

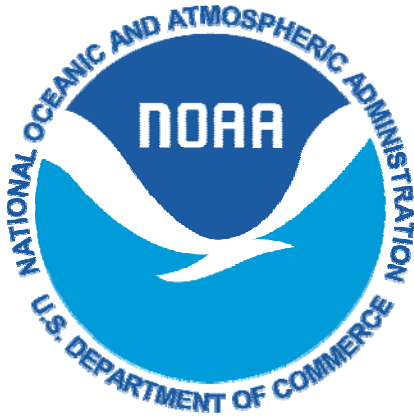


CHARACTERIZATION OF THE SHARK BOTTOM LONGLINE FISHERY: 2005-2006  
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## Introduction

The shark bottom longline fishery is active in the U.S. Atlantic Ocean and Gulf of Mexico from North Carolina through Texas. Vessels in the fishery are typically fiberglass and average 50 feet in length. Longline characteristics vary regionally with gear normally consisting of about 8-24 km of longline and 500-1500 hooks. Gear is set at sunset and allowed to soak overnight before hauling back in the morning. There are currently about 100 active vessels in this fishery out of about 250 vessels that possess directed shark fishing permits. These vessels make 4000 to 9000 sets per year. The shark bottom longline fishery targets large coastal sharks but small coastal sharks, pelagic sharks, and dogfish species are also caught. Depending on the time of year and length of the large coastal shark season, these vessels may also target reef fishes such as grouper, snapper, and tilefish.

Observations of the shark directed bottom longline fishery have been conducted since 1994 (Burgess and Morgan 2003<sup>1</sup>). From 1994 through 2001, observer coverage was conducted on a voluntary basis. Beginning with the 2002 fishing season, observer coverage of the shark directed bottom longline fishery became mandatory under the current federal management plan for highly migratory species (50 CFR 635.7, NMFS 2003). Observer coverage from 1994 through the 1st trimester season of 2005 was coordinated by the Commercial Shark Fishery Observer Program (CSFOP), Florida Museum of Natural History, University of Florida, Gainesville, FL (Burgess and Morgan 2003<sup>1</sup>). Starting with the 2nd trimester season of 2005, responsibility for the fishery observer program was transferred to the National Marine Fisheries Service (NMFS), Southeast Fisheries Science Center (SEFSC), Panama City Laboratory. Herein, we report on fishing activities in the shark bottom longline fishery from the second trimester season of 2005 through the end of 2006. This report amends data presented in internal trimester and year end reports from 2005 and 2006.

## Methods

Initially, shark bottom longline vessels were selected for coverage by randomly choosing vessels from a pool of vessels each trimester shark season based on the following criteria: (1) the

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<sup>1</sup> Burgess, G.H. and A. Morgan. 2003. Commercial Shark Fishery Observer Program. Renewal of an observer program to monitor the directed commercial shark fishery in the Gulf of Mexico and U.S. Atlantic Ocean: 2002(2) and 2003(1) fishing seasons. Final Report, U.S. National Marine Fisheries Service, Highly Migratory Species Management Division Award NA16FM1598, 15p.

vessel/owner possessed a current directed shark permit, (2) the permit holder (i.e. vessel/owner) must have reported fishing for sharks with bottom longline gear in the same season of the previous year, and (3) the permit holder must not have been selected for observer coverage for the prior three consecutive shark seasons. Vessels were selected from three fishing regions: northern U.S. Atlantic Ocean, southern U.S. Atlantic Ocean, and Gulf of Mexico. The northern U.S. Atlantic Ocean was defined from Virginia through Maine, the southern U.S. 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). Regardless of the target species, if a vessel was selected during the coverage period it was required to carry an observer. Thus, observers also boarded bottom longline fishing trips that targeted grouper, snapper, and tilefish as well as shark. Because of the overlap observed in 2005 with grouper/snapper and tilefish targeted longline sets and those vessels possessing directed shark permits, the vessel pool was expanded in 2006 to cover all bottom longline vessels regardless if they reported fishing for sharks with bottom longline gear in the same season of the previous year.

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. Each selection letter is mailed with a trip notification form that, when returned prior to a trip, provides the observer coordinator with written information concerning the vessel's name, captain, contact persons and phone numbers, communications and safety equipment available aboard the vessel, and information about the vessel's location, dates, and times of departure and return. The form is also used to inform the observer coordinator when a vessel is active in another fishery, under repair, or no longer fishing. The written notification is necessary to document the permit holder's efforts to comply with mandatory coverage. Telephone calls are helpful, after written notification, to determine other specific details prior to the deployment of the observer to meet the vessel. 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. Upon indication to fish, the observer coordinator deploys an observer to the permit holder vessel's reported port of departure. The observer is deployed generally 24-48 hours prior to the time the vessel plans to leave port. According to the Observer Health and Safety Regulations (50 CFR 600), all vessels selected for coverage must possess a current U.S. Coast

Guard safety examination decal. If the vessel does not possess a current decal, it is not permitted for the vessel to carry an observer and the vessel is thus prohibited to fish for the time period it has been selected for observer coverage.

For consistency among longline observer programs throughout the Southeast Fisheries Science Center, we adopted the methods outlined for the Pelagic Longline Observer Program (Beerkircher et al. 2004). 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, for example, the type and length of the mainline used, number and length of gangions, and make and model of hooks used. The Longline Haul Log is used to record the length, location, and time duration for each set and haulback, as well as environmental information and the type(s) of bait used. The Individual Animal Log records all species caught, condition of the catch (e.g. alive, dead, damaged, or unknown) when brought to the vessel, and the final disposition of the catch (e.g. kept, released, finned, etc.). When an animal is brought onboard the vessel, the observer records the species identification, sex (sharks only) and length information. In the event a protected resource (i.e. sea turtle or marine mammal) is encountered, the observer is also required to fill out additional sea turtle or marine mammal forms. If any species identification is questionable, the observer is instructed to take several digital pictures of the specimen in question for further review by SEFSC staff. Data from each trip are submitted to SEFSC staff on a per trip basis. The data are entered and reviewed by SEFSC staff and reviewed with observer contract staff to resolve any questions.

During 2002-2005, the objective of vessel selection was to achieve a representative 5% level of coverage of the total fishing effort in each fishing area and during each fishing season of that year (Chris Rilling, NMFS Office of Sustainable Fisheries, pers. comm.). Due to the need to attain a 5% coverage level for each season and area, permit holders could be selected for observer coverage multiple times a year. Beginning in 2006, the target coverage level was 3.9% of the total fishing effort. This level was estimated to attain a sample size needed to provide estimates of sea turtle, smalltooth sawfish, or marine mammal interactions with an expected coefficient of variation of 0.3 (Carlson, unpublished).

