2011 Annual Report on the Implementation of the Terms and Conditions of the 2009 Biological Opinion for the Gulf of Mexico Reef Fish Fishery

National Marine Fisheries Service
National Oceanic and Atmospheric Administration

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December 17, 2012

1. Introduction

Fishers engaged in the Gulf of Mexico reef fish fishery use bottom longlines, vertical lines, and modified buoy gear to target snappers, groupers, tilefish, jacks, and other assorted species. The National Marine Fisheries Service (NMFS) began placing observers on Gulf of Mexico reef fish fishery vessels in the second half of 2006 and continues to sample the fishery. On October 13, 2009, a new Biological Opinion on the Gulf of Mexico reef fish fishery was completed and the corresponding incidental take statement was issued. This included several reasonable and prudent measures (RPMs) to minimize the impacts of future takes of sea turtles and smalltooth sawfish by the Gulf reef fish fishery and to monitor levels of incidental take. These RPMs require NMFS to: (1) avoid and minimize take through outreach and education; (2) minimize future gear impacts through research; and (3) monitor the frequency, magnitude, and impact of incidental take. Non-discretionary Terms and Conditions (T&C) are specified for each of these RPMs.

This report satisfies several Terms and Conditions of the 2009 Biological Opinion on the Gulf of Mexico reef fish fishery that NMFS is required to implement. It specifically addresses (1) T&C 1b – requirement for NMFS to conduct in-person training and education of commercial and recreational fishermen on identification of sea turtle species, how to use required and recommended sea turtle gear removal equipment, the "Careful Release and Protocols for Sea Turtle Release with Minimal Injury," and the importance of maximizing gear removal to maximize post-release survival of sea turtles; (2) T&C 3 – requirement for NMFS to conduct or fund projects to characterize the fishery and its interactions with sea turtles and smalltooth sawfish, and potential fishing gear and fishing behavior modifications that reduce adverse impacts from this fishery; (3) T&C 4 – requirement for NMFS to update careful release protocols and modify release gears as new information becomes available; (4) T&C's 8-10 – requirement for NMFS to specify observer data collection and record keeping requirements, review observer data, and provide information on captures[1] and release condition of each bycaught sea turtle in the bottom longline portion of the U.S. Gulf of Mexico reef fish fishery for 2010; (5) T&C 12[2] – NMFS' progress in improving quantitative stock assessments of the primary incidentally-caught species; (6) T&C 14 – requirement for NMFS to maintain a database on fishing gear found associated with sea turtle strandings and to share the results with SERO; and (7) T&C 17 – requirement for NMFS to provide an annual bycatch report including bycatch estimates and CPUEs, a summary of the methods and data used, and the distribution of observed and total fishing effort for the bottom longline component of the Gulf reef fish fishery.

Observed sea turtle takes in 2011 were too few to create statistically reasonable extrapolated take estimates for the entire fishery. However, given the T&C requirement, extrapolations of bycatch estimates using methods employed in previous reports (SEFSC 2008 and 2009) were conducted, and as stated in the 2008, 2009, and 2010 reports, the 2011 extrapolated estimates are based upon sparse data sets (*i.e.*, observed sea turtle takes) and should not be assumed to be reasonable without invoking large assumptions regarding unobserved events (Appendix A).

[1] For the purpose of this report, captures of sea turtles (hereafter "takes") refers to sea turtles that were incidentally captured during fishing operations.

[2] T&C 12 requires NMFS to improve its quantitative stock assessment of the primary incidentally caught species and to report progress towards this goal annually.

To comply with government regulations (*i.e.*, MSFMCA), confidential information has been removed from this Annual Report; therefore, exact reproduction of the estimates provided in the appendix may not be possible.

2. Education and Outreach

2.1. *Description of Outreach Plan*

The Reef Fish outreach plan for the Gulf of Mexico is designed to meet the requirements of the Terms and Conditions of the Biological Opinion by training permitted participants in the reef fish fisheries as well as government officials from both State and Federal Agencies, and non-governmental organizations (NGOs). This requires in-person training and education of commercial and recreational fishermen on: (1) identification of sea turtle species, (2) how to use required and recommended sea turtle gear-removal equipment, (3) the "Careful Release and Protocols for Sea Turtle Release with Minimal Injury," and (4) the importance of maximizing gear removal to maximize post-release survival of sea turtles. This activity was accomplished by working with the Gulf of Mexico Fishery Management Council (GMFMC) and identifying groups to contact and offer training.

