Cooperative Bottom Longline Survey to Augment Fisheries Independent Reef Fish Data Collection in the Deep-water Snapper-Grouper Fishery of the South Atlantic United

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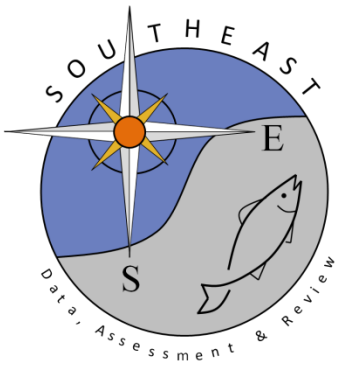
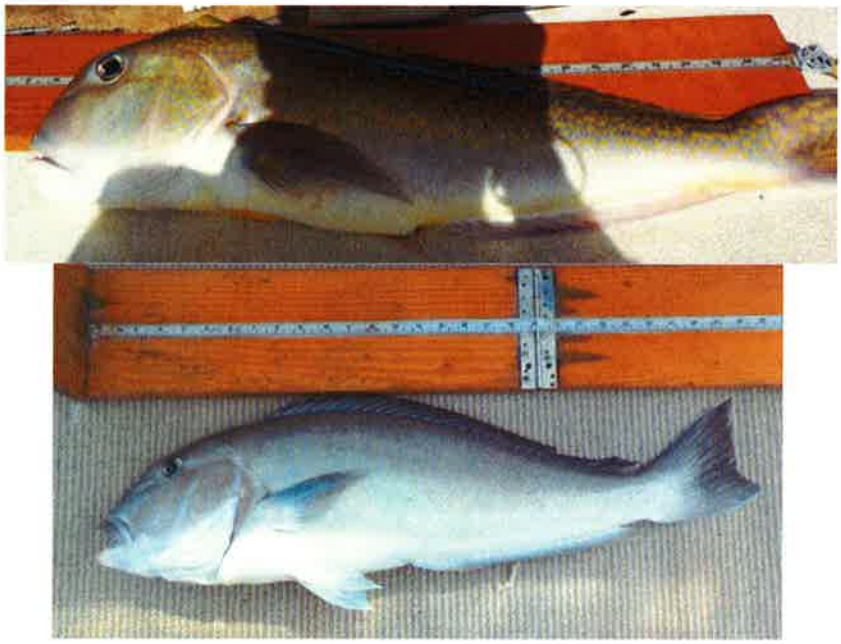


Cooperative Bottom Longline Survey to Augment Fisheries Independent Reef Fish Data Collection in the Deep-water Snapper-Grouper Fishery of the South Atlantic United States

NOAA/NMFS Award Number NA15NMF4270342 (GSAFFI #134)

FINAL REPORT



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Title: Cooperative Bottom Long Line Survey to Augment Fisheries Independent Reef Fish Data Collection in the Deep-water Snapper-Grouper Fishery of the South Atlantic United States

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Award No: NA15NMF4270342 (Foundation #134)

Project Period: September 1, 2015 – August 31, 2016

I. Abstract

The South Atlantic is in critical need of a fisheries independent program to assess deep-water snapper-grouper stocks, and a cooperative research program utilizing the expertise of commercial fishermen that have traditionally fished these stocks is an appropriate means for data collection. In order to meet the need for increased data in the snapper-grouper fishery, the Foundation received funding to establish an important data collection program to ensure more inclusive coverage of the South Atlantic. Industry Partners were contracted to complete fishery independent sampling. Long bottom long line (BLL) gear was utilized for this project in an effort to target Golden Tilefish *Lopholatilus chamaeleonticpes* and Blueline Tilefish *Caulolatilus microps*. Gear types varied based on the region sampled. Each station consisted of a four mile bottom long line with alternating gear types each mile (100 hooks/mile). We completed 41 sea days of data collection comprising 78 stations broken into 310 sets. Target species were collected for life history processing and analysis. A total of 31,015 hooks were deployed over the extent of the project. This accounted for 715.7 fishing hours. The minimum fished depth was 74.2 meters and maximum sampled depth was 267.7 meters. Blueline Tilefish (n = 425) dominated the catches in the northern latitude bands and Golden Tilefish (n = 994) dominated the catches in the southern range. Life history data were collected for over 97% of the target species collected during the project. This research can and will provide important data for upcoming stock assessments and therefore should be continued. This program can provide the groundwork as a proof of concept for a long-term BLL survey.

II. Purpose

Description of Problem:

The snapper-grouper fishery within the South Atlantic United States is comprised of 60 different species, including fishes within the Lutjanidae, Serranidae, Malacanthidae, Carangidae, and

Sparidae families (SAFMC, 2006; 2011). Many of the species are data-poor, with respect to information necessary to support fishery stock assessments. As a result, some species-specific stock assessment models have a high level of uncertainty. Effectively managing this complex fishery is important, yet very challenging, as seen over the past three decades.

This fishery is managed by the South Atlantic Fishery Management Council (SAFMC) under the Snapper-Grouper Fishery Management Plan (FMP), a multi-species plan. The first FMP for the fishery of the South Atlantic Region was prepared by the SAFMC in 1983 (SAFMC, 2006). Since the drafting and implementation of the original FMP, subsequent amendments have increased size limits, decreased the total allowable catch, limited commercial fishing gear, required logbooks, and limited fisher access to prevent overfishing and help rebuild stocks (SAFMC, 2006; 2010; 2011).

Stock assessments are a critical tool for evaluating and monitoring the status of fish stocks. Like all models, stock assessments have an associated level of uncertainty resulting from the use of inaccurate catch statistics, natural, environmental and anthropogenic variability, and nuances and assumptions associated with individual model types (NMFS, 1999). As a result of the June 2013 National Marine Fisheries Service's (NMFS) Regional Data Review workshop, several data limitation issues that are reducing the quality of South Atlantic stock assessments were identified. Many of these issues have resulted in the under-sampling of the snapper-grouper complex. Specifically, there is presently no long-term survey that effectively samples the entire range of the deep-water snapper-grouper species. As a result of these missing data streams and regulatory closures of traditionally important commercial fisheries (e.g. Red Snapper, low quotas for Snowy Grouper, etc.), there has been a paucity of data available for assessing some snapper-grouper species in the South Atlantic, particularly the deepwater complex. Consequently, indices of abundances during these assessments have been based upon data sources, such as recreational headboat landings, that do not adequately or appropriately sample the deeper water snapper-grouper species complex. Specifically, headboats along the east coast of the South Atlantic largely fish in depths from approximately 60 to 90 feet, and rarely, if ever, fish in depths of 200 to 600 feet where much of the snapper-grouper fishery is prosecuted.

In response to the declining availability of fishery-dependent data, fishery-independent survey efforts have increased in South Atlantic waters in recent years, primarily through the collaborative NMFS-funded Marine Resources Monitoring, Assessment, and Prediction (MARMAP) Program and Southeast Fishery Independent Survey (SEFIS) trap-video survey programs. Unfortunately, survey efforts for deep water species still remain well below recommended levels (Williams and Carmichael, 2009). Although data generated by the fishery-independent programs are drastically needed for stock assessments, funding has limited spatio-temporal coverage within the South Atlantic and raised public criticism. A pilot cooperative research project with industry and NMFS was conducted in September 2010 – January 2011 with the goal of determining if there is a 'cryptic biomass' of older and larger Red Snapper in the deeper waters of the continental shelf in the South Atlantic. While this limited pilot study did not locate older, larger fish in deeper waters (Mitchell et al., 2014), the study showed that cooperative surveys are an effective means of collecting important fisheries data.