## Results

From July 2005 through December 2006, the shark bottom longline observer program covered a total of 89 trips (defined as from the time when a vessel leaves the port until the vessel returns to port and lands catch, including multiple hauls therein) on 37 vessels with a total of 211 hauls (defined as setting gear, soaking gear for some duration of time, and retrieving gear from water) 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, grouper/shark mix, shark, or tilefish). There were no grouper/snapper-targeted trips observed in the U.S. Atlantic Ocean and no tilefish-targeted trips observed in the Gulf of Mexico. No trips were observed in the northern U.S. Atlantic Ocean, so subsequent references to the “U.S. Atlantic Ocean” refer to the coastal waters off the southern U.S. Atlantic states (Richards 1999).

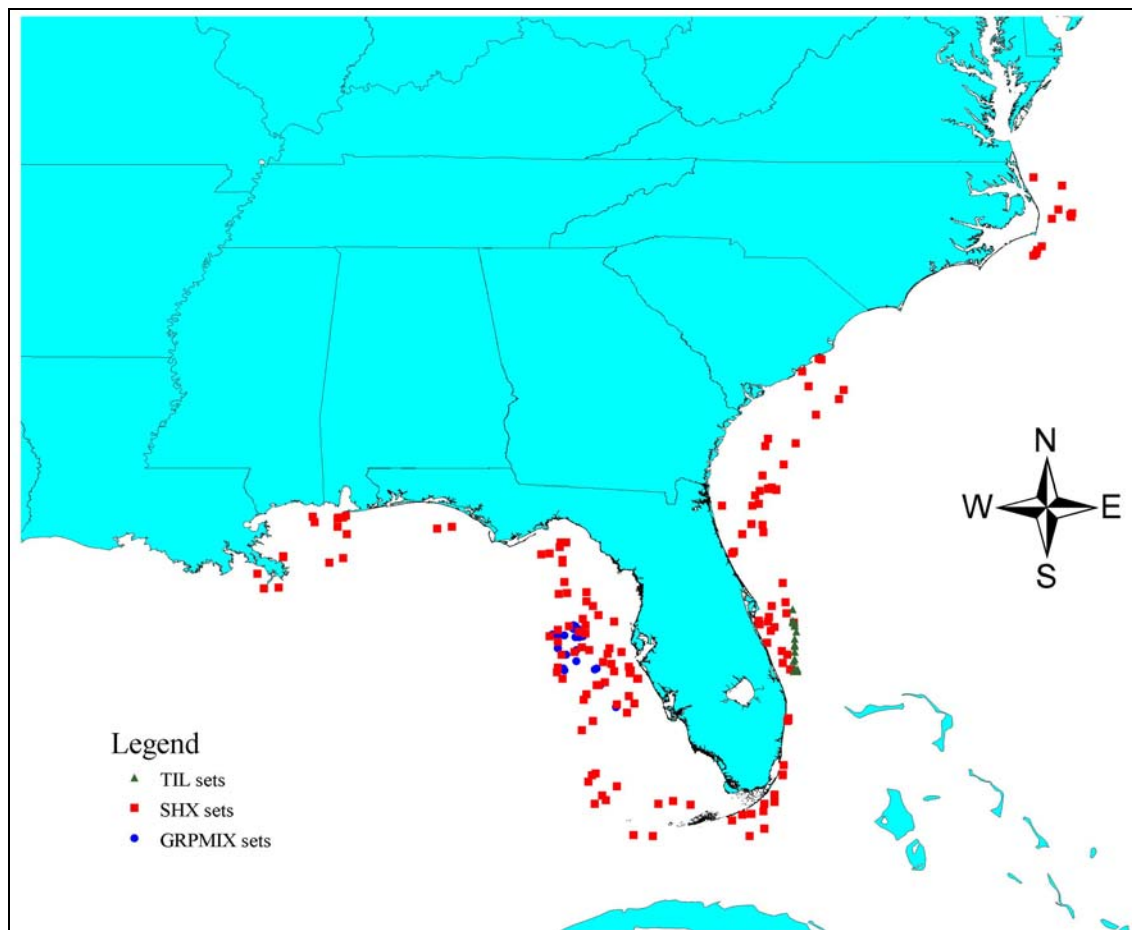


Figure 1. Distribution of sets for all observed hauls by target in the Gulf of Mexico and U.S. Atlantic Ocean from July 2005 through December 2006. Sets are separated by target species, including grouper/snapper and grouper/shark mix (GRPMIX), shark (SHX) and tilefish (TIL) targeted sets.

#### Gulf of Mexico grouper/snapper and mixed species targeted trips: gear and haul characteristics

There were 34 hauls on four (4) trips observed targeting grouper/snapper or grouper/shark in the Gulf of Mexico. The mainline length ranged from 3.2 to 24.1 km with an average of 13.1 km. The average bottom depth fished was 47.7 m and the number of hooks ranged from 210 to 2077 hooks with an average of 1264 hooks fished. Circle hooks sized 13.0 were the most common hook utilized (97.1% of hauls). The average soak duration (the time from when the last hook entered the water until the first hook was hauled back) was 2.8 hr.

#### Gulf of Mexico grouper/snapper and grouper/shark targeted trips: catch and bycatch

There were 3,848 individual animals caught on observed bottom longline hauls targeting grouper/snapper or grouper/shark in the Gulf of Mexico (Table 2). Teleosts comprised 91.2% of the catch, followed by sharks (8.3%), batoids (0.1%), and invertebrates (0.2%). Large coastal shark species comprised 20.6% of the shark catch, while small coastal shark species comprised 79.1% of the shark catch. Red grouper, *Epinephelus morio*, was the most frequently caught species of teleost (91.6%) and two species of shark, Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, and blacknose shark, *Carcharhinus acronotus*, comprised the majority of the shark catch (78.8%). Length frequencies of the shark species and their average sizes are presented in Figure 2 (for species with  $n \geq 10$ ).