2.2. *Summary of Outreach Activities with Fishermen and the General Public*

Outreach and training on sea turtle safe handling and release procedures were conducted with commercial fishers in the following ports: Port Isabel, TX, Port Mansfield, TX, Port Aransas, TX, and Port Lavaca, TX. For recreational fishers, outreach and training was conducted in Port Isabel, TX, Port Mansfield, TX, Port Aransas, TX, and Port Lavaca, TX. Waterproof copies of NMFS Technical Memorandum NMFS-SEFSC-524 ("Careful Release Protocols for Sea Turtle Release with Minimal Injury") were distributed to fishers at each of the above mentioned ports as well as Gulf of Mexico Fishery Management council meetings.

2.3. *Summary of Outreach Activities with Federal and State Agency Partners*

Law enforcement training was conducted for the United States Coast Guard at the Gulf Regional Fisheries Training Center (GRFTC) in New Orleans, LA, and Texas Parks and Wildlife officers in Galveston and Brownsville, TX. Two training classes were held for Florida Fish and Wildlife Commission officers in Quincy, FL.

3. Research Activities

3.1. *Hook Timer Project*

In 2010, NMFS conducted a pilot study, ***Characterization of Target Catch CPUE as a Function of Bait Soak Time in the Gulf of Mexico Bottom Longline Reef Fish Fishery: A Pilot Study to Examine Potential Sea Turtle Mitigation Measures***, to investigate the potential of reducing gear soak times as a method for reducing sea turtle interactions and mortality on reef fish bottom longlines. The objective of the fishery-dependent project was to characterize the catch per unit effort of the primary target species as it relates to bait soak time in the Gulf of Mexico reef fish bottom longline fishery. The 2010 hook timer study found that typical duration of sets is longer than necessary to effectively harvest reef

fish. The study also found that reduced soak times could reduce bycatch of sharks and possibly sea turtles, and also could reduce the mortality of turtles that are caught. These results were presented at a series of industry workshops in August 2011. Fishermen suggested that different fishing practices could reduce soak times and that seasonal effect and bait type should be evaluated. A continuation of the study was funded through the NOAA Fisheries Bycatch Reduction Engineering Program using FY12 funds. The project will begin in January of 2013 aboard commercial reef fish vessels in Florida and will aim to evaluate a suite of industry-recommended techniques to reduce gear soak times.

4. Coastal Logbook Data

4.1. *Data Collection Methodology*

Landings and fishing effort of commercial bottom longline vessels operating in the Gulf of Mexico are monitored by NMFS through the coastal logbook program. The program collects catch and effort data by fishing trip for vessels with permits to fish in a number of fisheries managed by the GMFMC. The coastal logbook program began in 1990 with the objective of a census of reef fish fishery permitted vessel activity, with the exception of Florida where a 20% sample of vessels was required to report. Beginning in 1993, the sampling in Florida was increased to require reports from all vessels permitted in the reef fish fishery.

For each fishing trip the logbook database includes a unique trip identifier, the landing date, fishing gear deployed, areas fished, number of days at sea, gear specific fishing effort (*e.g.*, longline: number of sets, number of hooks per set, length of the longline), species caught, and weight of the landings in pounds. Multiple areas and gears fished may be recorded for a single fishing trip. Data were filtered to remove records that were missing effort data or contained clearly erroneous data (*e.g.*, more than 24 sets/day, longline lengths more than 25 miles). In addition, trips that reported fishing in both regions were excluded. Coastal logbook data are trip-based and therefore, effort cannot be apportioned among areas.

Total effort reported to the costal logbook program was compiled by the species targeted. Reef fish targeted trips were defined as trips by those vessels that did not have a commercial directed shark permit, or trips by vessels that did have a commercial directed shark permit but landed 2/3 by weight species other than sharks. The data were further stratified by region as defined by the reef fish observer program: eastern Gulf of Mexico and western Gulf of Mexico. The eastern region included statistical areas 1-10 and the western region included statistical areas 11-21. There were no reports of trips where a vessel fished in both the eastern and western Gulf of Mexico in 2011.

Three measures of effort were summarized for the reef fish fishery: number of trips, number of sets, and total hooks fished. Hook hours fished could not be used as a measure of fishing effort because of inconsistent reporting of the time spent fishing. In some cases fishers reported hours fished per set, but other fishers reported total hours fished. In many cases it was not clear which “hours of fishing” had been reported.

