Catch and bycatch of greater amberjack in the Gulf of Mexico shark and reeffish bottom longline fishery based on observer data

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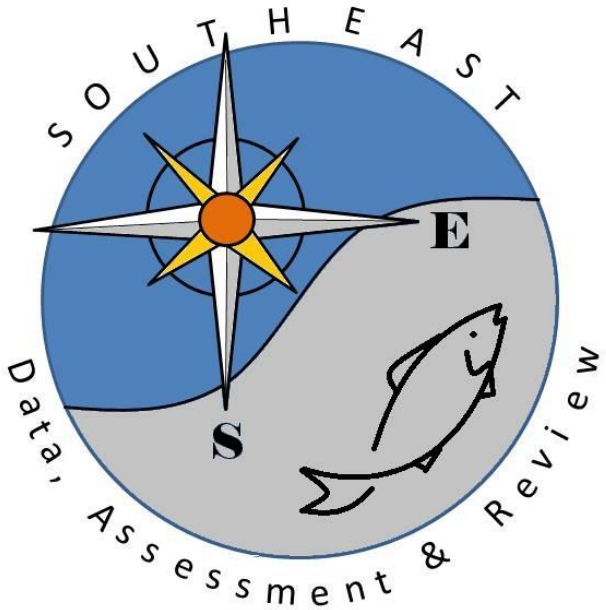

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Catch and bycatch of greater amberjack in the Gulf of Mexico shark and reeffish bottom longline fishery based on observer data

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Introduction

In the Gulf of Mexico, two fisheries utilize bottom longline gear to harvest Federally managed species. The shark bottom longline fishery currently has about 100 active vessels in the south Atlantic and Gulf of Mexico out of about 218 vessels that possess directed shark fishing permits. Depending on regulations, commercial shark fishers target and land sandbar shark, *Carcharhinus plumbeus*, blacktip shark, *Carcharhinus limbatus*, bull shark, *Carcharhinus leucas* and hammerhead sharks , *Sphyrna spp.* The commercial reef fish involves about 819 permitted vessels that target groupers, snappers, and other reef fish species with approximately 130 vessels reported using bottom longline gear. Details of the shark bottom longline fishery and its operations can be found in Hale et al. (2012 and reference therein) and for the reeffish fishery in Scott-Denton et al. (2011).

Data collected by the NMFS-Panama City Laboratory in the shark bottom longline fishery by on-board observers began in 2005 (Hale and Carlson, 2007). Regardless of the target species, if a vessel was selected during the coverage period it was required to carry an observer. Thus, while the focus of the observer program was on shark directed trips, 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 targeted longline sets and those vessels possessing directed shark permits (some vessels hold both shark and reeffish permits), the vessel pool covered all bottom longline vessels regardless if they reported fishing for sharks with bottom longline gear.

The objectives are to report observations on the catch and bycatch of greater amberjack, *Seriola dumerili*, in Gulf of Mexico shark and reeffish targeted bottom longline sets from 2005–2012.

Methods

Vessel selection

NMFS observers were placed on bottom longline vessel targeting shark or reeffish throughout the Gulf of Mexico based season and region. Observer coverage is based on proportional sampling effort, based on coastal logbook data, among seasons in the Gulf of Mexico.

Selection letters requiring observer coverage were issued to permit holders via U.S. certified mail approximately one month prior to the upcoming season. Once the permit holder received the selection letter, he or she was required to contact 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 (Hale et al. 2012).

Observer Protocol

For consistency among longline observer programs throughout the Southeast Fisheries Science Center, observers complete three data forms: Longline Gear Characteristic Log, Longline Haul Log, and Individual Animal Log. The Longline Gear Characteristic Log is used to record 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 on capture (e.g. alive, dead, damaged, or unknown) when brought to the vessel, and the final condition on release (e.g. kept, released, finned, etc.). When an animal is brought aboard the vessel, the observer records species, condition on capture, sex (when possible), and length.

Results and Discussion

Observer coverage summary

A total of 332 trips on 61 vessels (2217 sets) were observed in the Gulf of Mexico region from July of 2005 through December of 2012 (Figure 1). All sets utilized bottom longline gear with 76.7% (1699 sets) targeting reef fish (grouper, snapper), 21.0% (466 sets) targeting shark, 1.5% (33 sets) targeting tilefish, 0.6% (14 sets) targeting mixed species (shark and reef fish within the same set) and 0.2% (5 sets) targeting eel for bait. Due to low sample sizes, sets targeting tilefish, mixed species or bait are not described here in further detail. More in-depth catch information is reported in a yearly technical

memorandum from the observer program (eg. Hale et al. 2012 and references therein). A total of 37 vessels were observed on 73 trips (average trip length was 11.7 days with an average of 25.8 sets per trip) targeting reef fish, while a total of 30 vessels were observed on 263 trips (average trip length was 2.0 days with an average of 2.4 sets per trip) targeting shark. Based on Richards (2008), the percent observed of the total reef fish bottom longline effort was 0.75-2.1% for 2006-2007. Some vessels targeted different species on different trips within the same year or between years. Of the 2217 sets observed (all targets combined), 205 sets (9.2%) caught greater amberjack.

Gear description

In shark-targeted sets, the length of the mainline ranged from 0.4 – 35.2 km with an average length of 12.1 km (±7.8 Standard Deviation (S.D.)). Number of hooks set ranged from 25 - 1354, with an average of 390 hooks (±280 S.D.) per set. Depth ranged from 2 - 227 m with an average depth of 48.8 m (±34.8 S.D.). The gear was soaked an average of 12.9 hrs (±9.1 S.D.). The majority of longline vessels utilized circle hooks (80.7%). Some sets (14.3%) used two different hooks with 4.3% using a combination of circle and J-hooks. The most commonly used hooks were 18.0 and 16.0 circle hooks (51.5% and 24.3% respectively). Total hook effort was 181,631 hooks while total hook hours were 2,272,436.2 hours.

In reef fish-targeted sets, the length of the mainline ranged from 0.7 – 25.2 km with an average length of 9.1 km (±3.6 S.D.). Number of hooks ranged from 30 - 2300, with an average of 766 hooks (±352 S.D.) per set. Depth ranged from 29 - 355 m with an average depth of 98.8 m (±68.0 S.D.). The gear was soaked an average of 1.6 hrs (±2.4 S.D.). Reef fish vessels utilized circle hooks 98.7% of the time, and a combination of circle hooks sizes in 30.9% of sets. The most commonly used hooks were 13.0 and 14.0 circle hooks (46.7% and 32.1% respectively). Total hook effort was 1,301,478 hooks while total hook hours were 2,037,347.3 hours.

Observed Gulf of Mexico catches

Total observed catch composition (percent of numbers caught) of sets targeting shark was 95.4% sharks, 3.8% teleosts, 0.3% batoids, and 0.4% invertebrates, and 0.2% protected resource species (Table 1). Sandbar shark, *Carcharhinus plumbeus*, and

blacktip shark, *Carcharhinus limbatus*, were the most common species caught (28.1% and 19.2% by number respectively). Greater amberjack made up 3.8% by number of the teleost species (n = 34). The catch per unit effort (CPUE) for greater amberjack was 0.03 per 1000 hooks. The average length of greater amberjack caught was 107.1 cm (±17.8 S.D.; n = 25) FL (Table 3). Most individuals (48% split equally between two size bins) fell into either the 90-99 cm or 120-129 cm FL categories. Of the greater amberjack, 0.2% were undersized (less than 36 inches or 91.4 cm FL; Gulf of Mexico Fishery Management Council, 2012).

