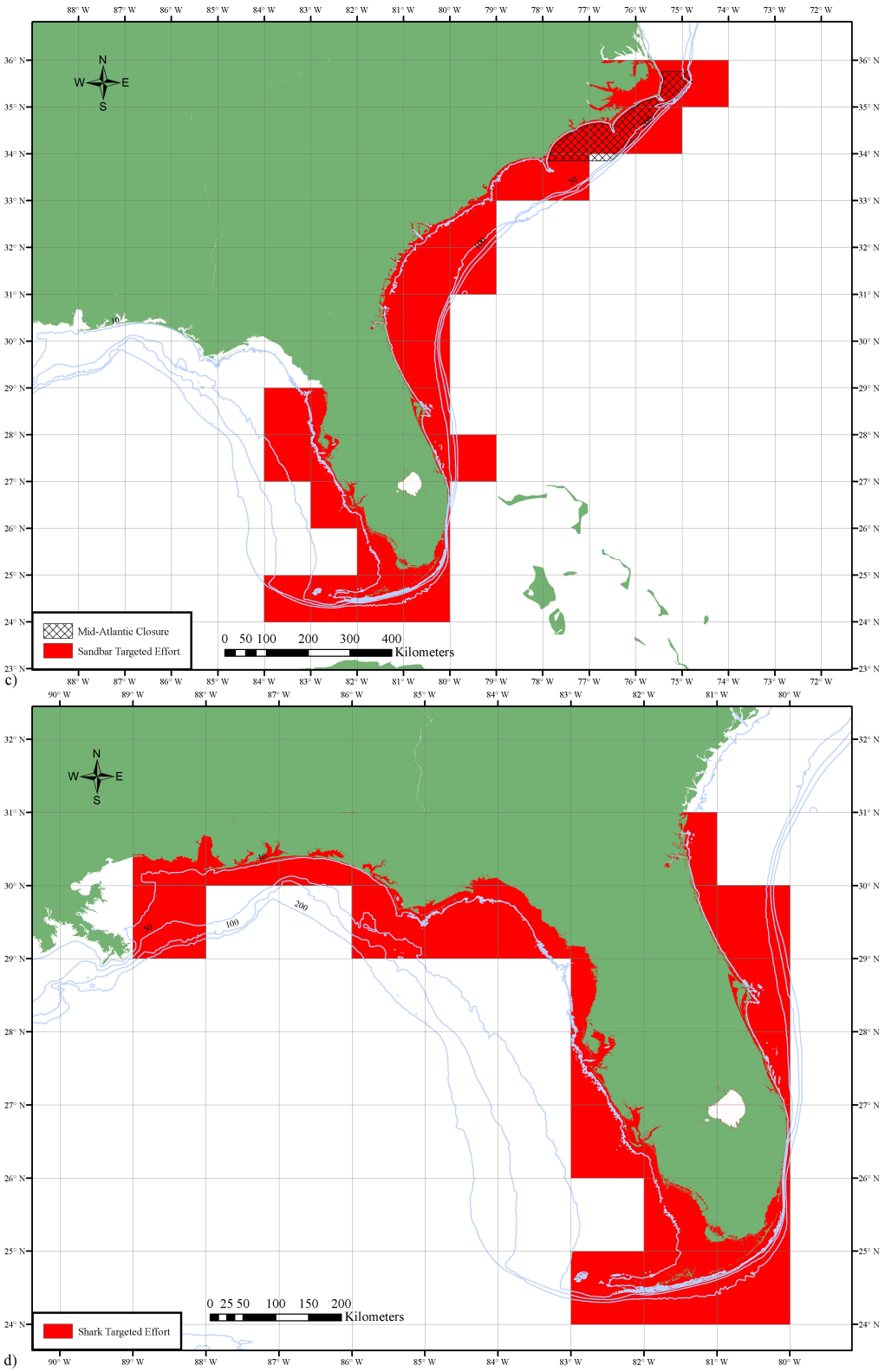
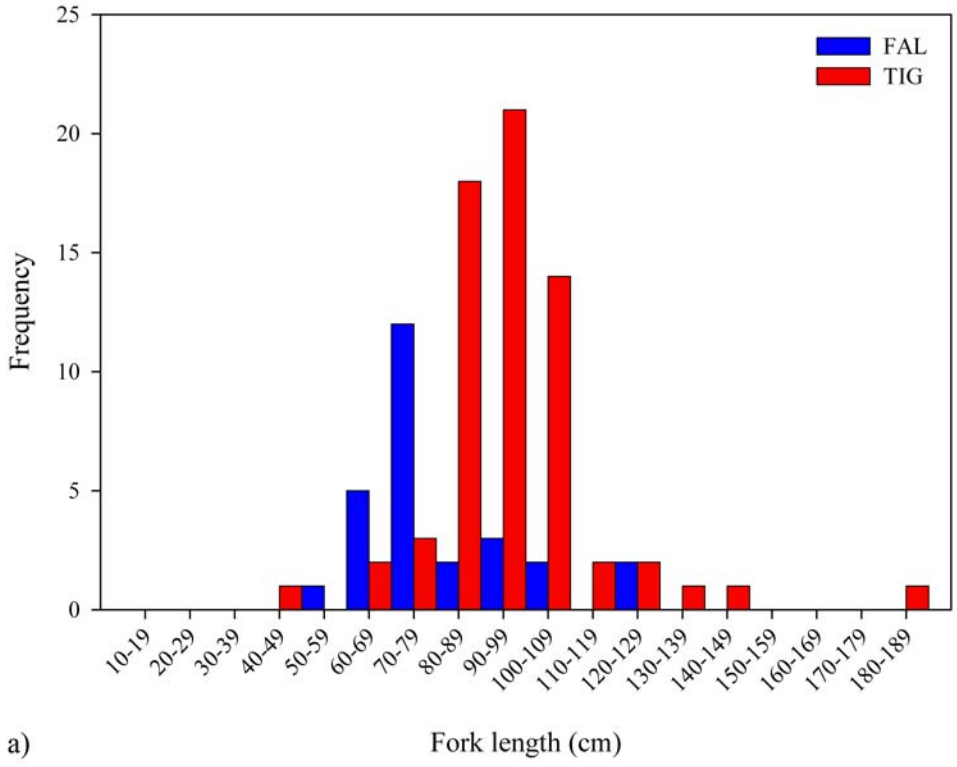