4.2. *Coverage Levels*

All vessels with permits to land federally managed species (other than swordfish and tunas) in the Gulf of Mexico are required to report landings and effort information to the coastal logbook program.

4.3. *Reported Effort*

All reef fish effort (trips, sets, and total hooks fished) for both regions during 2011, as defined in section 4.1, reported to the coastal logbook program (less filtered data as defined above) was included in the totals provided in Table 1. Reported effort (trips, sets, and hooks fished) by region, target, and permit type are provided in Table 2.

4.4. *Supplemental Discard Program*

In August 2001, NMFS initiated a program to collect commercial fishing vessel discard data from Gulf of Mexico fisheries. A reporting form was developed that supplements the existing coastal logbook forms that are mandatory for those fisheries. Each year, data collection for the discard logbook program involves a 20% random sample of the vessels with Gulf of Mexico reef fish, king mackerel, Spanish mackerel or shark permits. To assure that the sample is representative of vessels with those Federal permits, the universe of permitted vessels is stratified by gear fished. A random sample (weighted by fishing effort reported in the previous year) is selected, without replacement, from each stratum. Fishing gear strata include hand line, electric reel (bandit rig), trolling, bottom longline, trap, gillnet, and diving. The selected fishers are instructed to complete a supplemental discard form for every fishing trip they make. Trips with no discards are reported as such. Reported data include the numbers of discards by species, estimated condition of the animal when released, reason for release (due to regulations or unmarketable/unwanted), and the fishing area where the animal was discarded. No protected species interactions with bottom longline vessels in the Gulf of Mexico were reported to the supplemental discard program during 2011 (*i.e.*, no smalltooth sawfish, marine mammals, or sturgeon were reported).

5. Observer Data

5.1. Background

There are currently two mandatory NMFS observer programs in the Gulf of Mexico that monitor the commercial reef fish sector: the Shark Bottom Longline Observer Program and the Reef Fish Observer Program. The information contained in this report summarizes data collected from these two Observer Programs during the 2011 Gulf of Mexico commercial reef fish season.

For the Shark Bottom Longline Observer Program (SBLOP), observations of the shark-directed bottom longline fishery in the Atlantic Ocean and Gulf of Mexico have been conducted since 1994 (Hale and Carlson 2007, Hale *et al.* 2007, Morgan *et al.* 2009, Hale *et al.* 2009, Hale *et al.* 2010). Currently 215 U.S. fishers are permitted to target sharks (excluding dogfish) in the Atlantic Ocean and Gulf of Mexico, and an additional 264 fishers are permitted to land sharks incidentally. Amendments to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan based on updated stock assessments have eliminated the major directed shark fishery in the U.S. Atlantic and Gulf of Mexico (NMFS 2007).

With respect to the Reef Fish Observer Program (RFOP), Amendment 22 to the GMFMC's Reef Fish Fishery Management Plan dictates mandatory observer coverage. In July 2006, NMFS, in collaboration with the commercial fishing industry and the GMFMC, implemented a mandatory observer program to characterize the commercial reef fishery operating in the U.S. Gulf of Mexico (Scott-Denton *et al.* 2010, Scott-Denton *et al.* 2011). The fishery consists of approximately 890 federally permitted vessels (SERO, 2011). The primary gears used include bottom longline, electric (bandit) reel, hand lines, and more recently, modified buoy gear. Although numerous reef fish species are retained, the predominant targets of these fisheries are groupers and snappers.

5.2. Data Collection Methodology

NMFS observers were placed on commercial reef fish vessels operating throughout the Gulf of Mexico based on random selection stratified by season, gear, and region. Seasonal categories (*i.e.*, quarters) for both observer programs were: 1) January – March, 2) April – June, 3) July – September, and 4) October – December. Regions for the purpose of this analysis, for both observer programs, were eastern Gulf (shrimp statistical zones 1-10) and western Gulf (shrimp statistical zones 11-21).

For the SBLOP, vessels possessing valid directed shark and reef fish permits were randomly selected for coverage, with a target coverage level of 4-6% based on previous years effort in the coastal fisheries logbook. Because of the overlap with vessels targeting reef fish and shark within the same trip and vessels possessing directed shark permits (Hale and Carlson 2007), observers boarded trips regardless of the indicated target species. Data presented in this report are restricted to Gulf of Mexico reef fish-targeted bottom longline trips.