Total observed catch composition (percent of numbers caught) of sets targeting reef fish was 7.6% sharks, 91.8% teleosts, 0.1% batoids, 0.5% invertebrates, and <0.1% protected resource species (Table 2). The most commonly caught species was the red grouper, *Epinephelus morio*, (58.1% by number, n = 60,916) and Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, was the most common shark species (34.6% by number of overall shark species). Greater amberjack made up 0.4% by number of the overall teleost species (n = 364). The catch per unit effort (CPUE) for greater amberjack was 0.28 per 1000 hooks. The average length of greater amberjack caught was 84.4 cm (±28.0 S.D.; n = 289) FL. The 100 to 109 FL category had the highest percentage of individuals (17.7%, Table 3, Figure 2). Of the greater amberjack, 49.8% were undersized according to current regulations (less than 36 inches or 91.4 cm FL; Gulf of Mexico Fishery Management Council, 2012).

Observed depth range of greater amberjack catch

The depth of shark-targeted sets that caught greater amberjack ranged between 34 - 227 m with an average depth of 93.1 m. The majority of greater amberjack (29.4%) were caught between 81 and 90 meters depth (Table 4). The depth of reef fish-targeted sets that caught greater amberjack ranged between 37 - 355 m with an average depth of 114.8 m. Greater amberjack were commonly caught in three depth categories (Table 4, Figure 3): 41-50 (12.1%), 61-70 (11.5%), and 141-150 (10.7%). The length of greater amberjacks increased significantly with depth (Figure 4; $r^2 = 0.107$, $p < 0.0001$), however coefficient of correlation was low. The average depth of the set may not be a good representation of the benthic habitat use of amberjack. Capture may occur during gear deployment or retrieval as the hooks pass through the water column.

Condition on capture of greater amberjack

In shark-targeted sets, the majority of greater amberjack were alive when brought aboard the vessel (61.8%), with the remainder dead (26.5%) or damaged (11.7%). In reef fish-targeted sets, greater amberjack were also frequently alive (89.8%), with the remainder dead (7.7%), damaged (1.6%) or unknown status (0.8%).

In 2011, observers began recording details of barotrauma exhibited by teleost species. The occurrence of a protruding swim bladder or eyes or both was documented. In reef fish-targeted sets, symptoms of barotrauma were found in 0.8% of greater amberjack brought aboard and this was similar to that found by the Galveston Observer Program (0.7%; Scott-Denton et al., 2011). This low occurrence of barotrauma symptoms

provides further evidence that amberjack are not captured at the seafloor or may have a higher tolerance for changes in pressure.

Condition on release of greater amberjack

In shark-targeted sets, a larger proportion of greater amberjack were kept (58.8%), with 17.6% cut up for bait, 11.8% released dead, and 11.8% released dead (Table 3). In reef fish-targeted sets, the majority of greater amberjack were released alive (51.7%), with 25.0% kept, 17.3% cut up for bait, 5.4% released dead, and 0.6% released with unknown condition (Figures 2, 3 & 5, Table 3-5). In the Galveston Observer Program study, 45.9% of greater amberjack were kept, 36.7% were released alive, 8.1% were released dead, 5.2% were cut for bait and 4.1% released in unknown condition (Scott-Denton et al., 2011). Most greater amberjack, caught in reef fish sets, were not vented before release (68.1%; n = 72). The average soak duration of shark-targeted sets for kept greater amberjack was 11.7 hrs, for released dead was 17.3 hrs, and for released alive was 11.9 hrs (Table 5). In reef fish-targeted sets, the average soak duration for kept greater amberjack was 2.1 hrs, for released dead was 1.6 hrs, and for released alive was 1.3 hrs (Table 5, Figure 5).

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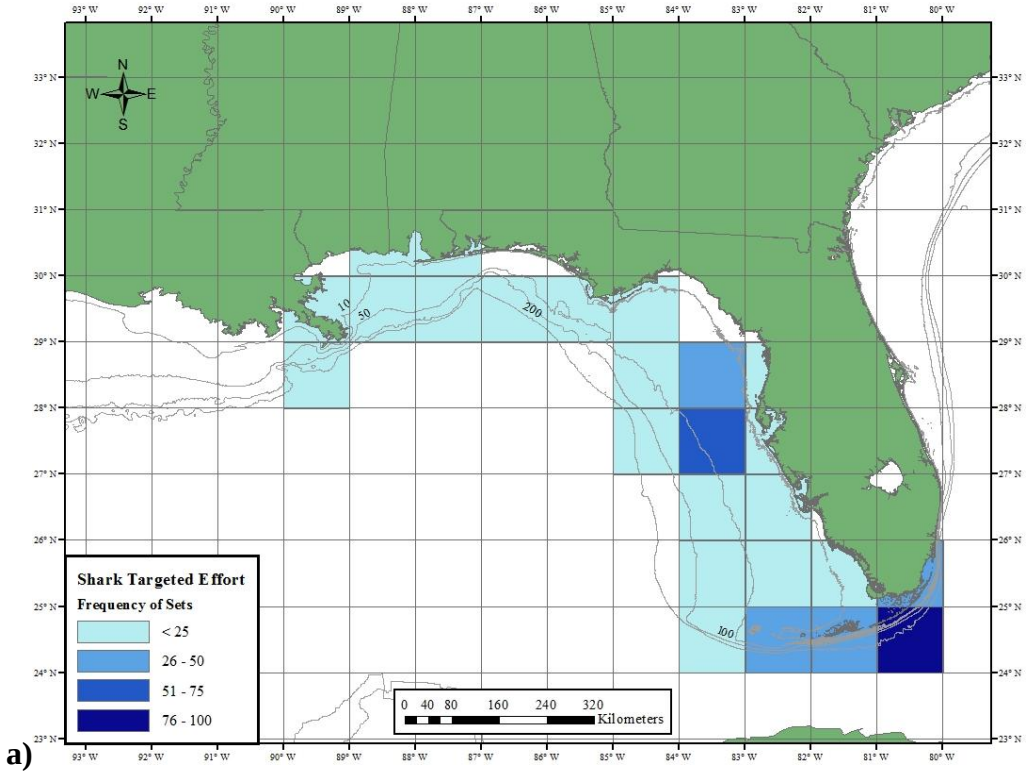

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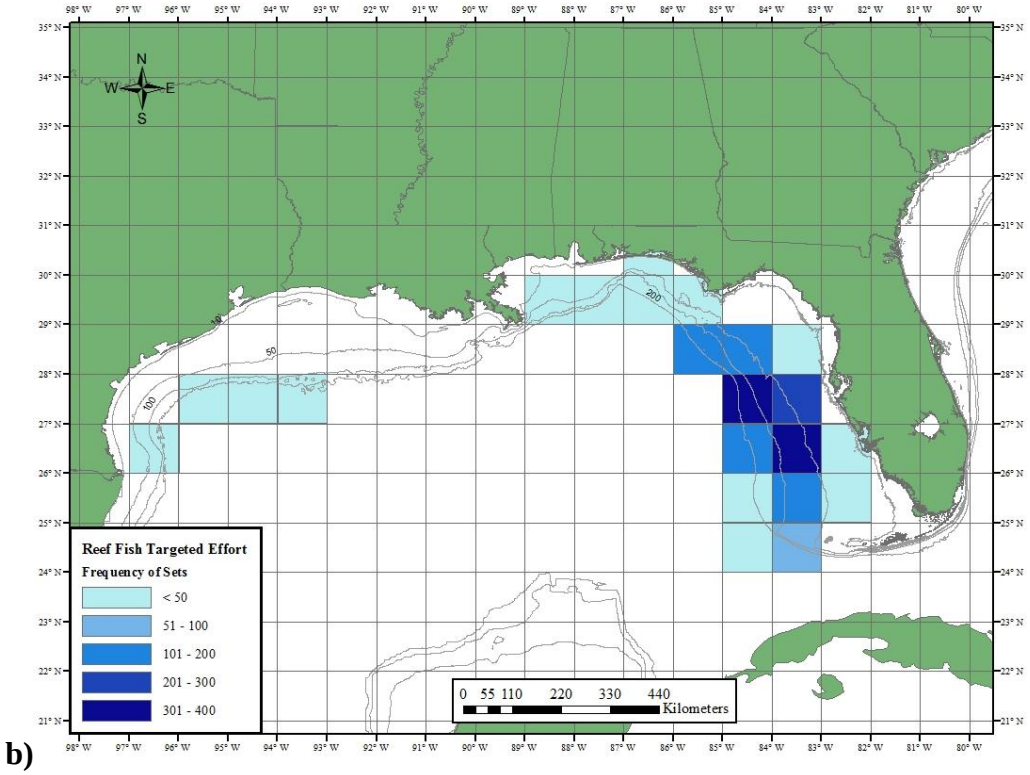