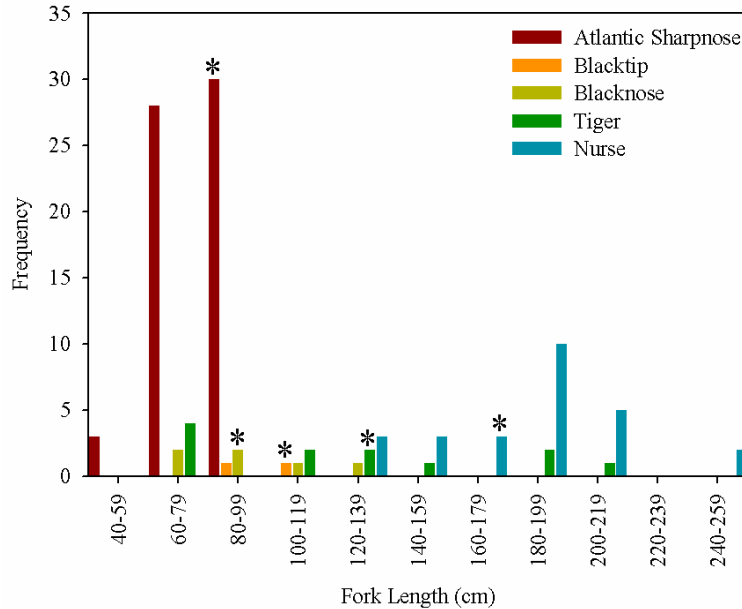


Figure 2. Length frequency (cm fork length) of sharks ( $n \geq 10$ ) observed caught on bottom longline sets targeting grouper/snapper or grouper/shark mix in the Gulf of Mexico. Average fork length (cm) for each species is indicated by an asterisk (\*).

#### Gulf of Mexico grouper/snapper and grouper/shark targeted trips: protected species interactions

Interactions with protected resources were observed for bottom longline vessels fishing in the Gulf of Mexico region targeting grouper/snapper or grouper/shark mix (Table 3). Seven (7) loggerhead sea turtles, *Caretta caretta*, were observed caught in bottom longline gear with two (2) released alive, three (3) released dead, and two (2) with an unknown status after release. No (0) sawfish, sea bird, or marine mammal interactions were observed.

#### Gulf of Mexico shark targeted trips: gear and haul characteristics

There were 82 hauls on 31 trips observed targeting shark in the Gulf of Mexico. The mainline length ranged from 2.1 to 30.6 km with an average of 13.5 km. The average bottom depth fished was 39.4 m and the number of hooks ranged from 47 to 1354 hooks with an average of 507 hooks fished. The most commonly used hook was 14.0 circle hooks (50.0% of hauls) with 18.0 circle hooks used in 30.5% of hauls. J hooks were also used (29.3% of hauls) with 12.0 sized hooks used most frequently (87.5% of hauls using J hooks). There were 18 hauls (21.9% of hauls) that employed two different types of hooks, with 12.0 J hooks used most

commonly as the second hook (66.7% of hauls using 2 hooks). The average soak duration was 9.2 hr.

#### Gulf of Mexico shark targeted trips: catch and bycatch

There were 4,732 individual animals caught on observed bottom longline hauls targeting shark in the Gulf of Mexico (Table 4). Sharks comprised 92.7% of the catch, followed by teleosts (6.4%), invertebrates (0.7%), and batoids (0.1%). Large coastal shark species comprised 75.4% of the shark catch, while small coastal shark species comprised 24.2% of the shark catch. Other shark species were also caught, including smooth dogfish, *Mustelus canis*, and dusky shark, *Carcharhinus obscurus* (0.4% of shark catch). Two (2) species of teleost, king snake eel, *Ophichthus rex*, and red grouper were the most frequently caught species of teleost (70.8%) and three species of shark, blacktip shark, *C. limbatus*, sandbar shark, *C. plumbeus*, and blacknose shark comprised the majority of the shark catch (68.8%). Length frequencies of the shark species and their average sizes are presented in Figure 3 (for species with  $n \geq 10$ ).

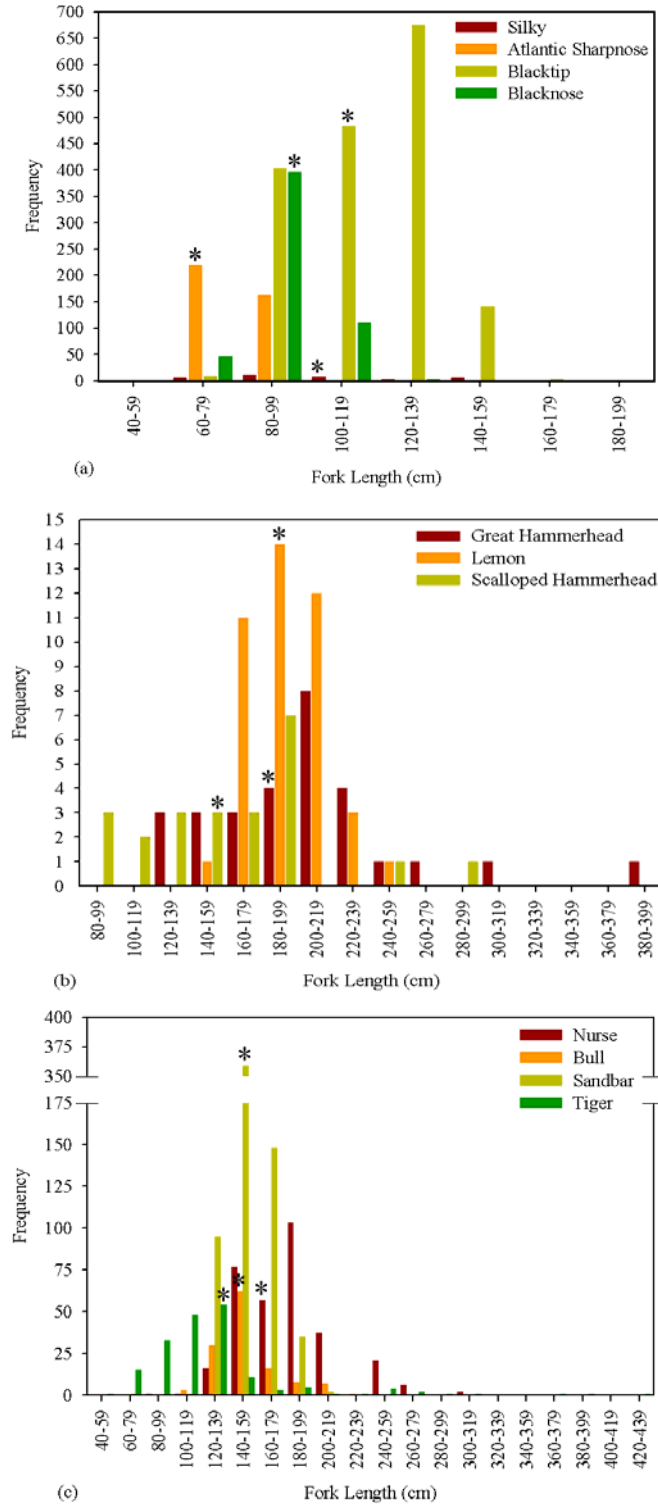


Figure 3. Length frequency (cm fork length) of sharks ( $n \geq 10$ ) observed caught on bottom longline sets targeting shark in the Gulf of Mexico. Average fork length (cm) for each species is indicated by an asterisk (\*).