In the RFOP, proportional sampling effort, based on coastal logbook data, among seasons and gears in the eastern and western Gulf of Mexico for all vessels with federal reef fish permits was recommended by NMFS in 2006, and used thereafter for vessel selection stratification purposes. Beginning in 2009, increased coverage was directed toward the bottom longline fishery in the eastern Gulf of Mexico to monitor protected species. The primary gear types assessed included bottom longline, modified buoy gear, and vertical line (bandit reel and hand line). Mandatory observer coverage for the reef fish fishery is currently 5% of the total sea days reported in the 2011 coastal logbook data.

For both programs, selection letters requiring observer coverage were issued to the permit holder via U.S. Certified Mail approximately one to two months prior to the upcoming fishing season. Once the permit holder received the selection letter, he or she was 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 have a current Commercial Fishing Vessel Safety Examination decal prior to the selection period for mandatory observer coverage. Once deployed, the observers collect data pertaining to vessel, gear, location and biological information. For each set (the location of gear placement at a defined time), the type, number and construction material of the fishing gear were recorded. Latitude, longitude, depth, and environmental parameters including sea state and bottom type were recorded at the start of each set. The total time the gear remained in the water (soak or fishing time) was calculated. Fishery data were obtained from each set. Discarded and retained species were processed, recording length, weight, and condition when brought onboard and, if necessary, condition at release.

Sightings or capture of sea turtles (and other protected species) were recorded in accordance with NMFS protocol (NMFS 2008).

5.3. 2011 Observer Programs

Trip, set/haul, gear and fishing characteristics by program for the 2011 commercial reef fish season are depicted (Table 3). Effort by region (Table 4) and by region and season (Table 5) are given. Sea days and percent coverage levels are depicted in Table 6. Protected resources interactions are shown in Table 7.

5.3.1. Shark Bottom Longline Observer Program (SBLOP) – Targeting Reef Fish

There were 225 hauls on 10 trips (Table 3) observed targeting shallow-water reef fish (mainly red grouper) and deep water grouper (mainly yellowedge grouper) using bottom longline gear in the Gulf of Mexico in 2011 (Hale *et al.* 2012). Trips averaged 11.2 sea days in length. The mainline length ranged from 1.9 to 9.6 km with an average of 7.1 km. The bottom depth fished ranged from 40 to 270 m with an average of 74 m, and the number of hooks ranged from 197 to 975 hooks with an average of 718 hooks fished. Circle hooks sized 14/0 were used 50.2% of the time, while circle hooks sized 13/0 were used 35.1% of the time. There were 81 hauls (36.0%) that employed two different types of hooks. The average soak duration (the time from when the last hook entered the water until the first hook was hauled back) was 0.9 hr.

5.3.2. Reef Fish Observer Program (RFOP) – Bottom Longline Gear

There were 2,335 sets on 82.6 trips (Table 3) observed targeting shallow-water reef fish (mainly red grouper) or deepwater grouper/tilefish (mainly yellowedge grouper and tilefish) in the Gulf of Mexico. The length of the mainline for this gear ranged from 0.4 to 19.4 km with an average of 7.3 km. The bottom depth fished ranged from 36 to 388 m with an average of 83.2 m. Hooks set ranged from 600 to 2,000 hooks with an average of 973 hooks fished. Circle hooks were deployed on all sets with size 13/0 the dominant (50.9%). The average soak duration (the time from when the first buoy entered the water until the last buoy was hauled back) was 3.7 hr.

5.3.3. Shark Bottom Longline Observer Program (SBLOP) – Modified Buoy Gear

None of the SBLOP observed trips used modified buoy gear in 2011.

5.3.4. Reef Fish Observer Program (RFOP) – Modified Buoy Gear

Data from RFOP observed trips that used modified buoy gear (n = 3) are not presented due to data confidentiality requirements.

5.3.5. Reef Fish Observer Program (RFOP) – Vertical Line Gear

There were 4,077 sets during 105 trips (Table 3) observed targeting shallow-water reef fish, mainly red grouper and snapper in the Gulf of Mexico. The bottom depth fished ranged from 3 to 312 m with an average of 47.7 m, and the number of hooks ranged from 1 to 240 hooks with an average of 18 hooks

fished. Circle hooks were deployed on most (99.6%) sets with size 8/0 the dominant (62.2%). The average soak duration was 0.6 hr.