b)

Figure 1. Distribution of observed bottom longline sets from 2005-2008 for: a) shark targeted and b) reef fish targeted sets.

Table 1. Total observed Gulf of Mexico catch and bycatch by species and species disposition in order of decreasing abundance for all shark targeted sets, 2005-2012. Catch disposition is by percent kept (Kept %), percent discarded alive (D.A. %), and percent discarded dead (D.D. %).

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Carcharhinus plumbeus	Sandbar shark	6615	87.5	9.1	2.8	0.6
Carcharhinus limbatus	Blacktip shark	4524	84.8	2.3	12.0	0.9
Rhizoprionodon terraenovae	Atlantic sharpnose shark	2463	17.4	1.3	80.2	1.1
Ginglymostoma cirratum	Nurse shark	1933	0.9	97.4	1.3	0.4
Galeocerdo cuvier	Tiger shark	1409	28.7	61.5	8.7	1.1
Carcharhinus acronotus	Blacknose shark	1359	69.2	2.7	27.8	0.3
Carcharhinus leucas	Bull shark	1072	92.0	5.1	0.4	2.5
Sphyrna lewini	Scalloped hammerhead shark	997	90.5	1.9	6.9	0.7
Carcharhinus brevipinna	Spinner shark	510	81.8	4.9	12.7	0.6
Sphyrna mokarran	Great hammerhead shark	460	92.8	2.0	4.5	0.7
Negaprion brevirostris	Lemon shark	435	92.6	1.6	0.7	5.1
Epinephelus morio	Red grouper	282	50.7	27.7	20.9	0.7
Carcharhinus falciformis	Silky shark	240	78.3	2.1	17.9	1.7
Ophichthus rex	King snake eel	162	7.4	0.0	91.4	1.2
Carcharhinus obscurus	Dusky shark	143	4.2	25.9	67.8	2.1
Epinephelus itajara	Goliath grouper	58	1.7	84.5	12.1	1.7
Mustelus canis	Smooth dogfish	53	11.3	18.9	69.8	0.0
Lutjanus analis	Mutton snapper	47	87.2	0.0	12.8	0.0
Carcharhinus signatus	Night shark	45	4.4	0.0	95.6	0.0
Epinephelus niveatus	Snowy grouper	38	86.8	0.0	13.2	0.0
Seriola dumerili	Greater amberjack	34	58.8	11.8	29.4	0.0
Scianops ocellatus	Red drum	32	6.3	81.3	9.3	3.1
Carcharhinus perezi	Caribbean reef shark	29	34.5	20.7	44.8	0.0
Lutjanus campechanus	Red snapper	29	37.9	17.3	44.8	0.0
Sphyrna tiburo	Bonnethead shark	28	32.1	0.0	67.9	0.0
Squalus mitsukurii	Shortspine dogfish	28	14.3	50.0	35.7	0.0
Callinectes sapidus	Blue crab	27	0.0	96.3	3.7	0.0
Squalidae	Dogfish family	27	3.7	51.9	3.7	40.7
Bagre marinus	Gafftopsail catfish	25	44.0	0.0	56.0	0.0
Sphyraena barracuda	Great barracuda	24	37.5	4.2	54.1	4.2
Pristis pectinata	Smalltooth sawfish	22	0.0	95.5	4.5	0.0
Carcharhinidae	Requiem shark family	21	0.0	0.0	57.1	42.9
Dasyatis americana	Southern stingray	21	0.0	95.2	4.8	0.0
Lutjanus cyanopterus	Cubera snapper	21	90.5	0.0	0.0	9.5
Mycteroperca microlepis	Gag grouper	21	76.2	9.5	14.3	0.0
Dasyatis sp.	Stingrays	20	0.0	85.0	15.0	0.0
Anthozoa	Coral	19	0.0	0.0	100.0	0.0
Elasmobranchii	Sharks	17	5.9	17.7	58.8	17.6

Table 1. Continued.

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Carcharhinus isodon	Finetooth shark	16	87.5	6.3	6.2	0.0
Porifera	Sponges	16	6.3	12.5	74.9	6.3
Mycteroperca bonaci	Black grouper	15	73.3	6.7	20.0	0.0
Rachycentron canadum	Cobia	14	64.3	21.4	14.3	0.0
Caretta caretta	Loggerhead sea turtle	12	0.0	50.0	41.7	8.3
Epinephelus flavolimbatus	Yellowedge grouper	12	100.0	0.0	0.0	0.0
Echeneidae	Remora family	11	9.1	90.9	0.0	0.0
Seriola rivoliana	Almaco jack	11	72.7	0.0	27.3	0.0
Mollusca	Molluscs	9	0.0	88.9	11.1	0.0
Muraenidae	Moray eel family	9	0.0	11.1	88.9	0.0
Anguilliformes	Eels	8	25.0	25.0	50.0	0.0
Echeneis naucrates	Sharksucker	7	0.0	85.7	14.3	0.0
Hexanchus griseus	Sixgill shark	7	0.0	100.0	0.0	0.0
Unknown animal	Unknown animal	7	14.3	0.0	0.0	85.7
Dasyatis centroura	Roughtail stingray	6	0.0	100.0	0.0	0.0
Sphyrna zygaena	Smooth hammerhead shark	6	100.0	0.0	0.0	0.0
Aetobatis narinari	Spotted eagle ray	5	0.0	100.0	0.0	0.0
Congridae	Conger eels	5	0.0	0.0	100.0	0.0
Gymnothorax funebris	Green moray eel	5	40.0	0.0	60.0	0.0
Asteroidea	Sea stars	4	0.0	100.0	0.0	0.0
Cancer spp.	Cancer crabs	4	0.0	100.0	0.0	0.0
Caranx hippos	Crevalle jack	3	0.0	0.0	100.0	0.0
Epinephelus nigritus	Warsaw grouper	3	66.7	0.0	33.3	0.0
Gymnothorax moring	Spotted moray eel	3	0.0	0.0	100.0	0.0
Isurus oxyrinchus	Shortfin mako shark	3	100.0	0.0	0.0	0.0
Raja eglanteria	Clearnose skate	3	33.3	33.4	33.3	0.0
Rajiformes	Skates and rays	3	0.0	100.0	0.0	0.0
Calappa flammea	Flame box crab	2	0.0	100.0	0.0	0.0
Sphyraenidae	Barracuda family	2	50.0	0.0	50.0	0.0
Sphyrna sp.	Hammerhead sharks	2	0.0	0.0	100.0	0.0
Batrachoididae	Toadfish family	1	0.0	100.0	0.0	0.0
Carcharodon carcharias	Great white shark	1	0.0	0.0	100.0	0.0
Cephalopoda	Octopus	1	0.0	100.0	0.0	0.0
Coryphaena hippurus	Dolphinfish	1	100.0	0.0	0.0	0.0
Dasyatis sabina	Atlantic stingray	1	0.0	100.0	0.0	0.0
Epinephelus drummondhayi	Speckled hind	1	0.0	100.0	0.0	0.0
Istiophorus platypterus	Sailfish	1	100.0	0.0	0.0	0.0
Isurus paucus	Longfin mako shark	1	0.0	100.0	0.0	0.0
Lutjanidae	Snapper family	1	100.0	0.0	0.0	0.0

Table 1. Continued.