Additionally, in 2012 the only fishery independent survey for Golden Tilefish in the southeast region, conducted by the MARMAP program, was halted as a result of a significant reduction in program funding. In the SEDAR Golden Tilefish stock assessment (SEDAR 25) report a number of specific research recommendations were listed addressing the collection of information that would strengthen future assessments. In particular, the SEDAR 25 Review Panel recommended "developing a fishery independent index, which eventually would greatly improve the determination of stock status" as a high priority research area (SEDAR, 2010). The other high priority research recommendation focused on the collection of reproductive information to address possible hermaphroditism, size and age specific spawning frequency, and spawning seasonality as a high priority research area (SEDAR, 2010). Increasing the number of age and reproductive samples collected from the main part of the species' range will improve assessment inputs.

Finally, in 2013 a benchmark stock assessment conducted for Blueline Tilefish (SEDAR 32) identified research needs similar to those for Golden Tilefish, the foremost being development of a fishery independent index of abundance. While fishery dependent commercial abundance indices were developed, the review panel noted that these indices were truncated at Cape Hatteras, excluding all catch and effort data north of this area. Given that a large portion of the Blueline Tilefish fishery now occurs north of Cape Hatteras, the panel suggested that the inconsistency between the truncated indexing and the use of all reported landings data from the Atlantic coast of the U.S. be addressed prior to the next assessment. Other high priority research needs included collection of data to define stock structure, reproductive information to better define spawning season/periodicity as well as size and age at maturity (SEDAR, 2013).

Bottom Long Line sampling - Bottom long line gear has traditionally been used to harvest deep-water snapper-grouper species, such as Blueline and Golden Tilefish. Presently, the MARMAP/SEFSC BLL survey efforts are underfunded; which has resulted in the inability to conduct annual surveys and reduces the spatial scale of the sampling regime. In addition, effort in the Blueline Tilefish fishery has increased significantly since 2006, with the majority of commercial harvest occurring in waters off North Carolina between Cape Hatteras and Virginia. However, this area has never been surveyed by MARMAP/SEFIS for any snapper-grouper species due to lack of resources. Golden Tilefish and Snowy Grouper are deepwater species also present in waters north of Cape Hatteras.

The South Atlantic is in critical need of a fishery independent program to assess deep-water snapper-grouper stocks, and a cooperative research program utilizing the expertise of commercial fishermen that have traditionally fished these stocks is an appropriate means for data collection. In order to meet the need for increased data in the snapper-grouper fishery, the Foundation received funding to establish an important data collection program to ensure more inclusive coverage of the South Atlantic. This program can provide the groundwork as a proof of concept for a long-term BLL survey and the data collected will improve stock assessment inputs, particularly those related to under-sampled deep-water species.

Objectives:

1. Through a science and industry based collaborative research program, establish the utility of a critical long-term fisheries independent bottom long line (BLL) survey for deep-water snapper-grouper species in the U.S. South Atlantic, specifically Golden and Blueline Tilefish; and
2. Provide critical life history data from the deep-water snapper-grouper species for use in stock assessments that are currently under-sampled.

III. Approach

Statement of Work:

Planning Meeting(s)

A conference call was held in September 2015 to discuss the plan of action for the project. Foundation staff, Dr. Marcel Reichert (SC-DNR), Dr. Todd Kellison (NMFS SEFSC), and Technical Monitor Jeff Pulver (NMFS) participated in the call. It was determined on the call that sampling should be postponed to the spring of 2016 to avoid potential interactions with right whales during their migration period. Also discussed on the call was the possibility of focusing the sampling on the southern region (GA/NE FL) due to lack of data in the area and ancillary funds that were distributed to NMFS and MARMAP to do similar work in the northern region (NC).

The planning meeting was held on March 7, 2016 in conjunction with the South Atlantic Fishery Management Council (SAFMC) meeting in Jekyll Island, GA (Appendix A, planning meeting agenda). The goals of the meeting were to introduce all parties, review the research protocol, and resolve any questions prior to sampling. Attendees included Foundation Program Director Frank Helies, Bob Jones (Southeastern Fisheries Association), Dr. Marcel Reichert (SC-DNR), Dr. Peter Barile (Industry Consultant), Dr. Michelle Duval (SAFMC), Ben Hartig (SAFMC), Dewey Hemilright (Industry Partner), Keenan Carpenter (Foundation Observer), and Daniel Parshley (Foundation Observer Coordinator).

A follow-up meeting with Mr. Helies, Dr. Barile, and Jim Freeman (Industry Partner) was held the following morning due to Mr. Freeman being unable to attend the previous day's meeting. Additional conference calls and follow-up calls with the Industry Partners were held in March 2016.

Mr. Helies coordinated a pre-deployment meeting held on April 30, 2016 where project participants worked through issues with deploying MARMAP standard gear in the southern range for the project. Efforts were made to unify sampling protocols between previous MARMAP sampling and appropriate fishing methods for the southern region encompassing the tilefish fishery. The most significant result of this meeting was the decision to deploy the gear in four mile stretches instead of two simultaneous one mile stretches. The vessel would remain connected to the fishing gear and initiate retrieval from the end of the set. This was decided to minimize gear loss due to the strong current encountered in the southern portion of the range.

The Fishery and Vessel Selection

The Council allows the use of BLL gear north of St. Lucie Inlet, FL in depths greater than 50 fathoms, where it is primarily used to target Golden Tilefish (SAFMC, 2011). Historically, Blueline Tilefish were a bycatch species offshore of Florida. More recently, Blueline Tilefish has become a target fishery species further to the north. Long line vessels are typically bigger than bandit boats, their trips are longer, and they cost more to operate because they operate farther offshore. These vessels can provide an effective platform for sampling deep-water snapper-grouper species. The Foundation's Industry Partners were given first preference for participation on the project. Additionally, these partners participated in the 2010 NOAA Fisheries cooperative study and were familiar with the sampling protocol.

The Foundation made available to cooperating fishing vessels funds that covered the costs of fuel, ice, bait, and crew for each at-sea sampling day. Additionally, vessel liability insurance was secured and funded by the Foundation to protect the vessel in the event of a catastrophic incident resulting in injury to the Observer.

Fishery Observer Training

The contracted Fishery Observer underwent specific and detailed training prior to his deployment on a commercial fishing vessel. It was the responsibility of the Observer Coordinator and Program Director to schedule and train the Fishery Observer. The observer was outfitted with the necessary sampling (baskets, fish boards, etc.) and safety (personal EPIRBs, lifejackets, etc.) gear.

Training detailed all administrative and programmatic procedures necessary to conduct the research and included (but was not limited to): overview of the data collection protocols, review and identification of all fauna harvested during hook-and-line fishing, proper handling of sea turtles, description and measurements of fishing gear, and best practices while aboard commercial fishing vessels (classroom and at-sea education). In addition, the observer underwent marine safety training that outlined procedures on how to respond properly and promptly to a variety of emergency situations that could be encountered during fishing operations (e.g., man overboard drills, firefighting, radio communication, etc.). The observer was also required to complete a First-Aid and CPR course.

Additional training was provided by scientists at SC-DNR. Training included biological sample processing and age/growth sample work-up. This consisted of removing otoliths, gonadal tissues, and tissues for genetic studies.

Permits

All state scientific collection permits (Florida, Georgia, South Carolina, and North Carolina) for the observer were obtained and remained valid over the duration of this project. Additionally, the Foundation was granted an LOA through NOAA Fisheries to allow the collection and permanent retention of all harvested species during the project.