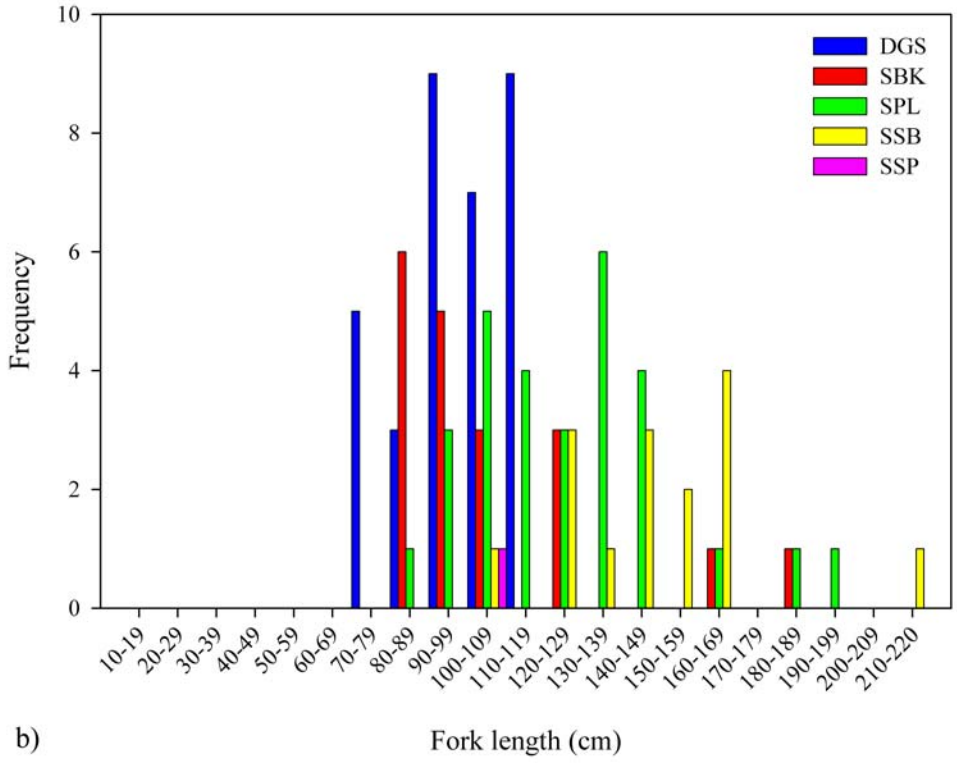