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Myliobatis sp.	Eagle rays	1	0.0	100.0	0.0	0.0
Ophichthus ocellatus	Pale-spotted eel	1	0.0	100.0	0.0	0.0
Polychaeta	Worms	1	0.0	100.0	0.0	0.0
Portunidae	Portunid crabs	1	0.0	100.0	0.0	0.0
Prionace glauca	Blue shark	1	100.0	0.0	0.0	0.0
Seriola fasciata	Lesser amberjack	1	100.0	0.0	0.0	0.0
Seriola sp.	Amberjacks	1	0.0	100.0	0.0	0.0
Seriola zonata	Banded rudderfish	1	0.0	0.0	100.0	0.0
Squalus cubensis	Cuban dogfish	1	0.0	100.0	0.0	0.0
Urophycis floridana	Southern hake	1	100.0	0.0	0.0	0.0

Table 2. Total observed Gulf of Mexico catch and bycatch by species and species disposition in order of decreasing abundance for all reef fish targeted sets, 2005-2012. Catch disposition is by percent kept (Kept %), percent discarded alive (D.A. %), and percent discarded dead (D.D. %).

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Epinephelus morio	Red grouper	60916	52.5	41.7	5.5	0.3
Epinephelus flavolimbatus	Yellowedge grouper	8249	98.3	0.9	0.8	0.0
Caulolatilus microps	Blueline tilefish	5368	61.4	7.1	31.1	0.4
Lutjanus campechanus	Red snapper	5321	37.1	55.3	7.3	0.3
Rhizoprionodon terraenovae	Atlantic sharpnose shark	2764	1.0	78.6	20.2	0.2
Mycteroperca phenax	Scamp grouper	2520	96.1	2.3	1.5	0.1
Lopholatilus chamaeleonticeps	Tilefish	2126	46.0	49.3	4.6	0.1
Mycteroperca microlepis	Gag grouper	1622	82.6	14.7	2.4	0.3
Mustelus canis	Smooth dogfish	1219	0.6	92.3	6.9	0.2
Carcharhinus acronotus	Blacknose shark	1183	1.4	90.3	8.1	0.2
Ophichthus rex	King snake eel	1064	0.4	22.2	76.3	1.1
Epinephelus niveatus	Snowy grouper	1029	94.8	3.3	1.9	0.0
Urophycis floridana	Southern hake	987	2.0	5.6	92.1	0.3
Muraenidae	Moray eel family	875	1.9	11.4	86.2	0.5
Lutjanus analis	Mutton snapper	682	99.3	0.5	0.1	0.1
Epinephelus drummondhayi	Speckled hind	595	80.2	16.5	3.0	0.3
Squalus cubensis	Cuban dogfish	487	0.0	90.8	9.2	0.0
Pagrus pagrus	Red porgy	465	78.3	9.2	12.5	0.0
Carcharhinus plumbeus	Sandbar shark	440	3.2	94.3	1.4	1.1
Seriola dumerili	Greater amberjack	364	25.0	51.7	22.8	0.5
Galeocerdo cuvier	Tiger shark	312	1.9	93.6	3.2	1.3
Calamus bajonado	Jolthead porgy	238	92.0	3.0	5.0	0.0
Squalidae	Dogfish family	223	2.2	96.0	1.8	0.0
Sphyraena barracuda	Great barracuda	207	15.0	38.6	45.4	1.0
Neomerinthe hemingwayi	Spinycheek scorpionfish	205	91.2	2.0	6.8	0.0
Anthozoa	Coral	195	0.5	3.1	82.0	14.4
Ginglymostoma cirratum	Nurse shark	191	1.6	96.3	0.5	1.6
Carcharhinidae	Requiem shark family	180	1.1	93.9	2.2	2.8
Carcharhinus falciformis	Silky shark	171	3.5	66.7	29.8	0.0
Opsanus pardus	Leopard toadfish	158	2.5	34.8	60.8	1.9
Echeneis naucrates	Sharksucker	152	1.3	81.6	17.1	0.0
Seriola sp.	Amberjacks	146	17.8	32.2	49.3	0.7
Sphyrna lewini	Scalloped hammerhead shark	145	4.1	73.1	21.4	1.4
Carcharhinus limbatus	Blacktip shark	139	6.5	74.8	16.5	2.2
Sparidae	Porgy family	139	79.1	10.8	9.4	0.7
Lutjanus griseus	Gray snapper	135	89.6	7.4	3.0	0.0
Ophichthus ocellatus	Pale-spotted eel	135	1.5	14.8	83.7	0.0
Hexanchus vitulus	Bigeye sixgill shark	133	0.0	82.7	17.3	0.0

Muraena retifera	Reticulate moray eel	129	2.3	3.1	94.6	0.0

Table 2. Continued.

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Mycteroperca bonaci	Black grouper	118	96.6	2.6	0.8	0.0
Triakidae	Houndsharks	112	1.8	97.3	0.9	0.0
Rhomboplites aurorubens	Vermillion snapper	106	45.3	29.2	25.5	0.0
Urophycis cirrata	Gulf hake	106	6.6	16.0	75.5	1.9
Brotula barbata	Bearded brotula	104	96.2	1.0	1.8	1.0
Echeneidae	Remora family	103	2.9	73.8	23.3	0.0
Euthynnus alletteratus	Little tunny	102	4.9	6.9	87.2	1.0
Elasmobranchii	Sharks	101	2.0	83.2	11.8	3.0
Congridae	Conger eels	96	2.1	10.4	87.5	0.0
Lutjanus synagris	Lane snapper	92	59.8	33.7	6.5	0.0
Epinephelus nigritus	Warsaw grouper	85	98.8	0.0	1.2	0.0
Gymnothorax moring	Spotted moray eel	77	1.3	2.6	96.1	0.0
Majidae	Spider crabs	76	2.6	92.2	2.6	2.6
Seriola rivoliana	Almaco jack	74	85.1	13.5	1.4	0.0
Seriola zonata	Banded rudderfish	67	9.0	76.1	14.9	0.0
Rachycentron canadum	Cobia	66	69.7	25.8	4.5	0.0
Balistes capriscus	Gray triggerfish	65	81.5	15.4	3.1	0.0
Merluccius sp.	Silver Hakes	65	3.1	3.1	93.8	0.0
Anguilliformes	Eels	61	0.0	26.2	73.8	0.0
Haemulon album	Margate grunt	61	95.1	3.3	1.6	0.0
Porifera	Sponges	55	0.0	1.8	87.3	10.9
Asteroidea	Sea stars	54	3.7	48.1	24.1	24.1
Trachinocephalus myops	Snakefish	54	1.9	25.9	72.2	0.0
Raja eglanteria	Clearnose skate	52	0.0	76.9	23.1	0.0
Coryphaena hippurus	Dolphinfish	51	76.5	0.0	23.5	0.0
Synodus foetens	Inshore lizardfish	50	0.0	10.0	90.0	0.0
Synodontidae	Lizardfish family	47	2.1	29.8	68.1	0.0
Carcharhinus brevipinna	Spinner shark	44	4.5	70.5	25.0	0.0
Tetraodontidae	Puffer family	41	2.4	92.7	4.9	0.0
Sarda sarda	Bonito	36	2.8	0.0	97.2	0.0
Synodus intermedius	Sanddiver lizardfish	34	0.0	17.6	82.4	0.0
Calamus proridens	Littlehead porgy	32	93.8	0.0	6.2	0.0
Serranidae	Grouper family	31	90.3	3.2	6.5	0.0
Lutjanus vivanus	Silk snapper	30	100.0	0.0	0.0	0.0
Carcharhinus signatus	Night shark	29	3.4	44.9	51.7	0.0
Pristipomoides aquilonaris	Wenchman snapper	28	28.6	3.6	67.8	0.0
Holocentrus sp.	Squirrelfishes	27	18.5	51.9	25.9	3.7
Thunnus sp.	Tunas	26	15.4	7.7	76.9	0.0
Centropristis sp.	Seabass family	25	20.0	36.0	44.0	0.0