Site Selection

The goal of the program was to sample 16 stations (one mile deployments) in each of seven "bands" defined by latitude increments between 27° to 33° and 35° to 37° (Table 1). Per discussions with cooperating scientists and industry representatives from the southeast, bands 30°, 33° and 34° were not included in the sampling universe due to low landings of the target species (Blueline and Golden Tilefish). Due to the change in sampling protocol from one mile deployments to four mile deployments, we changed the labeling terminology from the proposal. For this survey, stations ("collections" in the MARMAP vernacular) were labeled as a four mile deployment and each associated one mile stretch within a station was considered a set. Table 1 outlines the number of stations and sets sampled in each latitudinal band. The odd numbered stations are due to a few stations crossing lat bands.

Table 1: Latitudinal bands with associated ranges in degrees latitude and corresponding station/set information.

Sampling Range			
Latitude band	**Latitude range**	**Stations Sampled**	**Sets Sampled**
7	36 - 37°	9	34
6	35 - 36°	4	14
5	32 - 33°	11	43
4	31 - 32°	17	69
3	29 - 30°	7	28
2	28 - 29°	18	74
1	27 - 28°	12	48

The sampling universe included areas of suitable habitat (muddy bottom) along the continental shelf for tilefish. Sites within a specific latitudinal band were randomly selected prior to deployment. Each "sampling box" was 2.5 nautical miles wide by five nautical miles tall. BLL sites previously sampled by MARMAP were included in the site selection. The captain had discretion on gear deployment within each selected box once at sea.

It is widely recognized within the fishery that specific depth strata yield different sized fish, particularly for Golden Tilefish. In order to sample all size ranges, the research team utilized a balanced selection of "specific depths" within the universe of sampling sites (90–125 fa range for bands 1-5 and 30-80 fa for bands 6-7).

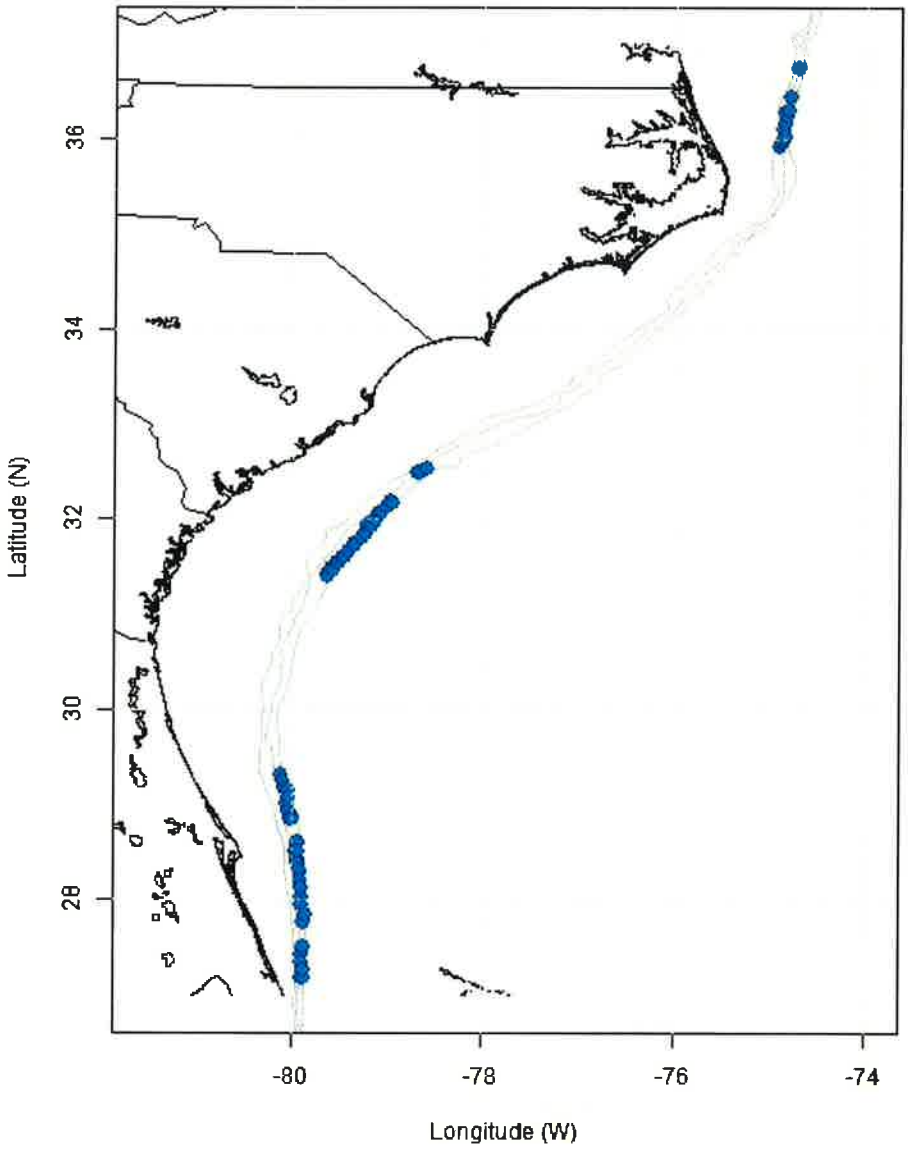

Figure 1: Sites sampled during this project. Bathymetry lines represent 50, 100, and 200m.

Gear

Bottom long line (BLL) gear was utilized for this project. Gear types varied based on the region sampled. The vessel tasked with sampling the southern range utilized steel cable groundline deployed from a long line reel. The vessel tasked with sampling the northern range utilized monofilament groundline deployed from a long line reel. Four specific gear types (A, B, C, D) were deployed during this project. Appendix B includes gear forms that outline the specifications of each gear type.

Each sampling site consisted of a four mile long line deployment. A different gear type was deployed on each one mile section of the ground line with alternating gear types, the order of the gear type being randomly assigned. One hundred gangions were attached in 12 m intervals to the ground line.

Gear A: MARMAP Standard

- This gear was modeled off MARMAP standard BLL gear deployed in the South Atlantic (Smart et al., 2015).
- Gangions consisted of an AK snap, approximately 0.5 m (20 inches) of 90 kg (200 lb) monofilament.
- Non-offset circle hook (Mustad 14/0) attached to the monofilament leader with a metal crimp.
- Baited with whole squid.

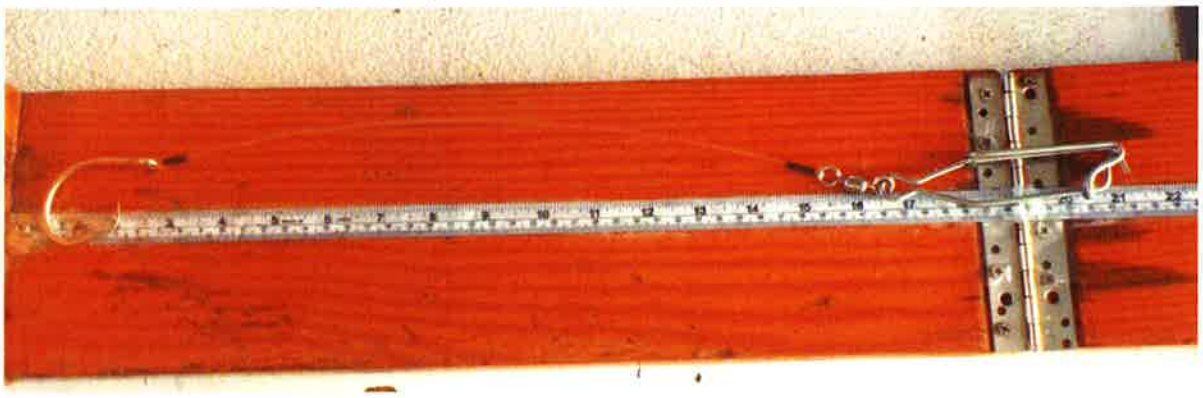

Figure 2: Gear A - modeled off MARMAP standard LBLL gear deployed in the South Atlantic (Smart et al., 2015).