#### Gulf of Mexico shark targeted trips: protected species interactions

Interactions with protected resources were observed for bottom longline vessels fishing in the Gulf of Mexico region targeting shark (Table 5). Four (4) loggerhead sea turtles were observed caught in bottom longline gear with two (2) released alive, one (1) released dead, and one (1) with an unknown status after release. No (0) sawfish, sea bird, or marine mammal interactions were observed.

#### U.S. Atlantic Ocean shark targeted trips: gear and haul characteristics

There were 77 hauls on 50 trips observed targeting shark in the U.S. Atlantic Ocean. The mainline length ranged from 1.6 to 30.6 km with an average of 14.9 km. The average bottom depth fished was 56.4 m and the number of hooks ranged from 50 to 1270 hooks with an average of 559 hooks fished. The most commonly used hook was 18.0 circle hooks (41.6% of hauls). J hooks were also used (53.3% of hauls) with 12.0 sized hooks used most frequently (34.5% of hauls using J hooks). There were 16 hauls (20.8% of hauls) that employed two different types of hooks, with 18.0 circle hooks used most commonly as the second hook (75.0% of hauls using 2 hooks). The average soak duration was 11.9 hr.

#### U.S. Atlantic Ocean shark targeted trips: catch and bycatch

There were 4,836 individual animals caught on observed bottom longline hauls targeting shark in the U.S. Atlantic Ocean (Table 6). Sharks comprised 95.5 of the catch, followed by teleosts (2.3%), batoids (2.1%), and invertebrates (0.02%). Large coastal shark species comprised 84.1% of the shark catch, while small coastal shark species comprised 13.5% of the shark catch. Other shark species were also caught including smooth dogfish, spiny dogfish, *Squalus acanthias*, dusky shark, sand tiger shark, *Carcharias taurus*, Caribbean reef shark, *C. perezi*, night shark, *C. signatus*, and shortfin mako shark, *Isurus oxyrinchus*. Red grouper were the most frequently caught species of teleost (29.1%), and two species of shark, sandbar shark and tiger shark, *Galeocerdo cuvier*, comprised the majority of the shark catch (62.7%). Length frequencies of the shark species and their average sizes are presented in Figure 4 (for species with  $n \geq 10$ ).

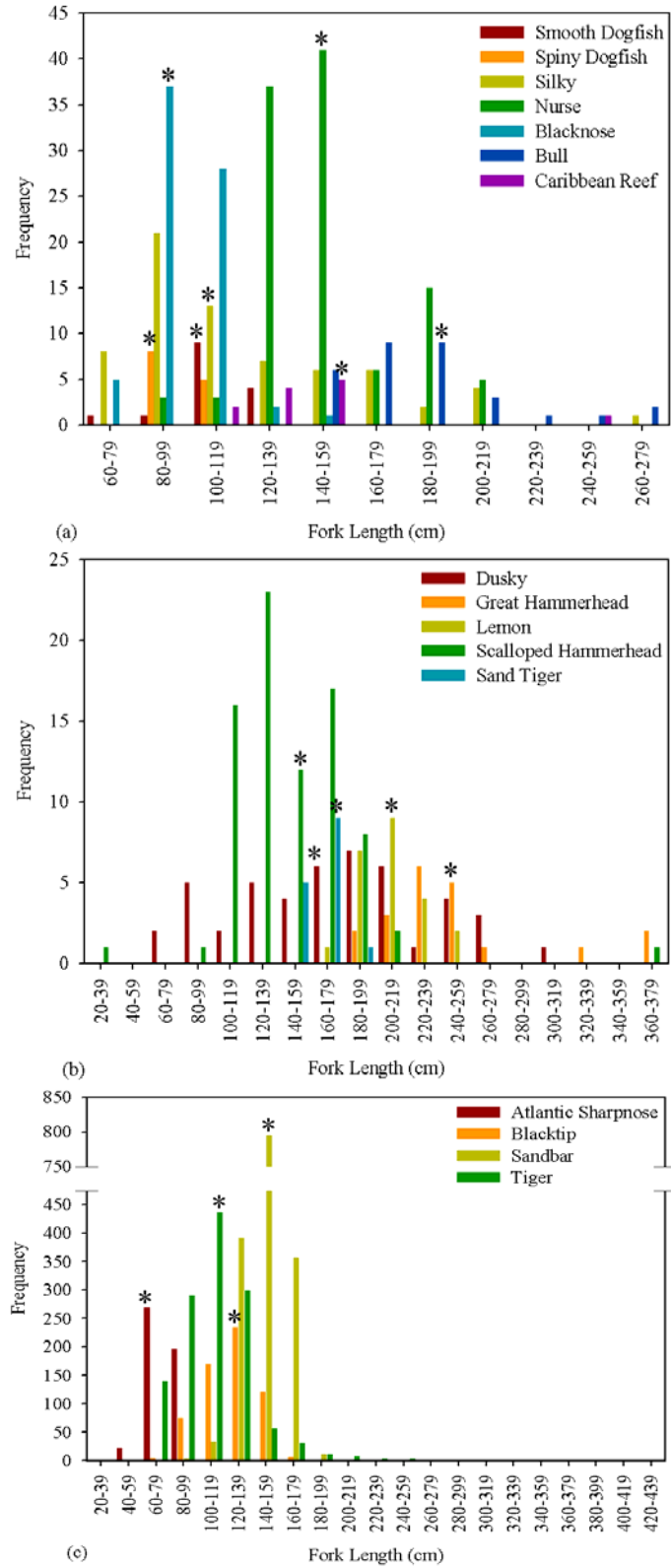


Figure 4. Length frequency (cm fork length) of sharks ( $n \geq 10$ ) observed caught on bottom longline sets targeting shark in the U.S. Atlantic Ocean. Average fork length (cm) for each species is indicated by an asterisk (\*).