Figure 1 cont'd. Distribution of all observed hauls by target in the Gulf of Mexico and U.S. Atlantic Ocean in 2010. Frequency of sets not reported due to confidentiality considerations. (c) Distribution of effort targeting sandbar shark, (d) distribution of effort targeting large coastal sharks.

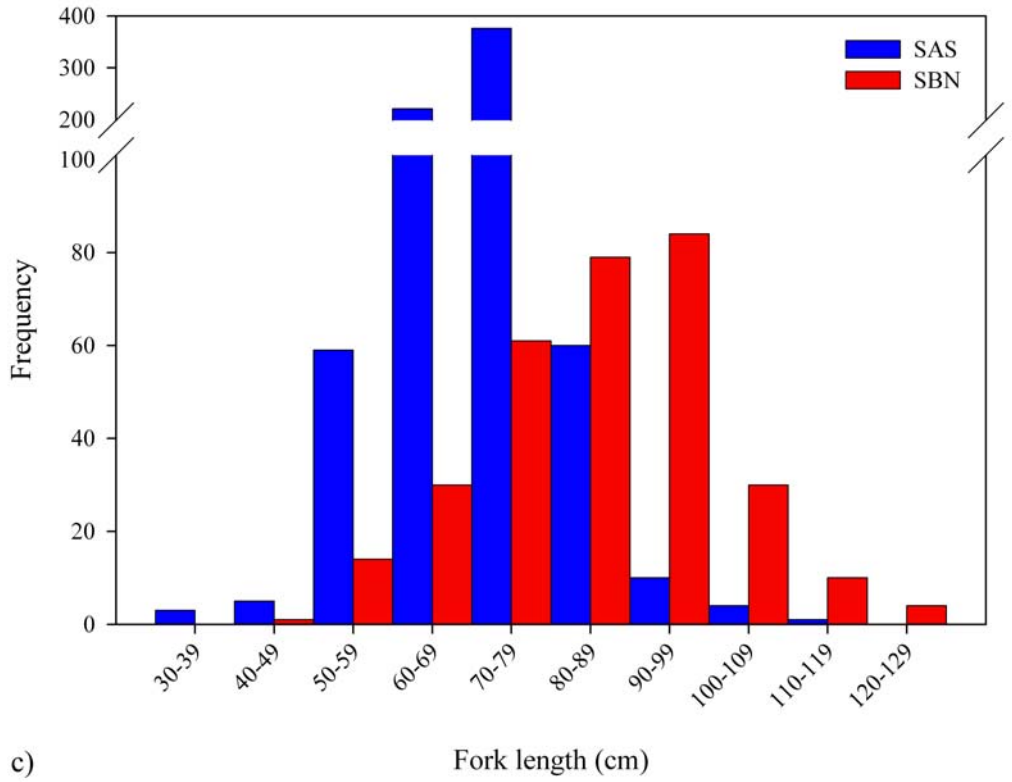


a)



b)

Figure 2. Length frequency (cm fork length) of a) silky (FAL) and tiger (TIG) sharks, b) smooth dogfish (DGS), blacktip (SBK), scalloped hammerhead (SPL), sandbar (SSB), and spinner (SSP) sharks observed caught on bottom longline sets targeting shallow water reef fish in the Gulf of Mexico and U.S. Atlantic Ocean.



c)

Figure 2 cont'd. Length frequency (cm fork length) of c) small coastal sharks including Atlantic sharpnose (SAS) and blacknose (SBN) sharks observed caught on bottom longline sets targeting shallow water reef fish in the Gulf of Mexico and U.S. Atlantic Ocean.