Gear B: Captain's Choice - Florida

- Gangions consisted of an AK snap, approximately 1.8 m (6ft) of 180 kg (400 lb) monofilament.
- Pink, blue or green glow bead
- Offset circle hook (Mustad 15/0, 25 degree offset).
- Hook attached to a swivel.
- Baited with cut squid.

Figure 3: Comparison of Gear A (right) and Gear B (left – red monofilament leader).

Gear C: Altered MARMAP Standard

- This gear was modeled off MARMAP standard LBLL gear deployed in the South Atlantic (Smart et al., 2015).
- Gangions consisted of an AK snap, approximately 0.5 m (20 inches) of 90 kg (200 lb) monofilament.
- Non-offset circle hook (Mustad 14/0) attached to the monofilament leader with a swivel instead of a metal crimp.
- Baited with whole squid.

Gear D: Captain's Choice – North Carolina

- Gangions consisted of an AK snap, approximately 0.8 m (2.6ft) of 136 kg (300 lb) monofilament.
- 1-2 green glow beads.
- Offset circle hook (12/0 circle, 10 degree offset).
- Hook attached to a swivel
- Baited with cut squid.

We utilized the NMFS Observer Training Manual (NMFS, 2015) Gear Specification Form to record gear dimensions throughout the project.

Data Collection

Sampling methodologies were borrowed and modified from protocols already in existence (MARMAP, 2009; NMFS, 2015; Smart et al., 2015), and were fine-tuned during the project. One fishery observer was deployed as chief scientist per cooperating vessel to collect data. Industry Partners were contracted to complete the fishery independent sampling. Long line gear was deployed in areas of soft bottom habitat to target Golden and Blueline Tilefish and prevent gear loss/destruction during daylight hours. Each station consisted of a four mile bottom long line with alternating gear types (A, B, C – southern range; A, D – northern range) each mile (100 hooks/mile). Each station consisted of four sets (one mile/100 hook section). We completed 41 sea days of data collection comprising 78 stations broken into 310 sets (Table 2). The first trip (P50-01) was utilized as a shakedown cruise to work out any issues with data collection.

Table 2: Data collection trip details.

Trip #	Dates (2016)	Vessel	Port	Sea Days	Sets
P50-01	4/30-5/4	Lady Maritza	Port Orange, FL	3	20
P50-02	5/9-5/16	Lady Maritza	Port Orange, FL	5	38
P50-03	5/21-5/25	Lady Maritza	Port Orange, FL	2	16
P50-04	6/3-6/5	Tar Baby	Wanchese, NC	3	20
P50-05	6/21-6/28	Lady Maritza	Port Orange, FL	6	48
P50-06	6/29-7/3	Lady Maritza	Port Orange, FL	3	28
P50-07	7/7-7/16	Lady Maritza	Port Orange, FL	8	64
P50-08	7/20-7/28	Lady Maritza	Port Orange, FL	7	48
P50-09	8/19-8/22	Tar Baby	Wanchese, NC	4	28

The Fisheries Observer recorded gear configurations and fishing effort data (e.g., date and time of deployment and retrieval, latitude, longitude and water depth of each deployed line).

The goal of the program was to allow each deployed hook to have a soak time of at least 90 minutes. Set time - start / end and Haul time - start / end were recorded for each one mile section of gear to calculate soak time for each gear type. Due to the necessity of deploying a longer long

line (four miles vs. one mile) to account for high bottom current in the southern portion of the sampling universe, some soak times were as high as four hours. The average soak times spread over each gear type for the duration of the project was 2.3 hours. From trips P50-03 through P50-09, the location of gear types were altered for each subsequent deployment to spread soak times over all gear types.

Gear fished in high currents was retrieved from the end of the deployment point. In the northern sampling areas, retrieval was from the start point of the gear set.

Mini-loggers were deployed on each one mile section of gear to record temperature profiles during fishing activities (see "Environmental Data").

Station Data

Station data were collected on the NMFS Observer Training Manual Long Line Station Sheets. Comparative information was transferred to a MARMAP Bridge Log at the end of a trip. Information included: Trip number, Collection Number, Set number, Date, Gear code, Set time - start / end, Haul time - start / end, GPS location, Predators observed, Bait, Soak time, Number of hooks set, Number of hooks lost, Water depth, Surface temperature, and Bottom type. Also recorded by the observer were surface current and any notes on deployments.

Length Frequency Work-up

Landed fish were processed following standard processing procedures. The on-board Length-Frequency (LF) workup consisted of identifying all fish in each sample (individual long line) to species level and measuring total length (TL to the nearest mm) of all individual fish of each species. Most specimens were tagged with a collection number, set, gear type, and were retained for additional life history processing [Age/Growth (A/G) work-up]. Any fish not retained for the A/G work-up (sharks) were degassed as necessary and released. LF data were recorded on the MARMAP Length Frequency forms (slightly altered for this project). Weighing each individual fish proved problematic while at-sea. Weights were taken during A/G work-up when returned to port.

Life History Work-up (Dockside)

Fish designated for life history (LH) work-up were tagged with the appropriate collection number and stored on ice (Figure 4). For this project, LH was conducted dockside when the vessel returned to port. The LH work-up consisted of verifying identification, weighing and measuring lengths of individual fish, and removing otoliths, gonadal tissues, and tissues for genetic studies. Lengths were measured and recorded manually (pinched tail total length, fork length, standard length, in mm preferred). Individual fish weight to the nearest gram was determined by an electronic scale. Otoliths (sagittal) were dissected from each fish and stored dry in coin envelopes. Gonad tissues were placed in Tissue Tek®*1 cassettes and fixed in 11% seawater-buffered formalin. Fin clips (generally the left pectoral fin) were removed from fish during LH work-up and preserved in vials with 1.0% sarcosyl urea. All samples of individual fish were labeled, stored, and hand delivered to MARMAP/SEAMAP-SA Reef Fish Laboratory

in Charleston, SC. Samples were later processed and analyzed by scientists with SC-DNR. LH methodology was taken from Smart et al., 2015.

Figure 4: Tilefish labeled for LH work-up.

Figure 5: Keenan Carpenter and Claudia Dennis remove otoliths from tilefish.

All priority species were retained under the auspices of a Letter of Authorization research permit obtained by the Foundation prior to initiation of sampling. However, sale of the catch was not permitted due to federal permitting restrictions. All fish were donated to regional charity programs identified by southeast states representatives.

Observer Keenan Carpenter was the primary person responsible for the LH work-up. He received incredible assistance from a large number of volunteers once at the dock to ensure the LH work-up was completed in a timely fashion (Figure 5). The names of those volunteers are listed in the "Project Management" section of this report.

Environmental Data

Bottom temperatures were recorded by temperature probes (Vemco miniloggers) attached to each "set" deployed simultaneously in the same sampling area. Mini-loggers were programmed to record temperature readings every 10 minutes. Data were offloaded at the end of each trip and sent to SC-DNR for analysis and inclusion in the database.

Data Review and Entry

As stated above, the Observer was tasked with collecting all data. At the end of each fished station, the observer and vessel captain verified the accuracy of the collected data by signature. At the conclusion of a fishing trip, the observer thoroughly reviewed all data sheets and verified that all data were legible and accurate. The Observer Coordinator debriefed the observer and verified that all data sheets were legible and accurately/completely filled out.