#### U.S. Atlantic Ocean shark targeted trips: protected species interactions

Interactions with protected resources were observed for bottom longline vessels fishing in the U.S. Atlantic Ocean targeting shark (Table 7). Five (5) loggerhead sea turtles were observed caught in bottom longline gear with one (1) released alive, two (2) released dead, and two (2) with an unknown status after release. One (1) leatherback sea turtle, *Dermochelys coriacea*, was observed caught in bottom longline gear and released dead. Four (4) smalltooth sawfish, *Pristis pectinata*, were observed caught in bottom longline gear, and all four were released alive. No (0) sea bird or marine mammal interactions were observed.

#### U.S. Atlantic Ocean tilefish targeted trips: gear and haul characteristics

There were 18 hauls on four (4) trips observed targeting tilefish in the U.S. Atlantic Ocean. The mainline length ranged from 6.1 to 11.3 km with an average of 8.6 km. The average bottom depth fished was 115.6 fathoms (211.5 m) and the number of hooks ranged from 323 to 900 hooks with an average of 800 hooks fished. The most commonly used hooks were 12.0 J hooks and 14.0 circle hooks (77.8% of hauls). Seven (7) hauls (38.9% of hauls) employed two different types of hooks, with 12.0 J hooks and 14.0 circle hooks used each time. The average soak duration was 0.6 hr.

#### U.S. Atlantic Ocean tilefish targeted trips: catch and bycatch

There were 1,293 individual animals caught on observed bottom longline hauls targeting tilefish in the U.S. Atlantic Ocean (Table 8). Teleosts comprised 99.2% of the catch, followed by sharks (0.3%), and invertebrates (0.5%). Large coastal shark species comprised 25% of the shark catch, while no small coastal shark species were caught. Other shark species were caught including night shark and smooth dogfish (75.0%). Tilefish, *Lopholatilus chamaeleonticeps*, were the most frequently caught species of teleost (91.4%), and night shark was the majority of the shark catch (50.0%). Not enough sharks were caught to construct length frequency graphs.

#### U.S. Atlantic Ocean tilefish targeted trips: protected species interactions

There were no (0) protected species interactions observed for bottom longline vessels fishing in the U.S. Atlantic Ocean region targeting tilefish.

## Discussion

Preliminary observations indicate a difference among hauls targeting grouper/snapper or a mix of grouper/shark, tilefish, and those targeting shark. In general, longline sets for snapper or grouper were deeper and used more hooks than hauls targeting shark. Grouper/snapper hauls all used circle hooks only. Additionally, the soak durations of hauls targeting grouper/snapper were much shorter than hauls targeting shark. For shark-targeted hauls, the gear used was much more variable between trips. J hooks were used 30% of the time, and 22% of hauls used more than one hook type. The soak durations of shark-targeted hauls were much longer than those of grouper/snapper-targeted hauls, with gear normally set at night and left to soak overnight until haulback in the morning. The gear characteristics of shark-targeted hauls also varied between areas fished, as evidenced by the difference in depths fished (deeper in the U.S. Atlantic Ocean) and soak duration (longer in the U.S. Atlantic Ocean). Hauls targeting tilefish were very different in gear characteristics from hauls targeting either grouper/snapper or shark, with fishing depth sometimes as much as four times as deep and soak duration only lasting half an hour on average.

The species composition of hauls varied by target species and by area. Red grouper was the predominant species caught in hauls targeting grouper/snapper, but there was a high number of species (45) that occurred as bycatch, including shark species. The predominant target of grouper/snapper and grouper/shark mix-targeted trips in the Gulf of Mexico is the red grouper, but only 27% of red grouper caught were kept because of size regulations (greater than 50.8 cm total length). Atlantic sharpnose shark and blacknose shark were caught in the highest numbers in grouper/snapper-targeted hauls, with the majority being discarded alive. However, when sandbar sharks were caught, they were kept for meat and fins.

Hauls targeting shark varied in catch and discards by area. In the Gulf of Mexico, blacktip shark were the most numerous shark caught, numbering almost twice as many as sandbar shark. A high number of species (28) occurred as bycatch, including groupers and various species of sharks. In the Gulf of Mexico, both blacktip and sandbar sharks were kept for meat and fins, while blacknose and Atlantic sharpnose sharks were usually kept for bait. Dusky shark, a prohibited species, was also caught in shark-targeted hauls in the Gulf of Mexico, with the majority discarded dead. Hauls targeting shark in the U.S. Atlantic Ocean similarly had a high number of species (31) that occurred as bycatch, including groupers and various species of

sharks. Sandbar shark was the most numerous shark caught, more than twice as many as blacktip shark. Both blacktip and sandbar sharks were kept for meat and fins. Tiger shark was caught twice as often as blacktip shark, and was kept for meat. Atlantic sharpnose shark was also caught in high number and was primarily kept for bait. Prohibited shark species were also caught in low numbers, and with the exception of the night shark were mainly released alive.

The species composition of hauls targeting tilefish in the U.S. Atlantic Ocean was much less variable. Tilefish was the predominant species caught, and 99% were kept. Southern hake was the second most commonly caught species, and was largely kept for bait or released alive. Hauls targeting tilefish did have bycatch of prohibited night sharks, which were kept due to mistaken identity.

Protected resource interactions differed by area. In the Gulf of Mexico, interactions were limited to loggerhead sea turtles, with 11 sea turtles total (36% released alive and 36% released dead). Protected resource interactions of observed hauls in the U.S. Atlantic Ocean were limited to hauls targeting sharks, but included interactions with loggerhead sea turtles, leatherback sea turtles, and smalltooth sawfish. The majority of the sea turtles were released dead (40%), while the smalltooth sawfish were all released alive.

In conclusion, observer coverage from July 2005 through 2006 focused primarily on vessels in the Gulf of Mexico and the coastal waters off the southern U.S. Atlantic states targeting shark. As a result of overlap in vessels targeting both shark and grouper/snapper in the same trip, observer coverage was expanded to cover all vessels fishing with bottom longline gear regardless of target in 2006. Further, overages in the shark quota in 2006 resulted in reduced effort for vessels targeting sharks in 2007. How this shark bottom longline fishery will respond is currently unknown, but observer coverage of the bottom longline fishery will continue on all vessels regardless of target to better understand the changing dynamics of this fishery and its impact on all marine resources.