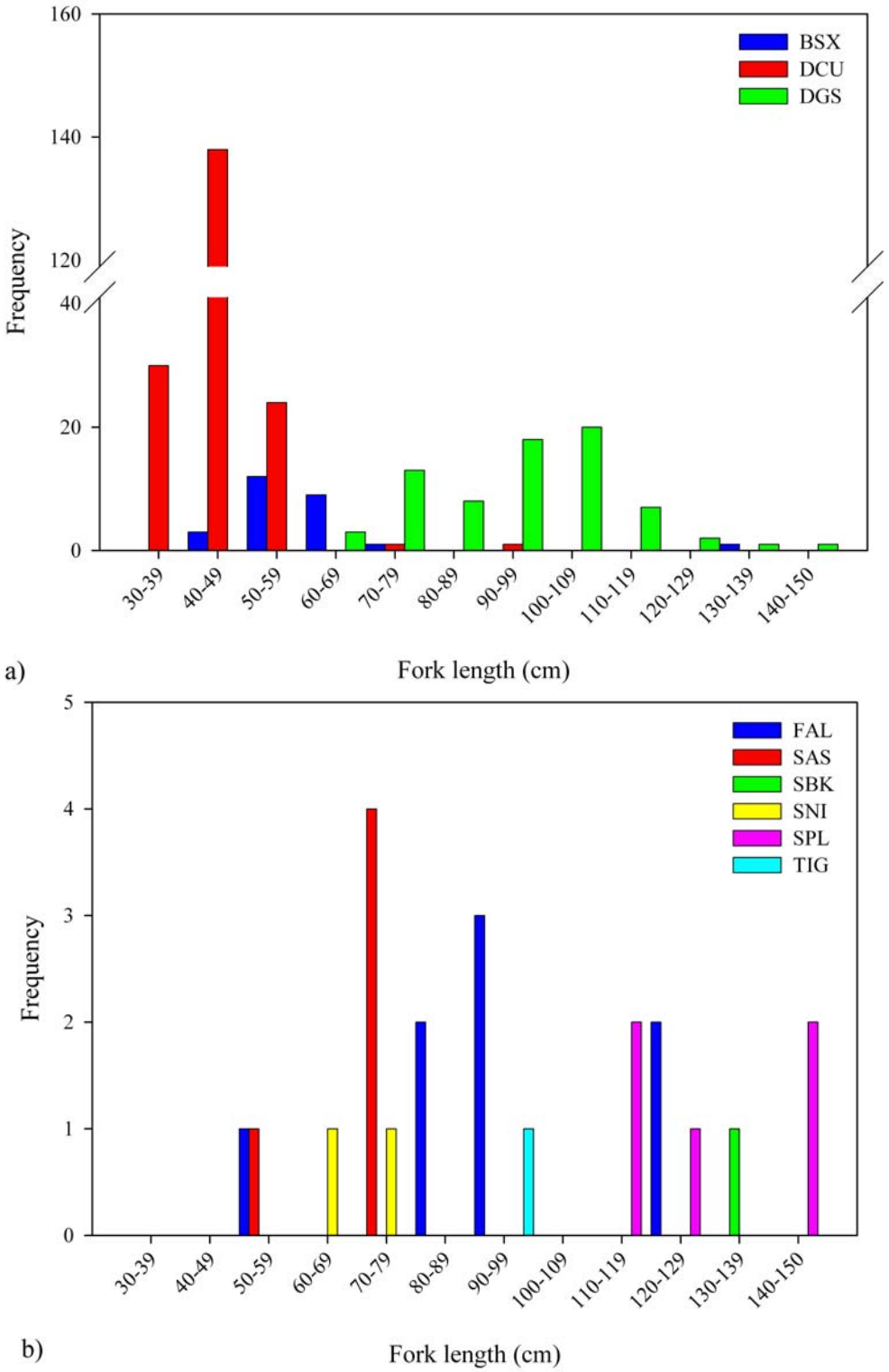


Figure 3. Length frequency (cm fork length) of a) bigeye sixgill (BSX), Cuban dogfish (DCU), and smooth dogfish (DGS) sharks and b) silky (FAL), Atlantic sharpnose (SAS), blacktip (SBK), night (SNI), scalloped hammerhead (SPL), and tiger (TIG) sharks observed caught on bottom longline sets targeting deep water reef fish in the Gulf of Mexico and U.S. Atlantic Ocean.