5.3.6. Observed Protected Species Interactions

Two interactions with protected resources (sea bird, sea turtle, sawfish, or marine mammal) were recorded for shark bottom longline vessels targeting reef fish in the Gulf of Mexico in 2011. One loggerhead sea turtle and one laughing gull, *Larus autricilla*, were observed in bottom longline gear. Four loggerhead sea turtle interactions and two unidentified sea birds were documented in the RFOP bottom longline fishery in 2011 (Table 7). Table 8 provides a summary of takes, gear characteristics, capture and release conditions, and final disposition of sea turtles documented by the observer program.

6. STSSN database and Fishing Gear Found Associated with Stranded Sea Turtles (T&C 14)

The "Fishing Gear Database" for the Gulf of Mexico and SE U.S. States (Texas-North Carolina) is maintained by a point of contact at the NMFS, Pascagoula Laboratory and is updated quarterly. In 2011, 39 sea turtle strandings (34 in the Gulf of Mexico, 5 in the Atlantic) were reported with associated fishing gear. It is important to note that quarterly updates may not include all gear found in the previous quarter since there is a time lag for individual states submission of gear/data.

7. Data Analysis

7.1. *Discussion*

NMFS has made prior estimates of total bycatch in the Gulf of Mexico commercial bottom longline reef fish fishery (*i.e.*, SEFSC 2008, SEFSC 2009, NMFS 2010). Following Pennington (1983), these reports used the delta lognormal model to estimate bycatch, but this model may not be appropriate as it is very likely that attaining an approximation of normality using the binomial distribution (*i.e*., as assumed in the delta-lognormal approach) was violated because of low sample sizes[3] and frequency of occurrence. The reports stated, "In any case, the extrapolated estimates based upon sparse data sets (*i.e*., sea turtle takes) should not be assumed to be reasonable without potentially invoking large assumptions regarding unobserved events."

A statistical examination of the above reports showed that sample size and incidences of sea turtle interactions were indeed very low in the reef fish bottom longline fishery. The confidence interval estimation was also based on the assumption that all samples are non-correlated and independent – assumptions that are not likely to hold true. Sets are clustered within trips due to the sampling protocols. Furthermore, although the delta-lognormal approach has been used to estimate bycatch for other species and/or fisheries, the approach was probably not robust enough to handle situations with sparse data.

[3] Approximately 40 positive observations are needed to determine the type of distribution. In this case, however, the low sample size and interaction rates do not allow for verification of the approximate normal distribution assumption for using the binomial model nor for verification of the lognormal distribution assumption for the non-zero catch rates.

In addition to concerns with the estimation methodology, NMFS questioned whether or not the effort data obtained from logbooks and used for the expansion of bycatch rates to total take estimates had been appropriately restricted to ensure that the bycatch rates were only multiplied by the applicable effort. Such restrictions would include any gear restrictions to ensure that only reef fish bottom longline effort is used as well as time-area restrictions to provide estimates only when and where interactions take place. Only one of the reports (*i.e*., SEFSC 2008 and not SEFSC 2009), considered these issues, but only peripherally in reference to extrapolations to the western Gulf of Mexico (a large and unobserved strata). Walters (2003) cautioned against this type of extrapolation to unobserved spatial strata. It was also noted that further stratification, *e.g.*, by statistical area, while more appropriate and less tenuous than the design stratification used in the previous NMFS reports (SEFSC 2008 and 2009), would exacerbate the low sample-size problem.

The data considered in this report (*i.e.*, the 2011 Gulf of Mexico Reef Fish Fishery observed bycatch of loggerhead sea turtles) have the same limitations as the data for years 2006 thru 2010. Only 5 loggerhead sea turtles were observed taken in the randomly sampled portion of the fishery. The delta-lognormal approach is probably not appropriate for analyzing this type of data as these data are not likely to fit the assumption that the non-zero CPUE's are drawn from a lognormal distribution. Hence, calculation of bycatch estimates using the SEFSC (2008 and 2009) methodology is no longer considered appropriate. However, in an effort to meet the T&C requirement, extrapolations of bycatch estimates utilizing the methods employed in previous reports (SEFSC 2008 and 2009) are provided in Appendix A.

7.2. *Improvements in Quantitative Stock Assessment*

NMFS has made progress towards the goal of improved quantitative stock assessment. A proposal entitled, "***Quantitative Evaluation of Alternative Analytic Approaches to Analyses of Anthropogenic Impacts on Marine Turtle Populations"*** was referenced in our prior report, and was submitted for funding consideration and remains viable. If funded, the proposed work will develop and utilize a variety of quantitative assessment tools to evaluate the risks and benefits associated with various impact assessment approaches. This process will enable identification of the most sensitive assessment parameters, which can be useful when prioritizing research and data collection efforts.