#### Acknowledgments

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Table 1. Number of trips, vessels, and hauls observed in the Gulf of Mexico (GOM) and southern U.S. Atlantic Ocean (SA) for all target species. Target species include grouper (GRP), a mix of grouper and shark (MIX), shark (SHX), or tilefish (TIL).

Area and Target	Vessels Observed	Trips Observed	Hauls Observed
GOM GRP + MIX	4	4	34
GOM SHX	18	31	82
SA SHX	17	50	77
SA TIL	3	4	18
Total	42	89	211

Table 2. Number caught (n) and disposition of catch in percentage for all observed hauls targeting grouper/snapper or grouper/shark mix 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	3216	27.0	2.6	70.4	0.1
<i>Rhizoprionodon terraenovae</i>	Atlantic Sharpnose Shark	131	45.0	3.8	50.4	0.8
<i>Carcharhinus acronotus</i>	Blacknose Shark	121	3.3	0.8	95.9	0.0
Sparidae	Porgy Family	50	90.0	4.0	6.0	0.0
<i>Lutjanus campechanus</i>	Red Snapper	32	40.6	15.6	43.8	0.0
<i>Mycteroperca phenax</i>	Scamp	30	93.3	0.0	6.7	0.0
Echeneidae	Remora Family	29	0.0	0.0	100.0	0.0
<i>Ginglymostoma cirratum</i>	Nurse Shark	27	0.0	0.0	100.0	0.0
<i>Mycteroperca microlepis</i>	Gag	25	92.0	0.0	8.0	0.0
<i>Lutjanus griseus</i>	Gray Snapper	20	95.0	0.0	5.0	0.0
<i>Seriola dumerili</i>	Greater Amberjack	12	8.3	25.0	66.7	0.0
<i>Galeocerdo cuvier</i>	Tiger Shark	12	16.7	16.7	66.7	0.0
<i>Calamus bajonado</i>	Jolthead Porgy	11	90.9	0.0	9.1	0.0
<i>Rhomboplites aurorubens</i>	Vermilion Snapper	11	45.5	9.1	45.5	0.0
<i>Carcharhinus limbatus</i>	Blacktip Shark	10	20.0	0.0	80.0	0.0
<i>Lutjanus analis</i>	Mutton Snapper	8	100.0	0.0	0.0	0.0
<i>Malacanthus plumieri</i>	Sand Tilefish	6	0.0	0.0	100.0	0.0
<i>Holocentrus</i> sp.	Squirrelfishes	6	66.7	0.0	33.3	0.0
<i>Echeneis naucrates</i>	Sharksucker	6	0.0	0.0	100.0	0.0
<i>Carcharhinus falciformis</i>	Silky Shark	5	60.0	0.0	40.0	0.0
<i>Carcharhinus plumbeus</i>	Sandbar Shark	5	100.0	0.0	0.0	0.0
<i>Carcharhinus brevipinna</i>	Spinner Shark	5	40.0	0.0	60.0	0.0
<i>Opsanus pardus</i>	Leopard Toadfish	5	80.0	0.0	20.0	0.0
<i>Trachinocephalus myops</i>	Snakefish	4	0.0	0.0	100.0	0.0
<i>Leiostomus xanthurus</i>	Spot	4	100.0	0.0	0.0	0.0
Batrachoididae	Toadfish Family	4	0.0	0.0	100.0	0.0
<i>Rachycentron canadum</i>	Cobia	3	66.7	0.0	33.3	0.0
Anthozoa	Coral	3	0.0	0.0	100.0	0.0
<i>Trachinotus falcatus</i>	Permit	3	0.0	0.0	100.0	0.0
Porifera	Sponge	3	0.0	0.0	100.0	0.0
<i>Muraena retifera</i>	Reticulate Moray Eel	3	100.0	0.0	0.0	0.0
<i>Epinephelus drummondhayi</i>	Speckled Hind	3	0.0	0.0	100.0	0.0
Lutjanidae	Snapper Family	3	100.0	0.0	0.0	0.0
<i>Calappa flammea</i>	Flame Box Crab	2	0.0	0.0	100.0	0.0
<i>Coryphaena hippurus</i>	Dolphinfish	2	100.0	0.0	0.0	0.0
<i>Euthynnus alletteratus</i>	Little Tunny	2	50.0	50.0	0.0	0.0
<i>Eleganyis bipinnulata</i>	Rainbow Runner	2	100.0	0.0	0.0	0.0
<i>Sphyrna tiburo</i>	Bonnethead Shark	1	100.0	0.0	0.0	0.0
<i>Fistularia tabacaria</i>	Bluespotted Cornetfish	1	0.0	0.0	100.0	0.0
<i>Sphyrna barracuda</i>	Great Barracuda	1	100.0	0.0	0.0	0.0
<i>Sphyrna mokarran</i>	Great Hammerhead Shark	1	100.0	0.0	0.0	0.0
<i>Scomberomorus cavalla</i>	King Mackerel	1	0.0	0.0	100.0	0.0
<i>Negaprion brevirostris</i>	Lemon Shark	1	0.0	0.0	100.0	0.0
<i>Lutjanus synagris</i>	Lane Snapper	1	100.0	0.0	0.0	0.0

Table 2 Continued.

Scientific Name	Common Name	n	% K	% DD	% DA	% U
<i>Diplectrum formosum</i>	Sand Perch	1	0.0	100.0	0.0	0.0
<i>Gymnura</i> sp.	Butterfly Ray	1	0.0	0.0	100.0	0.0
<i>Sciaenops ocellatus</i>	Red Drum	1	0.0	0.0	100.0	0.0
<i>Epinephelus guttatus</i>	Red Hind	1	100.0	0.0	0.0	0.0
Serranidae	Seabass Family	1	0.0	0.0	100.0	0.0
<i>Mustelus norrisi</i>	Florida Smoothhound Shark	1	0.0	0.0	100.0	0.0
<i>Gymnothorax moringa</i>	Spotted Moray Eel	1	100.0	0.0	0.0	0.0
<i>Dasyatis americana</i>	Southern Stingray	1	0.0	0.0	100.0	0.0
<i>Opsanus beta</i>	Gulf Toadfish	1	100.0	0.0	0.0	0.0
Teleostii	Unknown fish	1	0.0	0.0	100.0	0.0

Table 3. Number (n) of protected species interactions for all observed hauls targeting grouper/snapper or grouper/shark mix in the Gulf of Mexico. 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	7	42.9	28.6	28.6