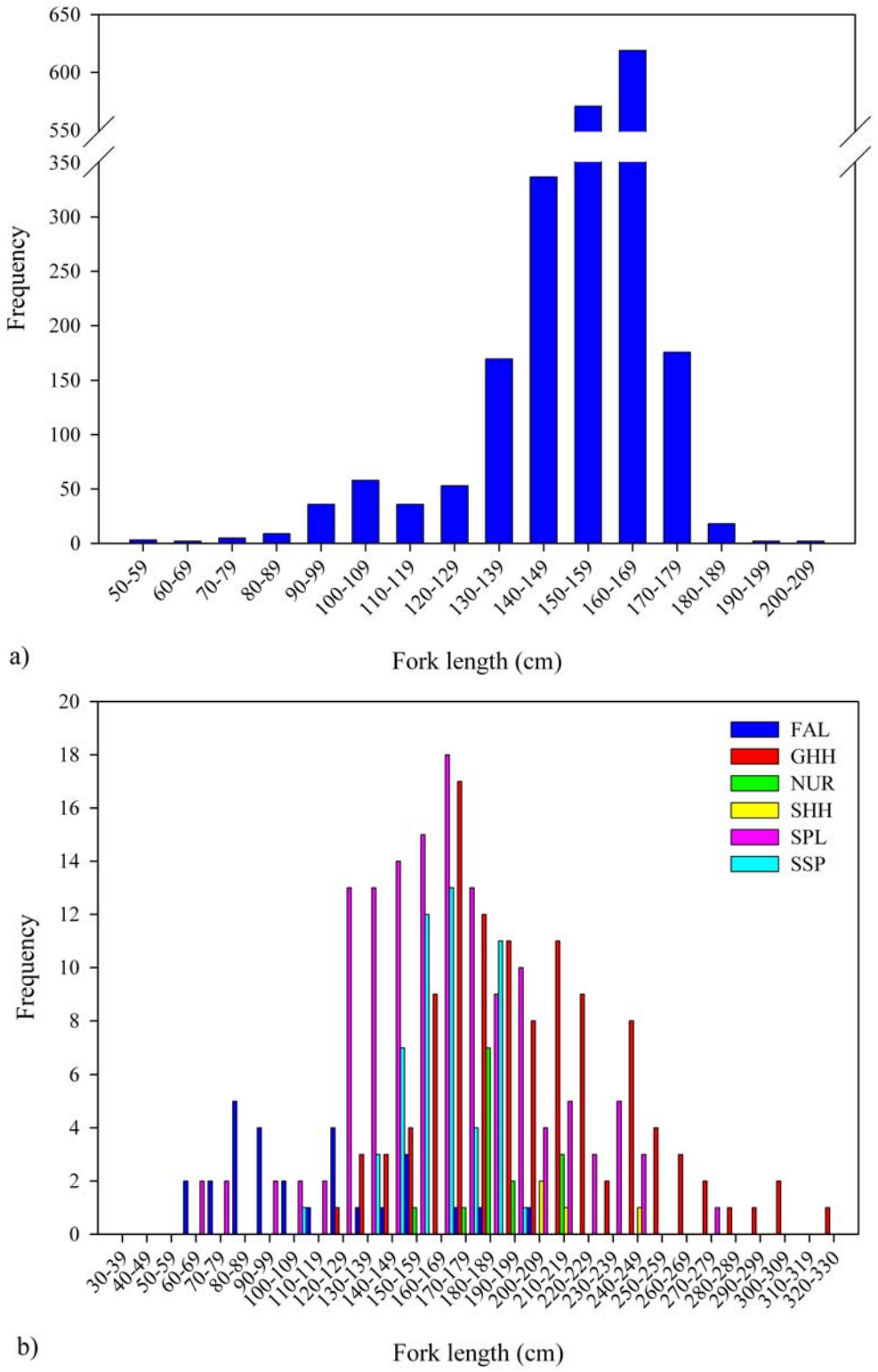
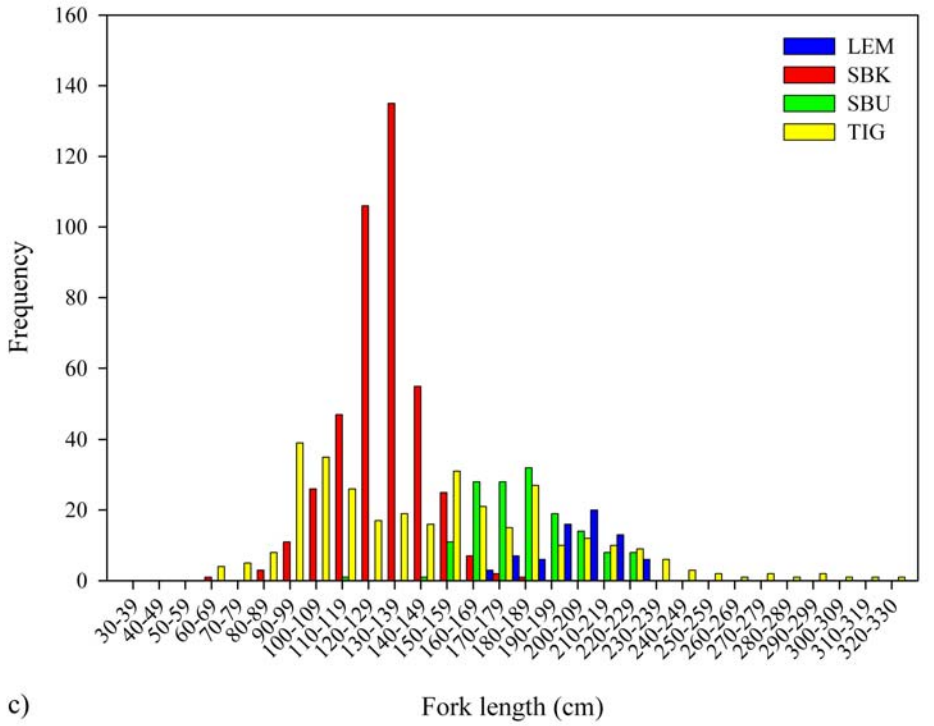