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Table 1. Effort by region (combined statistical zones, East = 1-10, West = 11-21) reported to the coastal logbook program during 2011.

Effort Measure	Eastern Gulf	Western Gulf
Number of trips	665	202
Number of sets	17,909	1,667
Total hooks fished	12,882,977	1,341,570

Table 2. Detailed effort reported to the coastal logbook program during 2011 including all effort, subdivided by target group (as defined in section 4.1).

Region	Target[1]	Permit[2]	Trips	Sets	Total hooks
Eastern Gulf	reef fish	0	371	11,827	8,444,575
Eastern Gulf	reef fish	1	235	6,014	4,410,885
Eastern Gulf	shark	1	59	68	27,517
Eastern Gulf	mixed	1	NR	NR	NR
Western Gulf	reef fish	0 & 1 combined	68	1,461	1,321,100
Western Gulf	reef fish	1	*	*	*
Western Gulf	shark	1	134	206	20,470
Western Gulf	mixed	1	NR	NR	NR

[1] reef fish – trips by vessels that did not have a commercial directed shark permit and trips by vessels that did have a commercial directed shark permit but landed 2/3 by weight species other than sharks;
shark – trips by vessels with directed shark permits that landed 2/3, by weight, sharks of any species;
mixed – trips by vessels with directed shark permits that did not land a 2/3 majority of either shark or reef fish species

[2] 0 – vessels without directed shark permits, 1 – vessels with directed shark permits

***** Data not presented due to data confidentiality requirements, combined with data from vessels without directed shark permits

NR – no reports to coastal logbook program

Table 3. Trip, set, and gear characteristics for all sets targeting reef fish species in the Gulf of Mexico in 2011 observed by the Shark Bottom Longline (SBLOP) and Reef Fish (RFOP) observer programs.

	Bottom Longline		Modified Buoy		Vertical Line
	SBLOP	RFOP	SBLOP	RFOP	RFOP
Number of Trips	10	82.6	-	3	105
Trip Length (days)	2-18 (**Error! Bookmark not defined.Error! Bookmark not defined.Error! Bookmark not defined.**$\bar{x}$ = 11.2)	3 – 27 (**Error! Bookmark not defined.Error! Bookmark not defined.Error! Bookmark not defined.**$\bar{x}$ = 12.5)	-	*	1 –24 ($\bar{x}$ = 5.9)
Number of Vessels	8	33	-	*	92
Total Sets	225	2,335	-	*	4,077
Sea Days	112	941.8	-	29.7	529.5
Bottom Depth (m)	40 - 270 ($\bar{x}$ = 74)	36 – 388 ($\bar{x}$ =83.2)	-	*	3 – 312 ($\bar{x}$ = 47.7)
Mainline Length (km)	1.9 – 9.6 ($\bar{x}$ = 7.1)	0.4 – 19.4 ($\bar{x}$ = 7.3)	-	*	-
Mainline Material	Cable (100%)	Cable (90.9%) Monofilament (9.1%)	-	*	Monofilament (92.6%) Cable (5.79%)
Mainline Test (lbs)	1,000 – 4,000 ($\bar{x}$ = 1825.6)	450 – 5,000 ($\bar{x}$ = 1,697.8)	-	*	10 – 3000 ($\bar{x}$ = 103.1)
Gangion Length (ft)	3 – 12 ($\bar{x}$ = 5.9)	1.5 – 12.0 ($\bar{x}$ = 5.9)	-	*	-
Gangion Material	Monofilament (100%)	Monofilament (100.0%)	-	*	-
Distance Between Hooks (ft)	7 - 53 ($\bar{x}$ = 32.2)	5.0 – 50.0 ($\bar{x}$ =23.4)	-	*	-
Rod Mount	-	-	-	*	Fixed (83.6%) Portable (16.4%)
Reel Type	-	-	-	*	Electric (55.6%) Hand (24.1%) Hydraulic (20.3%)
Number of Hooks/Set	197 – 975 ($\bar{x}$ =718)	600 – 2,000 ($\bar{x}$ =972.8)	-	*	1 – 240 ($\bar{x}$ =18.3)
Hook Brand	Mustad (65.3%) Lindgren Pitman (20.0%) Eagle Claw (14.7%)	Mustad (82.9%) Eagle Claw (17.1%)	-	*	Mustad (97.4%) Eagle Claw (0.9%)
Hook Shape	Circle (100%)	Circle (100%)	-	*	Circle (99.6%)
Hook Offset	Straight (56.4%) Offset (43.6%) 10° (100%)	Straight 45.1%) Offset (54.9%) 10° (91.9%) 5° (4.3%) 25° (2.0%) 20° (1.9%)	-	*	Straight (69.7%) Offset (30.3%) 10° (91.9%) 25° (5.8%) 0° (2.0%)
Hook Size	14/0 (50.2%) 13/0 (35.1%) 12/0 (14.8%)	13/0 (50.9%) 14/0 (24.5%) 12/0 (9.5%) 15/0 (8.9%) 16/0 (4.8%) 11/0 (1.4%)	-	*	8/0 (62.2%) 14/0 (7.6%) 12/0 (6.6%) 9/0 (5.1%) 10/0 (4.2%) 3/0 (3.8%) 11/0 (2.9%) 6/0 (2.3%) 13/0 (1.9%) 15/0 (1.2%)
Total Hooks Set	161,520	2,239,519	-	*	128,552
Avg Soak Duration in hrs[1]	0.2 – 13.6 ($\bar{x}$ = 0.9)	0.9 – 34.3 ($\bar{x}$ =3.7)	-	*	<0.1 – 8.6 ($\bar{x}$ = 0.6)
Total Hours Fished (sets)	206.5 (225)	8620.6 (2,332)	-	*	2,365.7 (4,073)
Total Hook Hours	141,408.1	8,551,256.0	-	*	89,511.6