Table 4. Number caught (n) and disposition of catch in percentage for all observed hauls targeting shark 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>Carcharhinus limbatus</i>	Blacktip Shark	1754	90.6	8.0	0.5	0.9
<i>Carcharhinus plumbeus</i>	Sandbar Shark	642	97.8	0.0	1.1	1.1
<i>Carcharhinus acronotus</i>	Blacknose Shark	622	78.9	18.5	1.4	2.4
<i>Rhizoprionodon terraenovae</i>	Atlantic Sharpnose Shark	437	67.3	32.0	0.5	0.2
<i>Ginglymostoma cirratum</i>	Nurse Shark	325	0.3	0.3	99.1	0.3
<i>Galeocerdo cuvier</i>	Tiger Shark	184	33.2	4.3	60.9	1.6
<i>Carcharhinus leucas</i>	Bull Shark	129	93.8	0.0	1.6	4.7
<i>Carcharhinus brevipinna</i>	Spinner Shark	123	99.2	0.0	0.0	0.8
<i>Ophichthus rex</i>	King Snake Eel	114	95.6	2.6	0.0	1.8
<i>Epinephelus morio</i>	Red Grouper	102	41.2	20.6	38.2	0.0
<i>Negaprion brevirostris</i>	Lemon Shark	44	93.2	2.3	0.0	4.5
<i>Carcharhinus falciformis</i>	Silky Shark	36	83.3	11.1	5.6	0.0
<i>Sphyrna mokarran</i>	Great Hammerhead Shark	30	96.7	0.0	3.3	0.0
<i>Callinectes sapidus</i>	Blue Crab	25	0.0	0.0	100.0	0.0
<i>Sphyrna lewini</i>	Scalloped Hammerhead Shark	24	91.7	0.0	4.2	4.2
<i>Sciaenops ocellatus</i>	Red Drum	19	0.0	15.8	78.9	5.3
Carcharhinidae	Requiem Shark Family	14	14.3	57.1	0.0	28.6
<i>Lutjanus campechanus</i>	Red Snapper	14	21.4	42.9	35.7	0.0
<i>Mustelus canis</i>	Smooth Dogfish Shark	12	0.0	58.3	41.7	0.0
<i>Mycteroperca microlepis</i>	Gag	11	72.7	27.3	0.0	0.0
Echeneidae	Remora Family	8	0.0	0.0	100.0	0.0
<i>Epinephelus itajara</i>	Goliath Grouper	8	0.0	12.5	87.5	0.0
<i>Echeneis naucrates</i>	Sharksucker	6	16.7	0.0	83.3	0.0
Congridae	Conger Eel Family	5	100.0	0.0	0.0	0.0
<i>Rachycentron canadum</i>	Cobia	5	60.0	0.0	40.0	0.0
<i>Carcharhinus obscurus</i>	Dusky Shark	4	0.0	75.0	25.0	0.0
<i>Aetobatus narinari</i>	Spotted Eagle Ray	3	0.0	0.0	100.0	0.0
<i>Mycteroperca bonaci</i>	Black Grouper	3	33.3	33.3	33.3	0.0
Elasmobranchii	Sharks	3	0.0	66.7	33.3	0.0
<i>Sphyrna barracuda</i>	Great Barracuda	3	66.7	33.3	0.0	0.0
<i>Calappa flammea</i>	Flame Box Crab	2	0.0	0.0	100.0	0.0
<i>Carcharhinus isodon</i>	Finetooth Shark	2	100.0	0.0	0.0	0.0
Porifera	Sponge	2	0.0	0.0	100.0	0.0
Anthozoa	Coral	1	0.0	100.0	0.0	0.0
<i>Cancer</i> spp.	Cancer Crab	1	0.0	0.0	100.0	0.0
<i>Caranx hippos</i>	Crevalle Jack	1	0.0	100.0	0.0	0.0
<i>Epinephelus drummondhayi</i>	Speckled Hind	1	0.0	0.0	100.0	0.0
<i>Epinephelus nigritus</i>	Warsaw Grouper	1	0.0	100.0	0.0	0.0
<i>Pomatomus saltatrix</i>	Bluefish	1	0.0	0.0	100.0	0.0
Portunidae	Portunid Crab Family	1	0.0	0.0	100.0	0.0
<i>Seriola fasciata</i>	Lesser Amberjack	1	100.0	0.0	0.0	0.0
<i>Seriola</i> sp.	Amberjack	1	0.0	0.0	100.0	0.0
<i>Seriola zonata</i>	Banded Rudderfish	1	100.0	0.0	0.0	0.0
Teleostii	Unknown Fish	1	0	0	0	100.0

Table 4 Continued.

Scientific Name	Common Name	n	% K	% DD	% DA	%U
<i>Sphyrna</i> sp.	Hammerhead Shark	1	0.0	100.0	0.0	0.0

Table 5. Number (n) of protected species interactions for all observed hauls targeting shark in the Gulf of Mexico. 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	4	25	50	25