Figure 4. Length frequency (cm fork length) of a) sandbar (SSB) sharks, b) silky (FAL), great hammerhead (GHH), nurse (NUR), smooth hammerhead (SHH), scalloped hammerhead (SPL), and spinner (SSP) sharks observed caught on bottom longline sets targeting sandbar shark in the Gulf of Mexico and U.S. Atlantic Ocean.



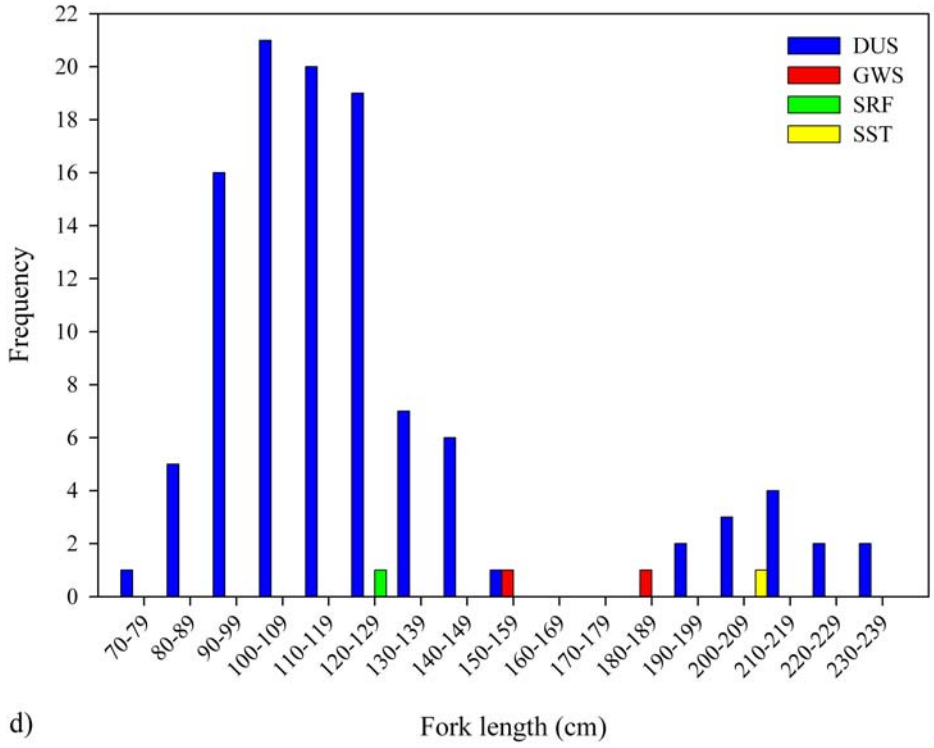
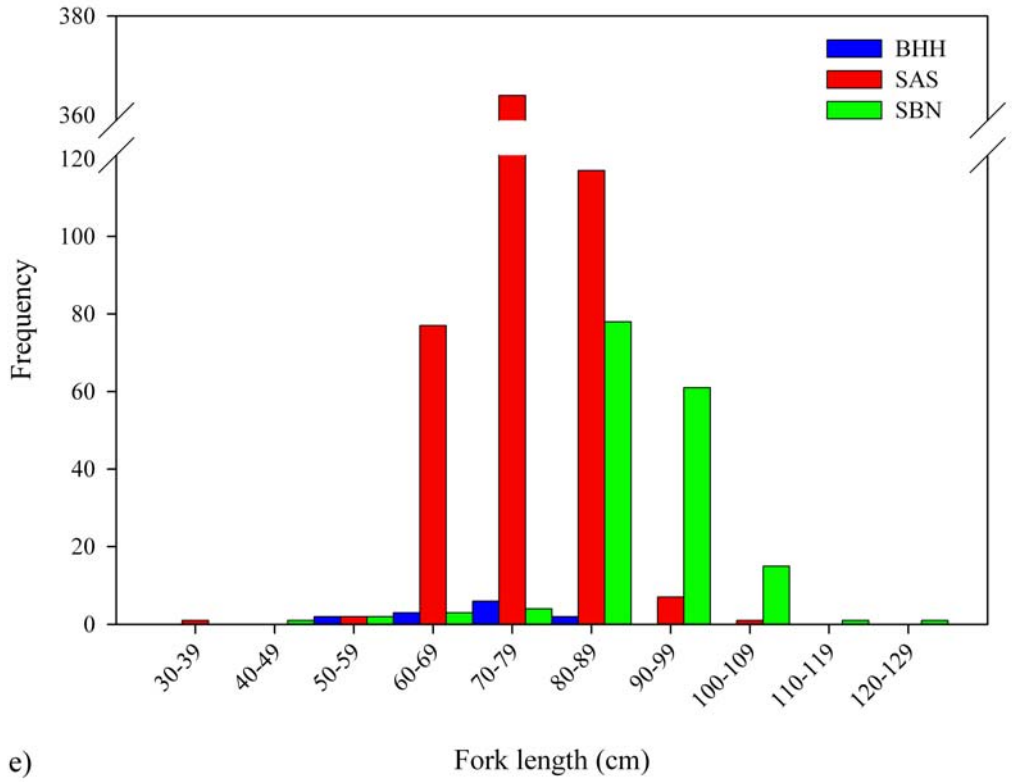