[1] Different start and end points are used to measure Average Soak Duration for SBLOP and RFOP. SBLOP calculates it from when the set ends to when the haul begins, whereas RFOP calculates it from when the first buoy is set to when the last buoy is retrieved.

***** Data not presented due to data confidentiality requirements.

Table 4. Effort by region for all observed sets targeting reef fish species in the Gulf of Mexico Shark Bottom Logline (SBLOP) and Reef Fish (RFOP) observer programs.

	Bottom Longline		Modified Buoy		Vertical Line	
	SBLOP	RFOP	SBLOP	RFOP	SBLOP	RFOP
Eastern Gulf						
n	225	2,208	0	169	n/a	3,711[3]
Hooks Set	161,520	2,108,319[1]	0	44,450	n/a	82,930
Hours	206.5	7,827.8[2]	0	341	n/a	2,025.8[4]
Western Gulf						
n	0	127	0	20	n/a	366[5]
Hooks Set	0	131,200	0	6,000	n/a	45,622
Hours	0	792.8	0	133	n/a	339.9[6]

[1] Hooks set was not reported for 65 sets.
[2] Hours fished was not reported for 3 sets.
[3] Location was not reported for 1 set, but inferred from other sets in trip.
[4] Hours fished was not reported for 1 set.
[5] Location was not reported for 2 sets, but inferred from other sets in trip.
[6] Hours fished was not reported for 3 sets.

Table 5: Observed reef fish effort (trips, sets, and hooks) for the Gulf of Mexico from the Shark Bottom Longline (SBLOP) and Reef Fish (RFOP) observer programs by region, gear type, and season. Data were aggregated into two seasons (1 – January-June and 2 – July-December).

		Eastern Gulf					Western Gulf			
		Bottom Longline		Modified Buoy		Vertical Line	Bottom Longline		Vertical Line	Modified Buoy
	Season	SBLOP	RFOP	SBLOP	RFOP	RFOP	SBLOP	RFOP	RFOP	RFOP
TRIPS	1	2	60.8[1]	0	1	27.0	0	3.0	5.0	0
	2	8	16.9	0	1	60.7	0	2.0	12.3	1
SETS	1	*	1,777[2]	0	*	775	0	*	96[5]	0
	2	167	431[3]	0	*	2,936[4]	0	*	270[6]	*
HOOKS	1	*	1,698,219	0	*	26,038	0	*	17,373	0
	2	120,005	410,100	0	*	56,892	0	*	28,249	*

[1] Includes 2 trips with no sets, but location inferred from traditional fishing location.
[2] Includes 42 sets with no count of hooks set.
[3] Includes 23 sets with no count of hooks set.
[4] Includes 1 set with no location, but inferred from other sets in trip.
[5] Includes 1 set with no location, but inferred from other sets in trip.
[6] Includes 1 set with no location, but inferred from other sets in trip.
* Data not presented due to data confidentiality requirements.

Table 6. Number of sea days for all gear types for Observer Program sets and industry in the Gulf of Mexico in 2011.