Table 2. Continued.

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Scyliorhinus retifer	Chain catshark	25	0.0	88.0	12.0	0.0
Calappa flammea	Flame box crab	24	12.5	87.5	0.0	0.0
Thunnus atlanticus	Blackfin tuna	23	60.9	8.7	30.4	0.0
Carcharhinus leucas	Bull shark	22	0.0	100.0	0.0	0.0
Seriola fasciata	Lesser amberjack	22	9.1	77.3	13.6	0.0
Unknown animal	Unknown animal	22	36.4	27.3	9.0	27.3
Carcharhinus obscurus	Dusky shark	21	0.0	90.5	9.5	0.0
Sphyraenidae	Barracuda family	21	9.5	28.6	61.9	0.0
Batrachoididae	Toadfish family	20	5.0	60.0	35.0	0.0
Caulolatilus chrysops	Goldface tilefish	20	100.0	0.0	0.0	0.0
Lutjanidae	Snapper family	19	84.2	10.5	5.3	0.0
Malacanthus plumieri	Sand tilefish	18	5.6	72.2	22.2	0.0
Phycidae	Phycid Hakes	17	0.0	0.0	100.0	0.0
Holothuroideae	Sea cucumber	16	0.0	0.0	93.7	6.3
Diplectrum formosum	Sand perch	15	0.0	40.0	60.0	0.0
Gymnothorax funebris	Green moray eel	15	6.7	20.0	73.3	0.0
Mollusca	Molluscs	15	0.0	20.0	80.0	0.0
Paralichthys sp.	Flounders	15	40.0	46.7	13.3	0.0
Sphyrna sp.	Hammerhead sharks	15	0.0	86.7	6.6	6.7
Scomberomorus cavalla	King mackerel	14	0.0	14.3	85.7	0.0
Scorpaenidae	Scorpionfish family	14	92.9	7.1	0.0	0.0
Etelis oculatus	Queen snapper	13	92.3	0.0	7.7	0.0
Caretta caretta	Loggerhead sea turtle	12	0.0	41.7	41.6	16.7
Epinephelus itajara	Goliath grouper	12	0.0	33.3	66.7	0.0
Dasyatis americana	Southern stingray	11	0.0	45.5	54.5	0.0
Decapoda	Crabs	11	9.1	72.7	0.0	18.2
Haemulon plumieri	White grunt	11	100.0	0.0	0.0	0.0
Centropristis ocyurus	Bank seabass	10	0.0	70.0	30.0	0.0
Scianops ocellatus	Red drum	10	0.0	100.0	0.0	0.0
Cancer spp.	Cancer crabs	9	0.0	66.7	33.3	0.0
Dasyatis sp.	Stingrays	9	0.0	77.8	22.2	0.0
Caranx hippos	Crevalle jack	8	12.5	0.0	87.5	0.0
Hexanchus griseus	Sixgill shark	8	0.0	87.5	12.5	0.0
Acanthocybium solanderi	Wahoo	7	57.1	0.0	42.9	0.0
Ocyurus chrysurus	Yellowtail snapper	7	85.7	14.3	0.0	0.0
Caranx crysos	Bluerunner jack	6	0.0	16.7	83.3	0.0
Gymnothorax kolpos	Blacktail Moray	6	0.0	0.0	100.0	0.0
Squalus mitsukurii	Shortspine dogfish	6	0.0	33.3	66.7	0.0
Carcharhinus isodon	Finetooth shark	5	0.0	80.0	20.0	0.0

Table 2. Continued.

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Echinodermata	Sea urchins	5	0.0	60.0	20.0	20.0
Epinephelus adscensionis	Rock hind	5	80.0	0.0	0.0	20.0
Lagocephalus laevigatus	Smooth puffer	5	60.0	40.0	0.0	0.0
Osteichthyes	Unknown teleost	5	40.0	0.0	60.0	0.0
Rajiformes	Skates and rays	5	0.0	60.0	40.0	0.0
Balistes vetula	Queen triggerfish	4	100.0	0.0	0.0	0.0
Leiostomus xanthurus	Spot	4	100.0	0.0	0.0	0.0
Menticirrhus littoralis	Gulf kingfish	4	25.0	0.0	75.0	0.0
Opsanus beta	Gulf toadfish	4	0.0	100.0	0.0	0.0
Paralichthys lethostigma	Southern flounder	4	75.0	25.0	0.0	0.0
Polychaeta	Worms	4	0.0	100.0	0.0	0.0
Sphyrna mokarran	Great hammerhead shark	4	0.0	50.0	50.0	0.0
Thunnus obesus	Bigeye tuna	4	50.0	0.0	50.0	0.0
Carangidae	Jack family	3	0.0	33.3	66.7	0.0
Caranx sp.	Jacks	3	66.7	0.0	33.3	0.0
Dipturus garricki	San Blas skate	3	0.0	100.0	0.0	0.0
Echeneis neucratoides	Whitefin sharksucker	3	0.0	100.0	0.0	0.0
Gymnothorax saxicola	Ocellated moray eel	3	0.0	0.0	100.0	0.0
Lutjanus buccanella	Blackfin snapper	3	100.0	0.0	0.0	0.0
Mustelus norrisi	Florida smoothhound shark	3	0.0	33.3	66.7	0.0
Nephropidae	Lobsters	3	0.0	66.7	0.0	33.3
Rhinoptera bonasus	Cownose ray	3	0.0	0.0	100.0	0.0
Thunnus albacares	Yellowfin tuna	3	66.7	0.0	33.3	0.0
Trachinotus falcatus	Permit	3	0.0	100.0	0.0	0.0
Xiphius gladius	Swordfish	3	100.0	0.0	0.0	0.0
Antennariidae	Frogfish family	2	0.0	50.0	50.0	0.0
Calamus calamus	Saucereye porgy	2	50.0	50.0	0.0	0.0
Centropristis philadelphica	Rock seabass	2	0.0	0.0	100.0	0.0
Crustacea	Sand fleas	2	0.0	0.0	100.0	0.0
Cynoscion sp.	Seatrouts	2	0.0	0.0	100.0	0.0
Dasyatis centroura	Roughtail stingray	2	0.0	50.0	50.0	0.0
Epinephelus guttatus	Red hind	2	50.0	0.0	50.0	0.0
Hexanchidae	Cow sharks	2	0.0	100.0	0.0	0.0
Isurus sp.	Mako sharks	2	0.0	50.0	50.0	0.0
Lagocephalus lagocephalus	Oceanic puffer	2	0.0	100.0	0.0	0.0
Pelecanus occidentalis	Brown pelican	2	0.0	0.0	100.0	0.0
Pomatomus saltatrix	Bluefish	2	0.0	0.0	100.0	0.0
Pontinus longispinis	Longspine scorpionfish	2	0.0	50.0	50.0	0.0
Sphyrna tiburo	Bonnethead shark	2	0.0	100.0	0.0	0.0

Table 2. Continued.