Figure 4 cont'd. Length frequency (cm fork length) of c) lemon (LEM), blacktip (SBK), bull (SBU), and tiger (TIG) sharks, d) prohibited sharks including dusky (DUS), great white (GWS), Caribbean reef (SRF), and sand tiger (SST) sharks observed caught on bottom longline sets targeting sandbar shark in the Gulf of Mexico and U.S. Atlantic Ocean.



e)

Figure 4 cont'd. Length frequency (cm fork length) of e) small coastal sharks including bonnethead (BHH), Atlantic sharpnose (SAS), and blacknose (SBN) sharks observed caught on bottom longline sets targeting sandbar shark in the Gulf of Mexico and U.S. Atlantic Ocean.

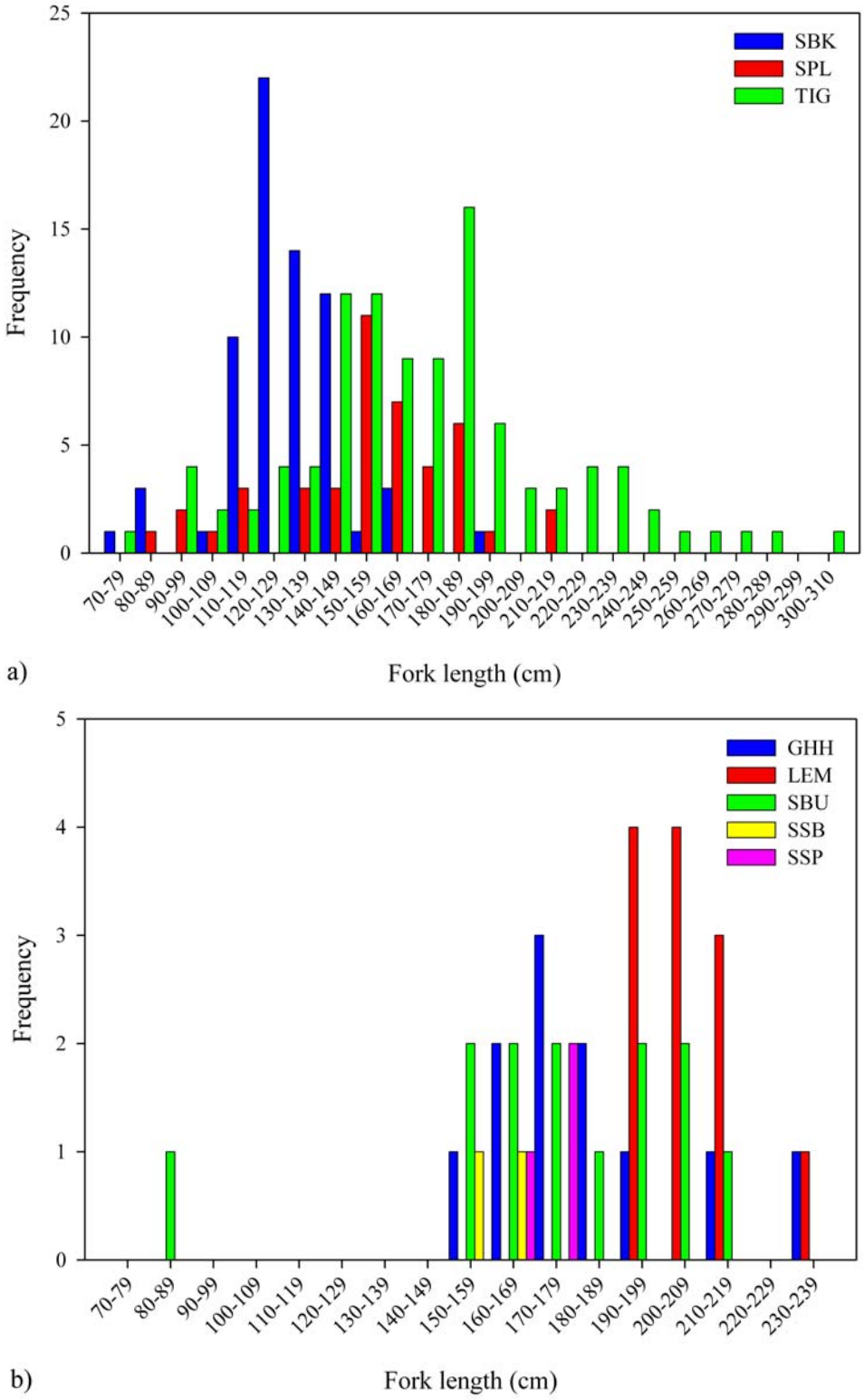