Raw data sheets were mailed to the Foundation for archiving and data were electronically entered into a database at the Foundation office. Additionally, copies of the original data sheets for completed trips were sent to project cooperators at SC-DNR in Charleston, SC for inclusion in the MARMAP database.

Statistical Methods

The dataset created during the performance of this award was not intended to be considered a standalone dataset, but was meant to augment existing datasets and assist scientists in the development of more accurate stock assessments for the deepwater snapper-grouper complex. However, some basic analyses were undertaken to further examine certain aspects of the fishery. We believe that additional, more thorough analyses should be undertaken in the future by the state and federal agency data providers to ensure these data are fully utilized in the stock assessment process.

Project Management:

Principal Investigator:

Ms. Judy L. Jamison	Executive Director

Foundation Staff:

Mr. Frank C. Helies	Program Director
Ms. Gwen Hughes	Program Manager
Ms. Charlotte Irsch	Grants/Contracts Specialist

Overall project quality control and assurance was assumed by the Gulf & South Atlantic Fisheries Foundation, Inc. through its office in Tampa, Florida. Foundation staff had responsibility for all Foundation administrative and programmatic activities, with oversight by the Foundation's Board of Trustees.

While the Foundation took the lead in project management, this project required the cooperation and active participation of many organizations and individuals. The essential personnel we would like to thank for their participation and hard work are:

South Carolina Department of Natural Resources Cooperators:

Dr. Marcel Reichert	MARMAP/SEAMAP-SA Reef Fish Program, Charleston, SC
Dr. Wally Bubley	
Dr. Joey Ballenger	
Dr. Tracey Smart	

Industry Scientific Consultant:

Dr. Peter Barile	Marine Research and Consulting, Inc.

Observer Coordinator:

Daniel Parshley

Fishery Observer:

Keenan Carpenter

Industry Partners:

Jim Freeman and family	Commercial Fisherman, Florida, F/V Lady Maritza
Captain Eric Meagley	Commercial Fisherman, Florida, F/V Lady Maritza
Dewey Hemilright	Commercial Fisherman, North Carolina, F/V Tar Baby
Bob Jones	Southeastern Fisheries Association
Ben Hartig	Commercial Fisherman, SAFMC Member

NOAA Fisheries Cooperators:

Jeff Pulver	NMFS Technical Monitor, SEFSC, Galveston, TX
Dr. Todd Kellison	NMFS, SEFSC, Beaufort, NC
Claudia Dennis	NMFS Port Agent
David Hoke	NMFS Port Agent

North Carolina Division of Marine Fisheries Cooperators:

Dr. Michelle Duval SAFMC Chair
Kathleen Boylan
Beth Egbert
Samantha Farquhar
Robert Preston
Madeleine Van Middlesworth
TD Van Middlesworth

IV. Findings

Results:

Effort

Sampling was completed over nine trips ranging from four to 10 sea days. We were able to complete 41 sea days of sampling (three over the proposed number) over a four month period. A total of 31,015 hooks were deployed over the extent of the project. This accounted for 715.7 fishing hours. The average soak time for each one mile section was 2.3 hours. The minimum fished depth was 74.2 meters and maximum sampled depth was 267.7 meters. The average surface current encountered while sampling in the northern latitude bands was 0.7 knots. The average surface current encountered while sampling in the southern latitude bands was 3.0 knots, with a minimum of 0 knots and a maximum of 4.6 knots.

Gear Performance / Trip Observations – Southern Range

The 200 lb test on Gears A and C appeared to be insufficient when dealing with any moderate account of tidal movement. Several times during the course of a trip the captain had to turn the boat around to chase after fish that floated to the surface after breaking free of the leader. This is attributed to the spinning of hooked fish and subsequent strain on the line on retrieval from depth. In most cases a fish broken free of a line occurred at the crimp immediately adjacent to the hook, not counting the cases where shark interference was evident. The captain's recommendation was the use of 400 lb test and the addition of swivels on the leaders.

Hooks baited with whole squid (A, C) were observed coming back clean to the boat, save one or two instances during a trip. The hooks with cut bait often, though not always, came back with the bait still present in varying degrees of wholeness.

The captain held to the belief that hooks that drag, either via tidal influence or active manipulation by the boat, covered more ground and so, caught more fish. Given the tendency of a large number of the fish caught to appear later in the string this seems plausible. According to the captain, the weight and the first hundred or so hooks effectively hold the string in place at a target depth, but when setting cable in the rest of the string fans out in an arc dependent on boat and tidal motion. This arc is pulled straight into alignment with the weight and first mile of cable as the boat continues forward with the set, dragging the hooks in the arc across more bottom increasing the chances of catching fish. However, this could be a result of the fact some hooks had a longer soak time. This showed the need for randomizing gear types across each deployment and should be considered when designing future survey efforts.

Table 3 outlines the gear performance for the trips made in the southern range. Total hooks lost accounts for all compromised gear. This includes lost gear attributable to shark damage (retrieved half fish or heads back). The observer also noted the number of tilefish broken off and visibly confirmed on the surface after retrieving a broken leader. Captain's choice leaders (B) were retrieved intact (no hook loss) and fish were believed to have been poorly hooked and torn off by current. Under less intense tidal conditions more of the lost fish would have been retrieved

via gaff. However, the conditions during sampling would have made the endeavor either hazardous or not worth the effort.

Throughout the project, both leader types (200 and 400 lb monofilament) returned examples of kinking, knotting, and twisting in varying degrees of severity. For trips #P50-05-#P50-08, the observer noted the number of leaders that were remade by the crew due to kinking, knotting, or twisting by gear type. The heavier mono was normally just untangled and put back into service, save for the extremely tightly twisted examples. The lighter mono was often immediately reused if only lightly kinked, but visible twisting, abrasion or severe kinking of the mono resulted in the replacement of the leader in the string with a backup of the same parameters.

Table 3: Gear performance metrics for the trips made in the southern range.

Gear Performance				
Gear Type	**Total Hooks Lost**	**# Fish Break-offs**	**# Fish Retrieved**	**# of Leaders Remade**
A	87	29	8	138
B	19	5	3	114
C	69	18	7	80

Figure 6: Gear B Captain's Choice in a tangled mess.

Gear Performance / Trip Observations – Northern Range

There was a significant amount of shark predation on trips in the northern latitude bands (Table 4). Nearly every set had at least one shark cut off. The main species were dusky sharks, spinner sharks, and hammerheads of undetermined species. Dusky sharks and spinners comprised the majority of the interactions. For most shark captures, sharks were identified and cut free promptly at the side of the vessel by the captain as they hauled gear to avoid further gear damage.

There was none of the observed gear stress (disregarding bite offs) that was prevalent in the southern range.

Table 4: Gear performance metrics for the trips made in the northern range.

Gear Performance		
Gear Type	**Hooks Lost**	**# Shark Cut-offs**
A	48	36
D	33	23

Length Frequency

A wide variety of species were collected during this project (Table 5). Blueline Tilefish (n = 425) dominated the catches in the northern latitude bands and Golden Tilefish (n = 994) dominated the catches in the southern range.

Table 5: Total numbers (n) of collected fish during the project. Species in bold kept and processed for life history analysis.