Species	Common Name	Total Number Caught	Kept (%)	D. A. (%)	D. D. (%)	U. (%)
Squatina dumeril	Atlantic angel shark	2	0.0	100.0	0.0	0.0
Auxis thaza	Frigate mackerel	1	0.0	0.0	100.0	0.0
Calamus nodosus	Knobbed porgy	1	100.0	0.0	0.0	0.0
Cancer irroratus	Atlantic rock crab	1	0.0	100.0	0.0	0.0
Caulolatilus cyanops	Blackline tilefish	1	0.0	100.0	0.0	0.0
Cephalopoda	Octopus	1	0.0	0.0	100.0	0.0
Cookeolus japonicus	Bulleye	1	100.0	0.0	0.0	0.0
Elagatis bipinnulata	Rainbow runner	1	0.0	0.0	100.0	0.0
Epinephelus cruentatus	Graysby grouper	1	0.0	100.0	0.0	0.0
Fistularia petimba	Red Cornetfish	1	0.0	100.0	0.0	0.0
Fistularia tabacaria	Bluespotted cornetfish	1	0.0	100.0	0.0	0.0
Gymnothorax vicinus	Purplemouth moray eel	1	0.0	0.0	100.0	0.0
Gymnura sp.	Butterfly ray	1	0.0	100.0	0.0	0.0
Heptranchias perlo	Sevengill shark	1	0.0	100.0	0.0	0.0
Isurus oxyrinchus	Shortfin mako shark	1	100.0	0.0	0.0	0.0
Labridae	Wrasse family	1	0.0	0.0	100.0	0.0
Lagodon rhomboides	Pinfish	1	0.0	0.0	100.0	0.0
Larinae sp.	Gulls	1	0.0	0.0	100.0	0.0
Larus argentatus	Herring gull	1	0.0	0.0	100.0	0.0
Larus autricilla	Laughing gull	1	0.0	0.0	100.0	0.0
Lobotes surinamensis	Tripletail	1	0.0	100.0	0.0	0.0
Lophius sp.	Monkfish anglerfish	1	0.0	0.0	100.0	0.0
Lutjanus cyanopterus	Cubera snapper	1	100.0	0.0	0.0	0.0
Lutjanus jocu	Dog snapper	1	100.0	0.0	0.0	0.0
Manta birostris	Manta ray	1	0.0	0.0	0.0	100.0
Mycteroperca interstitialis	Yellowmouth grouper	1	100.0	0.0	0.0	0.0
Narcine brasiliensis	Lesser electric ray	1	100.0	0.0	0.0	0.0
Negaprion brevirostris	Lemon shark	1	0.0	100.0	0.0	0.0
Paguroidea	Hermit crabs	1	0.0	0.0	100.0	0.0
Paralichthys albigutta	Gulf flounder	1	100.0	0.0	0.0	0.0
Peprilus alepidotus	Harvestfish	1	0.0	0.0	100.0	0.0
Peprilus triacanthus	Atlantic butterfish	1	100.0	0.0	0.0	0.0
Prionotus sp.	Searobins	1	0.0	100.0	0.0	0.0
Pterois sp.	Lionfish	1	100.0	0.0	0.0	0.0
Scyphozoa	Jellyfish	1	0.0	100.0	0.0	0.0
Sea bird	Sea birds	1	0.0	0.0	100.0	0.0
Squid	Squid	1	0.0	0.0	100.0	0.0

Table 3. Condition on release (in number) of greater amberjacks captured in the bottom longline fishery by fork length (cm) for shark-target sets (SHX) and reef fish-target sets (REF). Cut for bait is included with Released dead and unknown condition is excluded.

SHX n	SHX Kept	SHX Released Alive	SHX Released Dead	Total Length Bins (cm)	REF n	REF Kept	REF Released Alive	REF Released Dead
0	0	0	0	31-40	14	0	8	6
0	0	0	0	41-50	47	0	14	33
0	0	0	0	51-60	30	0	25	5
0	0	0	0	61-70	11	1	9	1
3	0	2	1	71-80	11	3	7	1
1	1	0	0	81-90	28	2	21	5
6	6	0	0	91-100	40	23	12	5
4	3	0	1	101-110	52	27	21	4
3	2	0	1	111-120	40	16	21	3
7	5	0	2	121-130	14	13	1	0
1	1	0	0	131-140	0	0	0	0
0	0	0	0	141-150	2	1	1	0

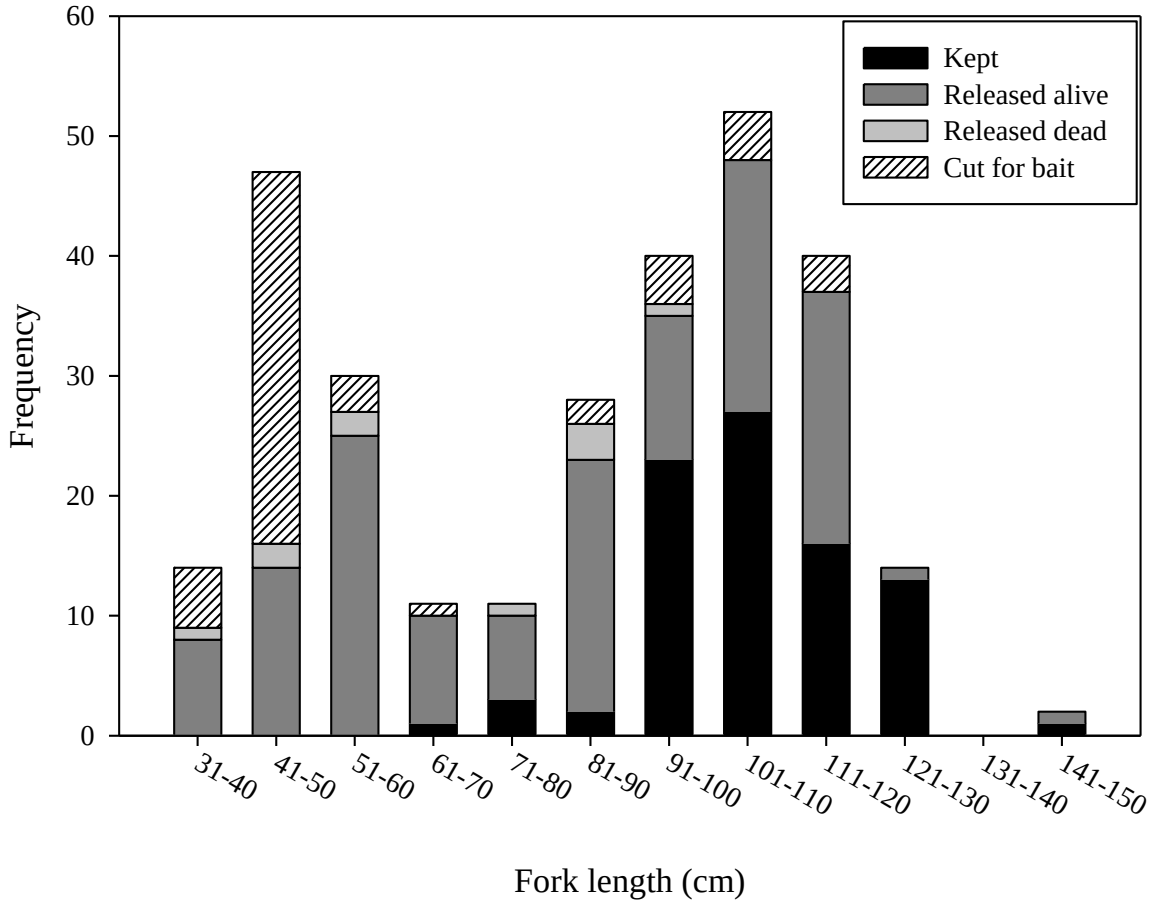

Figure 2. Length frequency (FL in cm) of greater amberjack caught in the reef fish-target bottom longline fishery with condition on release.