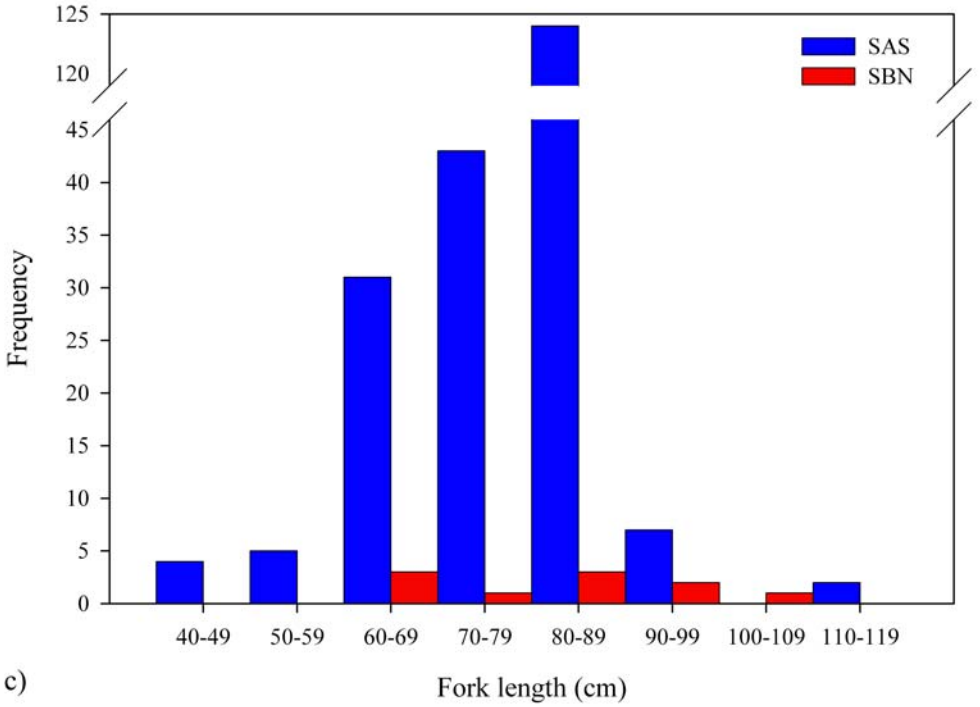


Figure 5. Length frequency (cm fork length) of a) blacktip (SBK), scalloped hammerhead (SPL), and tiger (TIG) sharks, b) great hammerhead (GHH), lemon (LEM), bull (SBU), sandbar (SSB), and spinner (SSP) sharks observed caught on bottom longline sets targeting large coastal shark in the Gulf of Mexico and U.S. Atlantic Ocean.



c)

Figure 5 cont'd. Length frequency (cm fork length) of c) small coastal sharks including Atlantic sharpnose (SAS) and blacknose (SBN) sharks observed caught on bottom longline sets targeting large coastal shark in the Gulf of Mexico and U.S. Atlantic Ocean.