Species	n
Black Sea Bass	11
Blackbelly Rosefish	2
Blackpored Eel	2
Blacktail Moray	5
Blueline Tilefish	**425**
Chain Dogfish	1
Cuban Dogfish	89
Dusky Shark	4
Golden Tilefish	**994**
Greater Amberjack	**15**
Little Tunny	1
Longspine Scorpionfish	1
Night Shark	6
Ophichthidae	1
Palespotted Eel	1
Roughskin Dogfish	14
Scalloped Hammerhead	17
Sharpnose Sevengill Shark	1
Silky Shark	5
Snowy Grouper	**5**
Spinner Shark	5
Spotted Hake	24
Unidentified Species	6
Yellowedge Grouper	**6**

A goal of the project was to survey adequate habitat to ensure sampling a wide range of sizes for the two main target species (Blueline Tilefish and Golden Tilefish; Table 6, Figures 7-8).

Table 6: Length frequency information for selected species collected during the project. n = number of fish captured. Lengths are measured in millimeters and weights in grams.

Length Frequency Information									
Species	n	Lengths (mm)				Weights (g)			
		Min	Max	Avg	Median	Min	Max	Avg	Median
Blueline Tilefish	425	456	847	637	652	1000	8300	2860	2900
Golden Tilefish	994	421	1125	688	646	710	16810	4036	2660
Greater Amberjack	15	990	1410	1104	1080	12730	35380	17221	15760
Snowy Grouper	5	760	865	794	788	6100	9100	7180	7020
Yellowedge Grouper	6	565	845	729	748	2840	9370	6228	5970

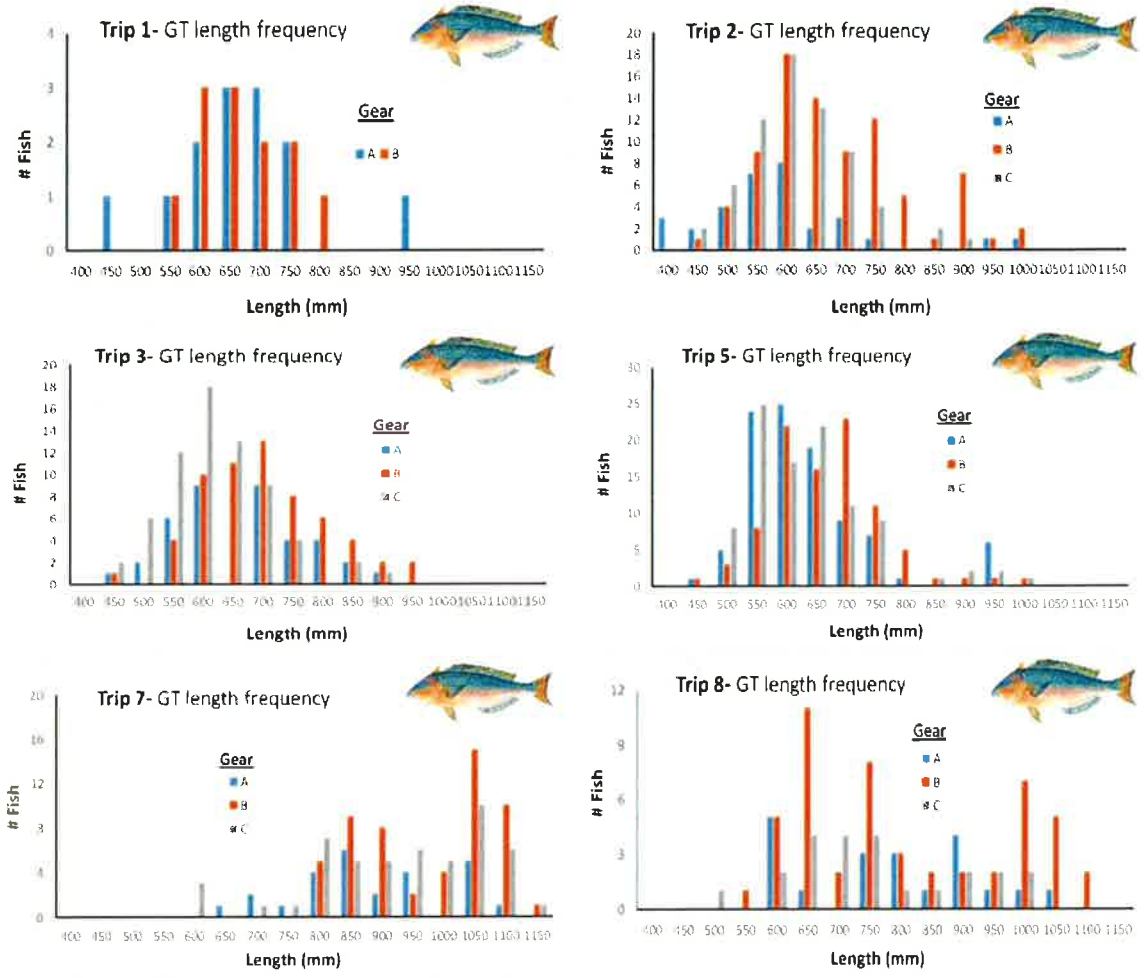

Figure 7: Trip specific length frequency information for Golden Tilefish collected during the project. Length frequencies are compared by gear type.

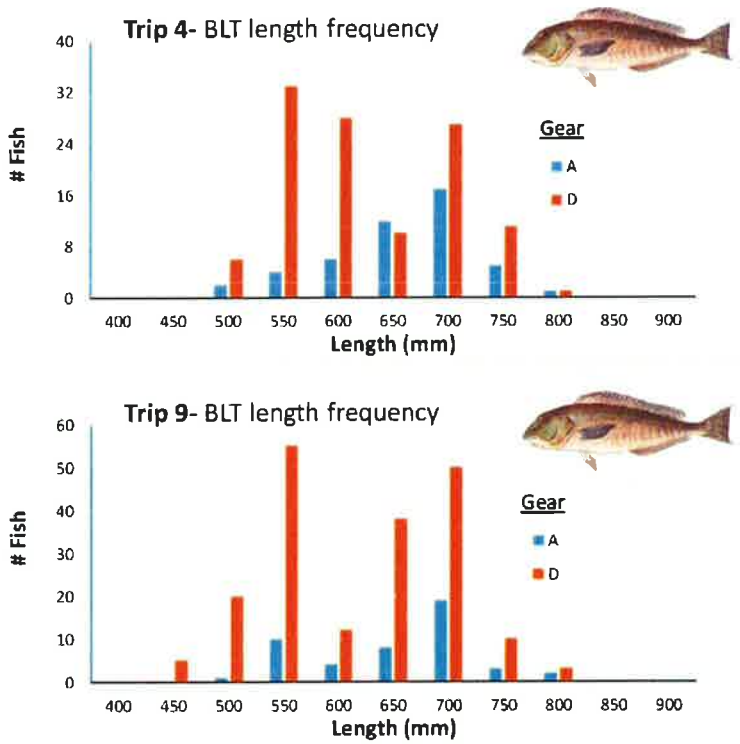

Figure 8: Trip specific length frequency information for Blueline Tilefish collected during the project. Length frequencies are compared by gear type.

Life History

Life history data were collected for 97% of the target species collected during the project (Table 7). The results of life history analyses will be provided by SC-DNR at a later date in a follow-up to this report.

Table 7: Total numbers of life history samples taken during the project.

Life History Samples Collected (n)			
Species	**A/G**	**Histology**	**DNA**
Blueline Tilefish	397	420	164
Golden Tilefish	987	866	243
Greater Amberjack	9	15	14
Snowy Grouper	5	5	3
Yellowedge Grouper	6	6	6
Grand Total	1404	1312	430

Figure 9: Sagittal otoliths collected from Golden Tilefish *Lopholatilus chamaeleonticeps*.