Table 4. Condition on release (in number) of greater amberjacks captured in the bottom longline fishery by average depth (m) for shark-target sets (SHX) and reef fish-target sets (REF). Cut for bait is included with Released dead and unknown condition is excluded.

SHX n	SHX Kept	SHX Released Alive	SHX Released Dead	Depth Bins (m)	REF n	REF Kept	REF Released Alive	REF Released Dead
2	2	0	0	31-40	8	0	8	0
1	0	0	1	41-50	44	5	21	18
1	0	0	1	51-60	12	3	9	0
3	1	0	2	61-70	42	12	24	6
6	4	1	1	71-80	32	7	23	2
10	6	0	4	81-90	25	7	14	4
1	1	0	0	91-100	31	9	20	2
0	0	0	0	101-110	13	0	12	1
0	0	0	0	111-120	22	11	9	2
4	1	2	1	121-130	8	6	2	0
0	0	0	0	131-140	1	1	0	0
6	5	1	0	141-150	39	3	3	33
0	0	0	0	151-160	3	1	0	2
0	0	0	0	161-170	13	1	6	6
0	0	0	0	171-180	2	0	1	1
0	0	0	0	181-190	16	0	15	0
0	0	0	0	191-200	4	0	1	3
0	0	0	0	201-210	11	3	7	0
0	0	0	0	211-220	16	9	4	3
0	0	0	0	221-230	9	8	1	0
0	0	0	0	231-240	1	0	1	0
0	0	0	0	241-250	8	4	4	0
0	0	0	0	251-260	1	0	1	0
0	0	0	0	261-270	2	0	2	0
0	0	0	0	271-280	1	1	0	0

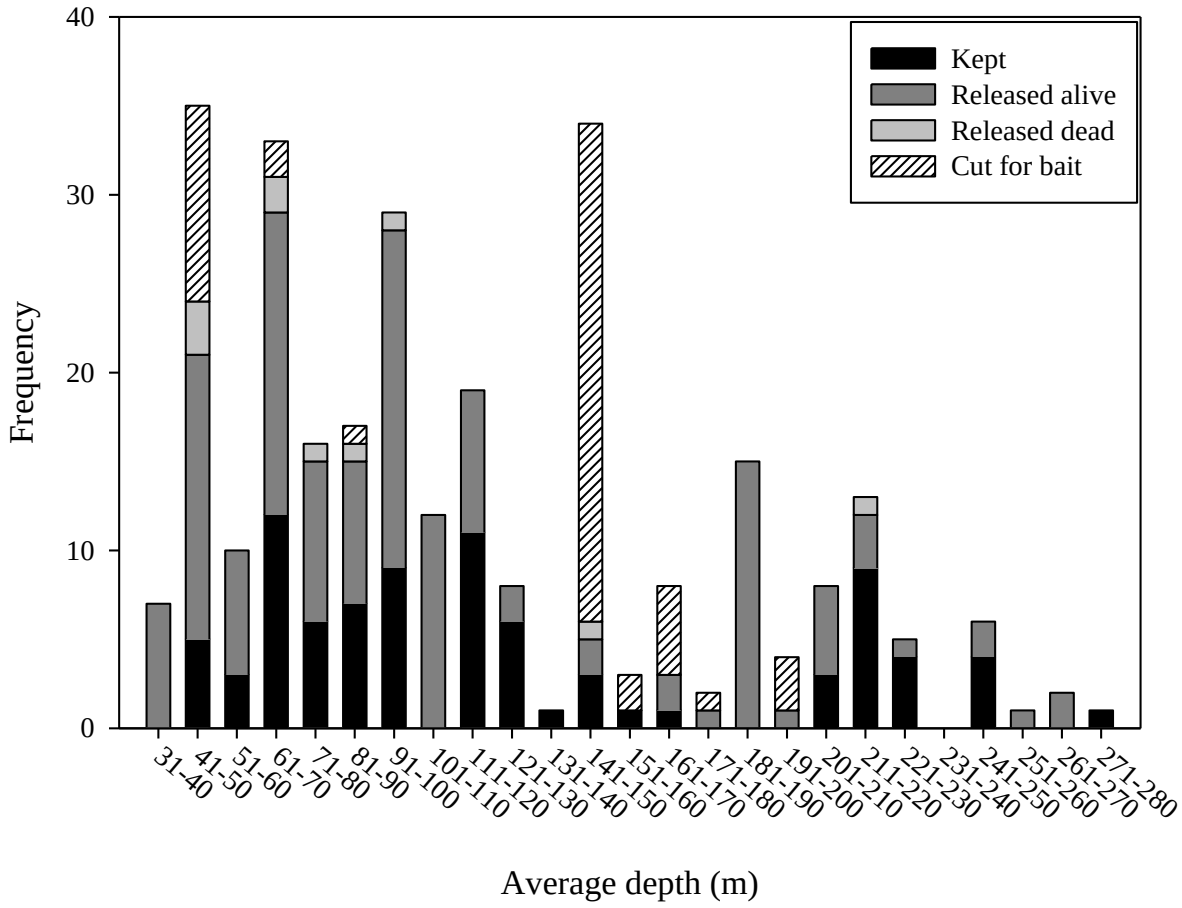

Figure 3. Depth frequency of greater amberjack caught in the reef fish-target bottom longline fishery with condition on release.