Gear Type	SBLOP	RFOP	Industry	Percent Coverage
Bottom Longline	225	941.8	6,754	17.3%
Modified Buoy	0	29.7	Not available	-
Vertical Line	n/a	529.5	21,316	2.5%
Total	225	1501	>28,070	-

* Data not presented due to data confidentiality requirements.

Table 7. Protected species interactions for all sets targeting reef fish species in the Gulf of Mexico in 2011 observed by the Shark Bottom Longline (SBLOP) and Reef Fish (RFOP) observer programs.

	Bottom Longline		Modified Buoy		Vertical Line	
	SBLOP	RFOP	SBLOP	RFOP	SBLOP	RFOP
Sea Turtles	1	4	0	0	n/a	0
Marine Mammals	0	0	0	0	n/a	0
Sea Birds	1	2	0	0	n/a	0

Table 8. Summary of sea turtle takes documented in the Gulf of Mexico reef fish fishery by the Shark Bottom Longline (SBLOP) and Reef Fish (RFOP) observer programs in 2011. Seasons are: 1 – January-March, 2 – April-June, 3 – July-September, and 4 – October-December.

	Turtle 1	Turtle 2	Turtle 3	Turtle 4	Turtle 5
Species	Loggerhead	Loggerhead	Loggerhead	Loggerhead	Loggerhead
Observer Program	RFOP	RFOP	RFOP	RFOP	SBLOP
Season	2	2	3	3	4
Depth (ft)	413	247	216	216	Unknown
Number of Hooks	1000	1000	1000	1000	750
Hook Type	Circle	Circle	Circle	Circle	Circle
Hook Size	15/0	Unknown	13/0	13/0	14/0
Offset (°)	10	Unknown	0	0	0
Bait	Other	Other	Squid or herring	Squid or herring	Squid
Capture Condition	Alive, injured	Alive, unknown	Alive, injured	Alive, injured	Alive, injured
Final Disposition	Released alive	Released alive	Released alive	Released alive	Released alive
Hook Location	Beak internal, upper jaw	Not known if hooked	Beak internal, upper jaw	Beak internal, upper jaw	Tongue
Hook Removed	No	No	Yes	Yes	Yes
Entangled Capture	Yes	Unknown	No	No	No
Entangled Released	No	Unknown	No	No	No
Line Left (ft)	2.0	5.0	0	0	0
Estimated Carapace Length (ft)	4.5	3.5	3.0	3.5	2.0
Injury Category Row	III	IV	I	III	III
Release Condition Column	C	A	D	D	D

Injury Category Row: II = hook location in mouth, side, other
Release Condition Column: D = all gear removed

Appendix A

Extrapolated Total Takes of Loggerhead Sea Turtles in the Gulf of Mexico by Year and Season in the Bottom Longline Portion of the Reef Fish Fishery.

T&C 17 specifies that the Annual Report on the Implementation of the Terms and Conditions of the 2009 Biological Opinion for the Gulf of Mexico Reef Fish Fishery include bycatch and catch per unit effort (CPUE) estimates. Extrapolations of bycatch estimates using methods employed in previous reports were conducted (Table A1), and as stated in the 2008 and 2009 reports, the 2010 extrapolated estimates are based upon sparse data sets (*i.e.*, sea turtle takes) and should not be assumed to be reasonable without potentially invoking large assumptions regarding unobserved events. Weightings were determined by approximated logbook effort (in sets) by the proportion of the fishery that either the RFOP or the SBLOP were presumed to have selected from.

Table A1. Extrapolated total takes of loggerhead sea turtles in the Gulf of Mexico for 2011 using a delta lognormal model by year and season, in the bottom longline portion of the reef fish fishery based on observations by the Shark Bottom Longline (SBLOP) and Reef Fish (RFOP) observer programs. Also included is the weighted sum of the extrapolated estimates.

			Eastern Gulf			Western Gulf		
	Year	Season	Takes	95% CI	CV	Takes	95% CI	CV
SBLOP	2011	1	0.0	-	-	-	-	-
	2011	2	16.9	3.3 – 86.5	1.0	-	-	-
RFOP	2011	1	7.8	2.2 – 27.3	0.71	0.0	-	-
	2011	2	27.4	5.4 – 140.0	1.0	0.0	-	-
Weighted Sum (SBLOP, RFOP) of Stratified Estimates			30.8	6.8 – 139.5	0.90	0.0	-	-