In addition to both tilefish species that were the main targets of the project, Snowy Grouper *Epinephelus niveatus*, Greater Amberjack *Seriola dumerili*, and Yellowedge Grouper *Hyporthodus flavolimbatus* specimens were captured and kept for life history work-up.

Figure 10: Snowy Grouper *Epinephelus niveatus*.

Figure 11: Greater Amberjack *Seriola dumerili*.

Problems Encountered:

Due to the delay in receiving the LOA to allow retention of samples for processing, sampling did not commence until May 2016. This necessitated all sampling to be completed in the late spring/summer seasons. We were unable to split the sampling into the fall / spring seasons as originally proposed.

During the pre-deployment meeting held in April 2016, project participants worked through issues with deploying MARMAP standard gear in the southern range for the project. The most significant result of this meeting was the decision to deploy the gear in four mile stretches instead of two simultaneous one mile stretches. This decision was made to minimize gear loss resulting from strong bottom currents, associated with proximity to the Florida Current, encountered in the southern portion of the range.

We are unable to fully present the results of the life history analyses. This is also a result of the truncated sampling schedule and completion of the project on time, without an extension. The final life history results will be provided to the Foundation and the funding agency through a report from SC-DNR at a later date.

Additional Work Needed:

The SAFMC continues to approve additional regulatory measures for snapper-grouper species in the South Atlantic. It remains critical that stock assessments contain the best possible data, for the benefit of both the fish stocks and the fishing public. This research can and will provide important data for upcoming stock assessments and therefore should be continued. Specifically, several consecutive years of fisheries independent data collection are necessary for development of indices of abundance, as expressed as Catch per Unit Effort (CPUE). Using the results of this survey project, we recommend that further funding is made available for continuing additional fisheries independent tilefish BLL surveys for at least two more years. This will provide the necessary threshold (n=3) of spatially explicit annual CPUE values to create an "index of abundance" for use in SEDAR stock assessments of these tilefish species.

It is also clear from the length frequency data presented here (see Fig. 7 and 8), that the "Captain's Choice" gears were not only more efficient at landing both Golden and Blueline Tilefish, but they provided a better indication of length structure of the population. Specifically, in several of the survey trips, these gears indicated strong year class cohorts, that were not visible in the previously utilized MARMAP long BLL gear. The data suggests that the "Captain's Choice" gear be adopted as standard fisheries independent BLL gear in future BLL surveys. When considering updating standardized gear, this project also shows the importance of standardizing the appropriate hook size for targeting tilefish, including brand and style.

V. Evaluation

Achievement of Goals and Objectives:

Objective 1: Through a science and industry based collaborative research program, establish the utility of a critical long-term fisheries independent bottom long line (BLL) survey for deep-water snapper-grouper species in the U.S. South Atlantic, specifically Golden and Blueline Tilefish.

Through the cooperation of Industry and Scientific Partners, we successfully utilized industry vessels to collect fishery independent data for the deepwater snapper-grouper fishery in the southeast. The groundwork was laid for development of a new sampling protocol that is appropriate for collecting data when encountering the specific environmental conditions (high bottom current) of the southern portion of the study area, where >90% of the Golden Tilefish fishery landings occur..

Objective 2: Provide critical life history data from the deep-water snapper-grouper species for use in stock assessments that are currently under-sampled.

The fishery observer, with assistance from many volunteers, was able to process over 1,200 fish for life history analysis. The final results of these analyses will be provided to the Foundation and funding agency at a later date and will be available for inclusion in future stock assessments.

Dissemination of Results:

Information and preliminary results of this project were disseminated through a public presentation to the South Atlantic Fishery Management Council at their June 2016 meeting in Cocoa Beach, FL. By coordinating the public presentation in conjunction with the Council Meeting, we maximized participation by commercial fishermen, fishery managers, and the concerned public. This public presentation highlighted the data collection methods for the project and preliminary results.

Summary reports of the project's findings were published as part of the "Foundation Project Update" section of the "Gulf and South Atlantic News", a publication of the Gulf & South Atlantic Fisheries Foundation, Inc. This newsletter is distributed to over 700 organizations and individuals throughout the region. An electronic version of this newsletter (PDF) is also included in the regular updates to the Foundation's website (www.gulfsouthfoundation.org).

Copies of this project's Final Report will be published and distributed to various federal and state fishery agencies, university extension/Sea Grant offices, and Industry associations. In addition, PDF copies of the Final Report will be made available for download from the Foundation's website.

Further Analyses of Results:

As previously mentioned, data analyses of the project results were not complete at the time of this report production. Agency partners have archived biological samples from fish landed in this survey project. As such, ageing of otoliths, histological analysis of reproductive tissue, and DNA

testing are information products that will result from further analysis and made available for future fishery stock assessments. Data on landings rate (i.e. CPUE) of tilefish species from these fisheries independent BLL surveys over the spatial boundaries of the study area should be used to construct "indices of abundance" values. We suggest that CPUE values should be calculated for the different experimental gear configurations utilized in this survey project, and compared. In an effort to compare the efficiency of different gears, landings efficiency rates should be statistically compared between the gears and analyzed versus environmental co-variates, such as current speed and temperature. Further, length frequencies of tilefish landed as a function of depth and latitudinal band are also important informational contributions that should be analyzed from this data base. This type of information is needed for understanding the dynamics of tilefish populations in future fishery stock assessments.

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Appendices

Appendix A

Planning Meeting Agenda

"Cooperative Bottom Long Line Survey to Augment Fisheries Independent Reef Fish Data Collection in the Deepwater Snapper-Grouper Fishery of the South Atlantic United States" (Award #NA15NMF4270342)

Planning Meeting
Westin Jekyll Island
March 7, 2016

AGENDA

Monday, March 7
~5:00pm

I. Project Overview – Frank Helies, Program Director

II. Program Goals

III. Sampling sites
- MARMAP site pool
- Industry input

IV. Timing of survey – date range
- ~38 total sea days
- Right whale issues

V. Sampling protocol – MARMAP/NMFS Observer Long Line
- Gear configuration
- Hooks
- Bait
- Soak time

VI. Data
- What will be collected
- Data collection forms
- Data entry/database/QA QC issues
- Data analyses

VII. Biological sampling
- Protocol
  - Supplies
  - On vessel or dockside
- Otoliths / gonads / DNA
- Other considerations: stomachs, muscle tissue
- Fish carcass donation after a trip
  - Value
  - Need to report as in-kind?

VIII. Supplies
- Sampling gear
- Temperature loggers

IX. Training

X. Reporting requirements
- Presentation to SAFMC

XI. Permits

XII. General Discussion

XIII. Future for the survey – possibility for continued funding

Participants:

Frank Helies – Gulf and South Atlantic Fisheries Foundation
Bob Jones – Southeastern Fisheries Association
Marcel Reichert – SC-DNR
Peter Barile – Industry Consultant
Jim Freeman – Industry
Daniel Parshley – Observer Coordinator
Keenan Carpenter - Observer
Michelle Duval – SAFMC Chair
Ben Hartig – SAFMC

Invited:

Todd Kellison – NMFS SEFSC
Jeff Pulver – NMFS Technical Monitor

Appendix B

Gear Forms

GEAR SPECIFICATION FORM - LONGLINE

ORG PRO	MO DAY YR		
P50-02	05 09 16	KXC	A
TRIP NO.	DATE	OBSERVER CODE	GEAR CODE

MAIN LINE LENGTH

1.0 ☐ MILES ☒ NAUTICAL MILES

MAIN LINE MATERIAL

☐ Mono ☐ Poly ☐ Nylon ☒ Cable ☐ Other

Main Line Diameter: 0.09 In.