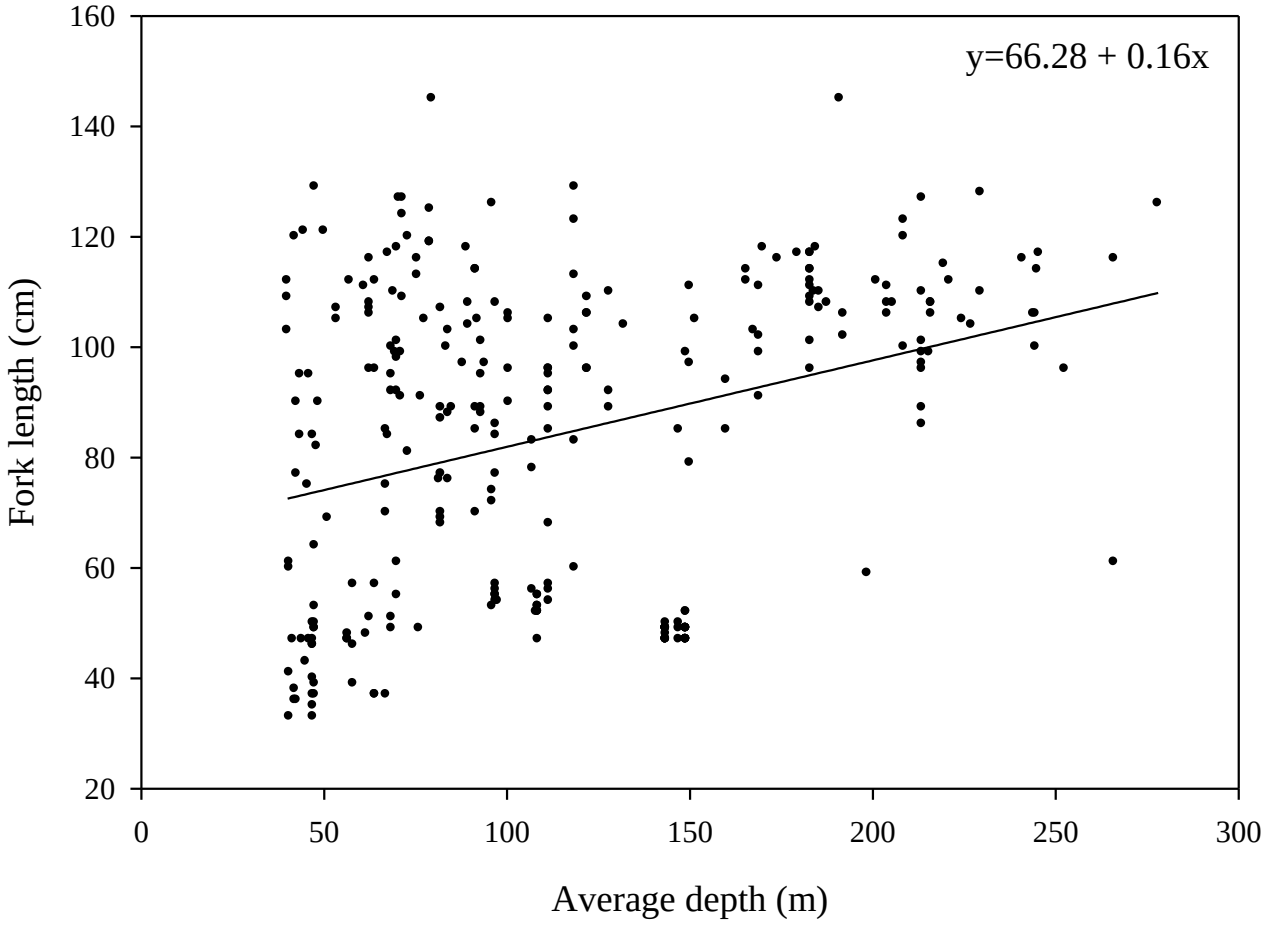

Figure 4. Fork length (cm) versus depth (m) of greater amberjack caught in the reef fish-target bottom longline fishery. A linear regression is plotted with the equation given (r^2 = 0.107, $p < 0.0001$).

Table 5. Condition on release (in number) of greater amberjacks captured in the bottom longline fishery by soak duration (hrs) for shark-target sets (SHX) and reef fish-target sets (REF). Cut for bait is included with Released dead and unknown condition is excluded.

SHX n	SHX Kept	SHX Released Alive	SHX Released Dead	Soak Duration Bins (hr)	REF n	REF Kept	REF Released Alive	REF Released Dead
0	0	0	0	0-1	142	26	92	23
0	0	0	0	1-2	143	38	59	45
0	0	0	0	2-3	40	12	23	5
0	0	0	0	3-4	25	10	9	6
0	0	0	0	4-5	4	0	2	2
0	0	0	0	5-6	2	0	1	1
0	0	0	0	6-7	0	0	0	0
0	0	0	0	7-8	0	0	0	0
0	0	0	0	8-9	0	0	0	0
11	10	1	0	9-10	2	0	2	0
5	2	1	2	10-11	0	0	0	0
0	0	0	0	11-12	4	4	0	0
1	0	0	1	12-13	0	0	0	0
3	2	0	1	13-14	2	1	0	1
8	3	2	3	14-15	0	0	0	0
2	1	0	1	15-16	0	0	0	0
1	1	0	0	16-17	0	0	0	0
1	1	0	0	17-18	0	0	0	0
				//				
2	0	0	2	33-34	0	0	0	0

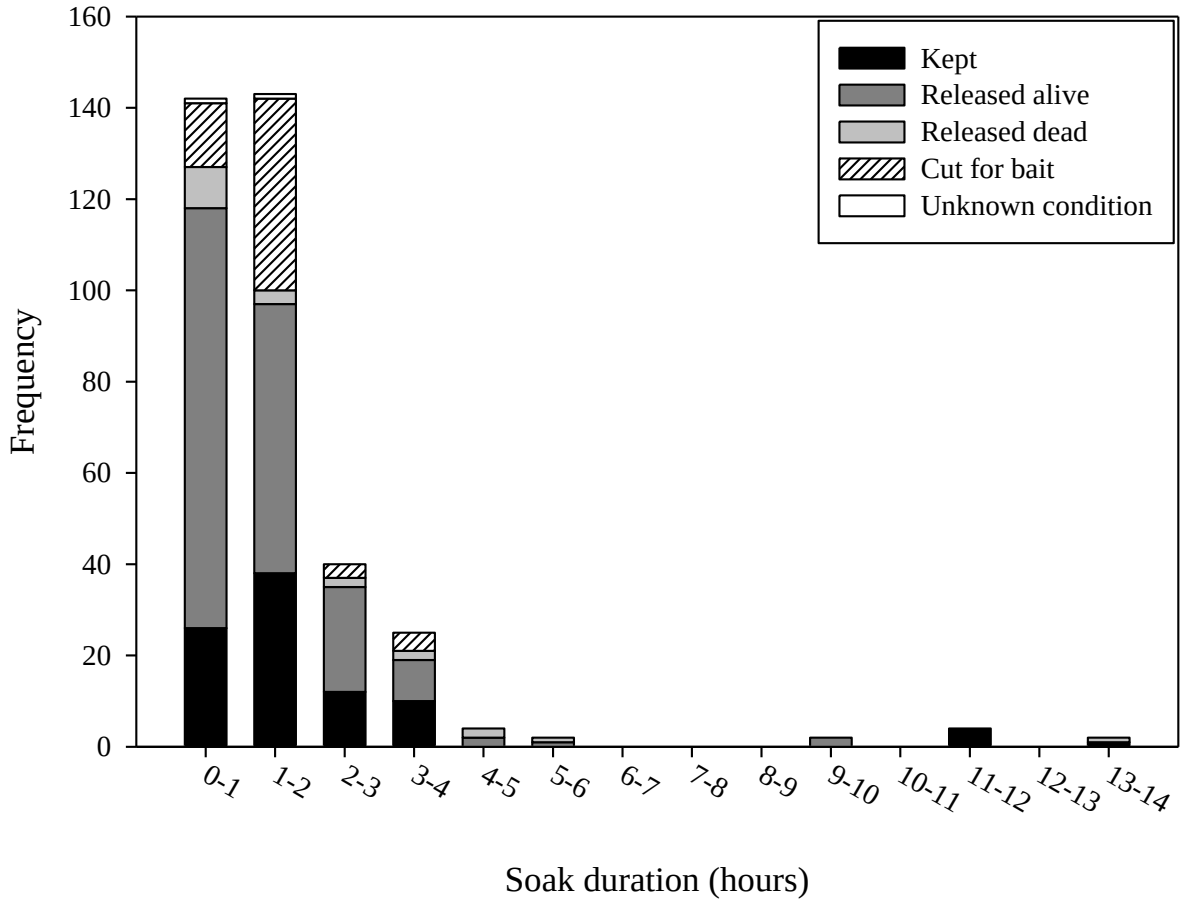

Figure 5. Soak frequency of greater amberjack caught in the reef fish-target bottom longline fishery with condition on release.