Table 6. Number caught (n) and disposition of catch in percentage for all observed hauls targeting shark in the southern U.S. Atlantic Ocean. 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	1599	99.1	0.1	0.0	0.8
<i>Galeocerdo cuvier</i>	Tiger Shark	1294	36.8	3.6	57.5	2.1
<i>Carcharhinus limbatus</i>	Blacktip Shark	623	98.9	0.5	0.0	0.6
<i>Rhizoprionodon terraenovae</i>	Atlantic Sharpnose Shark	544	69.7	29.2	1.1	0.0
<i>Ginglymostoma cirratum</i>	Nurse Shark	111	0.9	0.9	98.2	0.0
<i>Sphyrna lewini</i>	Scalloped Hammerhead Shark	83	95.2	1.2	3.6	0.0
<i>Carcharhinus acronotus</i>	Blacknose Shark	76	89.5	6.6	2.6	1.3
<i>Carcharhinus falciformis</i>	Silky Shark	74	98.6	1.4	0.0	0.0
<i>Carcharhinus obscurus</i>	Dusky Shark	46	8.7	37.0	54.3	0.0
Rajiformes	Batooids	37	0.0	0.0	100.0	0.0
<i>Epinephelus morio</i>	Red Grouper	32	75.0	18.8	3.1	3.1
<i>Carcharhinus leucas</i>	Bull Shark	31	93.5	0.0	3.2	3.2
<i>Negaprion brevirostris</i>	Lemon Shark	23	100.0	0.0	0.0	0.0
<i>Carcharhinus brevipinna</i>	Spinner Shark	23	100.0	0.0	0.0	0.0
<i>Sphyrna mokarran</i>	Great Hammerhead Shark	20	90.0	0.0	5.0	5.0
<i>Rhinoptera bonasus</i>	Cownose Ray	18	94.4	0.0	0.0	5.6
<i>Raja eglanteria</i>	Clearnose Skate	16	0.0	6.3	93.8	0.0
<i>Mustelus canis</i>	Smooth Dogfish Shark	15	100.0	0.0	0.0	0.0
<i>Carcharhias taurus</i>	Sand Tiger Shark	15	0.0	0.0	100.0	0.0
<i>Lutjanus analis</i>	Mutton Snapper	14	85.7	14.3	0.0	0.0
<i>Dasyatis</i> sp.	Stingrays	14	0.0	0.0	85.7	14.3
<i>Squalus acanthias</i>	Spiny Dogfish Shark	13	7.7	0.0	92.3	0.0
<i>Carcharhinus perezi</i>	Caribbean Reef Shark	12	91.7	0.0	8.3	0.0
<i>Mycteroperca microlepis</i>	Gag	10	80.0	20.0	0.0	0.0
<i>Epinephelus niveatus</i>	Snowy Grouper	10	100.0	0.0	0.0	0.0
<i>Dasyatis centroura</i>	Roughtail Stingray	9	0.0	0.0	100.0	0.0
<i>Sphyrna barracuda</i>	Great Barracuda	7	71.4	14.3	14.3	0.0
<i>Mycteroperca bonaci</i>	Black Grouper	6	100.0	0.0	0.0	0.0
<i>Rachycentron canadum</i>	Cobia	6	100.0	0.0	0.0	0.0
<i>Carcharhinus signatus</i>	Night Shark	6	50.0	33.3	16.7	0.0
<i>Dasyatis americana</i>	Southern Stingray	4	0.0	0.0	100.0	0.0
<i>Epinephelus flavolimbatus</i>	Yellowedge Grouper	4	100.0	0.0	0.0	0.0
<i>Bagre marinus</i>	Gafftopsail Catfish	3	100.0	0.0	0.0	0.0
<i>Ophichthus ocellatus</i>	Pale-spotted Eel	3	66.7	33.3	0.0	0.0
Muraenidae	Moray Eel Family	2	50.0	50.0	0.0	0.0
<i>Scianops ocellatus</i>	Red Drum	2	0.0	0.0	50.0	50.0
<i>Carcharhinus isodon</i>	Finetooth Shark	2	100.0	0.0	0.0	0.0
<i>Seriola rivoliana</i>	Almaco Jack	1	0.0	100.0	0.0	0.0
<i>Sphyrna tiburo</i>	Bonnethead Shark	1	0.0	100.0	0.0	0.0
<i>Mycteroperca phenax</i>	Scamp	1	100.0	0.0	0.0	0.0
Anguilliformes	Eel	1	100.0	0.0	0.0	0.0
<i>Epinephelus itajara</i>	Goliath Grouper	1	0.0	0.0	100.0	0.0
<i>Sphyrna zygaena</i>	Smooth Hammerhead Shark	1	100.0	0.0	0.0	0.0
Elasmobranchii	Sharks	1	100.0	0.0	0.0	0.0

Table 6 Continued.

Scientific Name	Common Name	n	% K	% DD	% DA	% U
<i>Isurus oxyrinchus</i>	Shortfin Mako Shark	1	100.0	0.0	0.0	0.0
Lutjanidae	Snapper Family	1	100.0	0.0	0.0	0.0
<i>Aetobatis narinari</i>	Spotted Eagle Ray	1	0.0	0.0	100.0	0.0
Carcharhinidae	Requiem Shark Family	1	0.0	0.0	0.0	100.0
Asteroidea	Starfish	1	0.0	0.0	100.0	0.0
<i>Echeneis naucrates</i>	Sharksucker	1	0.0	0.0	100.0	0.0
<i>Megalops atlanticus</i>	Tarpon	1	0.0	0.0	100.0	0.0
<i>Lopholatilus chamaeleonticeps</i>	Tilefish	1	100.0	0.0	0.0	0.0
Batrachoididae	Toadfish Family	1	0.0	0.0	100.0	0.0
<i>Epinephelus nigritus</i>	Warsaw Grouper	1	100.0	0.0	0.0	0.0
<i>Sphyrna</i> sp.	Hammerhead Shark	1	0.0	0.0	0.0	100.0
<i>Thunnus albacares</i>	Yellowfin Tuna	1	0.0	100.0	0.0	0.0

Table 7. Number (n) of protected species interactions for all observed hauls targeting shark in the southern U.S. Atlantic Ocean. 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	5	40	20	40
<i>Pristis pectinata</i>	Smalltooth Sawfish	4	0	100	0
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle	1	100	0	0

Table 8. Number caught (n) and disposition of catch in percentage for all observed hauls targeting tilefish in the southern U.S. Atlantic Ocean. 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>Lopholatilus chamaeleonticeps</i>	Tilefish	1173	98.5	0.5	0.3	0.8
<i>Urophycis floridana</i>	Southern Hake	93	38.7	23.7	36.6	1.1
Anguilliformes	Eels	6	16.7	0.0	83.3	0.0
Muraenidae	Moray Eel Family	3	0.0	0.0	100.0	0.0
<i>Seriola</i> sp.	Amberjacks	2	100.0	0.0	0.0	0.0
<i>Cancer borealis</i>	Jonah Crab	2	0.0	0.0	100.0	0.0
<i>Cancer irroratus</i>	Atlantic Rock Crab	2	0.0	100.0	0.0	0.0
<i>Coryphaena hippurus</i>	Dolphinfish	2	100.0	0.0	0.0	0.0
<i>Epinephelus niveatus</i>	Snowy Grouper	2	100.0	0.0	0.0	0.0
<i>Carcharhinus signatus</i>	Night Shark	2	100.0	0.0	0.0	0.0
Congridae	Conger Eel	1	0.0	0.0	100.0	0.0
<i>Mustelus canis</i>	Smooth Dogfish Shark	1	100.0	0.0	0.0	0.0
<i>Carcharhinus falciformis</i>	Silky Shark	1	0.0	0.0	100.0	0.0
<i>Sphyrna barracuda</i>	Great Barracuda	1	100.0	0.0	0.0	0.0
Majidae	Spider Crab Family	1	0.0	0.0	0.0	100.0
Asteroidea	Starfishes	1	0.0	0.0	100.0	0.0