Main Line Test: 2000 lbs

Comments: Cable's exact breaking strength unknown by captain

GANGION LENGTH

Length: 1.7 Feet

Comments: Gear configuration on back

GANGION MATERIAL

☒ Mono ☐ Cable ☐ Nylon ☐ Wire ☐ Other

Gangion Test: 200 lbs

Gangion Color: Clear

Construction: ☐ Twisted ☒ Single

Comments:

NUMBER OF HOOKS

No. of Hooks on Board (per Captain): 1000

Approx. Dist. between Hooks: 50.0 Feet

Comments: 1000 is an estimate by captain

HOOK TYPE # 1

Hook Type: ☐ J-Hook ☒ Circular ☐ Treble ☐ Lure ☐ Other

Hook Shape: ☒ Straight ☐ Offset ☐ Double ☐ Triple

Hook Size: 14 /0 Manufacturer/Style: Mustad/39950 DT Degrees Offset: °

Shaft Length 2.0 in. Point to Shaft 0.75 in.

Hook Material: ☒ Steel ☐ Stainless Steel ☐ Other ☐ Unknown

Comments:

HOOK TYPE # 2

Hook Type: ☐ J-Hook ☐ Circular ☐ Treble ☐ Lure ☐ Other

Hook Shape: ☐ Straight ☐ Offset ☐ Double ☐ Triple

Hook Size: /0 Manufacturer/Style: Degrees Offset: °

Shaft Length . in. Point to Shaft . in.

Hook Material: ☐ Steel ☐ Stainless Steel ☐ Other ☐ Unknown

Comments:

HOOK TYPE # 3

Hook Type: ☐ J-Hook ☐ Circular ☐ Treble ☐ Lure ☐ Other

Hook Shape: ☐ Straight ☐ Offset ☐ Double ☐ Triple

Hook Size: /0 Manufacturer/Style: Degrees Offset: °

Shaft Length . in. Point to Shaft . in.

Hook Material: ☐ Steel ☐ Stainless Steel ☐ Other ☐ Unknown

Comments:

TRACE HOOK W / DIMENSIONS BELOW

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GEAR A

GEAR SPECIFICATION FORM - LONGLINE

ORG PRO: P S O - 0 2 | TRIP NO.
MO DAY YR: 0 5 0 9 1 6 | DATE
OBSERVER CODE: K X C
GEAR CODE: 13

MAIN LINE LENGTH

1 1 . 0 | ☐ MILES ☒ NAUTICAL MILES

MAIN LINE MATERIAL

☐ Mono ☐ Poly ☐ Nylon ☒ Cable ☐ Other

Main Line Diameter: 0 . 0 4 In.

Main Line Test: 2 0 0 0 lbs

Comments: Approximation of test

GANGION LENGTH

Length: 6 . 0 Feet

Comments: Gear configuration varies

GANGION MATERIAL

☒ Mono ☐ Cable ☐ Nylon ☐ Wire ☐ Other

Gangion Test: 4 0 0 lbs

Gangion Color: Red

Construction: ☐ Twisted ☒ Single

Comments:

NUMBER OF HOOKS

No. of Hooks on Board (per Captain): 1 0 0 0

Approx. Dist. between Hooks: 1 0 . 0 Feet

Comments: Hooks on board is estimated

HOOK TYPE # 1

Hook Type: ☐ J-Hook ☒ Circular ☐ Treble ☐ Lure ☐ Other

Hook Shape: ☐ Straight ☒ Offset ☐ Double ☐ Triple

15/0 Hook Size | Mustad Manufacturer/Style: | 25° Degrees Offset

Shaft Length 2 . 5 0 in. | Point to Shaft 0 . 7 5 in.

Hook Material: ☒ Steel ☐ Stainless Steel ☐ Other ☐ Unknown

Comments: Model number not known

HOOK TYPE # 2

Hook Type: ☐ J-Hook ☐ Circular ☐ Treble ☐ Lure ☐ Other

Hook Shape: ☐ Straight ☐ Offset ☐ Double ☐ Triple

/0 Hook Size | Manufacturer/Style: | ° Degrees Offset

Shaft Length . in. | Point to Shaft . in.

Hook Material: ☐ Steel ☐ Stainless Steel ☐ Other ☐ Unknown

Comments:

HOOK TYPE # 3

Hook Type: ☐ J-Hook ☐ Circular ☐ Treble ☐ Lure ☐ Other

Hook Shape: ☐ Straight ☐ Offset ☐ Double ☐ Triple

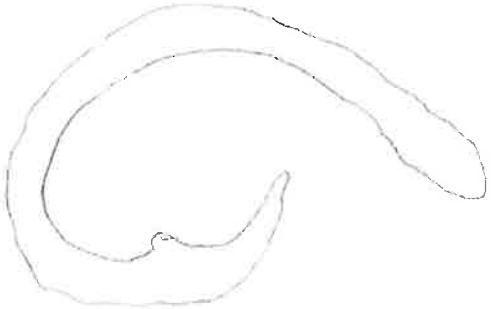
/0 Hook Size | Manufacturer/Style: | ° Degrees Offset

Shaft Length . in. | Point to Shaft . in.

Hook Material: ☐ Steel ☐ Stainless Steel ☐ Other ☐ Unknown

Comments:

TRACE HOOK W / DIMENSIONS BELOW



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GEAR B

GEAR SPECIFICATION FORM - LONGLINE

ORG PRO: P5 0-02 | TRIP NO.
MO DAY YR: 05 09 16 | DATE
OBSERVER CODE: KXC
GEAR CODE: C

MAIN LINE LENGTH

10.0 [ ] MILES [X] NAUTICAL MILES

MAIN LINE MATERIAL

[ ] Mono [ ] Poly [ ] Nylon [X] Cable [ ] Other

Main Line Diameter: 0.04 In.

Main Line Test: 2000 lbs

Comments: Test is Approximate

GANGION LENGTH

Length: 1.7 Feet

Comments: Gear configuration on back

GANGION MATERIAL

[X] Mono [ ] Cable [ ] Nylon [ ] Wire [ ] Other

Gangion Test: 200 lbs

Gangion Color: Clear

Construction: [ ] Twisted [X] Single

Comments:

NUMBER OF HOOKS

No. of Hooks on Board (per Captain): 1000

Approx. Dist. between Hooks: 50.0 Feet

Comments: Number of hooks on board is estimate

HOOK TYPE # 1

Hook Type: [ ] J-Hook [X] Circular [ ] Treble [ ] Lure [ ] Other

Hook Shape: [X] Straight [ ] Offset [ ] Double [ ] Triple

14/0 Hook Size | Mustad / 39960-DT Manufacturer/Style: | ° Degrees Offset

Shaft Length 2.00 in. Point to Shaft 0.75 in.

Hook Material: [X] Steel [ ] Stainless Steel [ ] Other [ ] Unknown

Comments:

HOOK TYPE # 2

Hook Type: [ ] J-Hook [ ] Circular [ ] Treble [ ] Lure [ ] Other

Hook Shape: [ ] Straight [ ] Offset [ ] Double [ ] Triple

/0 Hook Size | Manufacturer/Style: | ° Degrees Offset

Shaft Length . in. Point to Shaft . in.

Hook Material: [ ] Steel [ ] Stainless Steel [ ] Other [ ] Unknown

Comments:

HOOK TYPE # 3

Hook Type: [ ] J-Hook [ ] Circular [ ] Treble [ ] Lure [ ] Other

Hook Shape: [ ] Straight [ ] Offset [ ] Double [ ] Triple

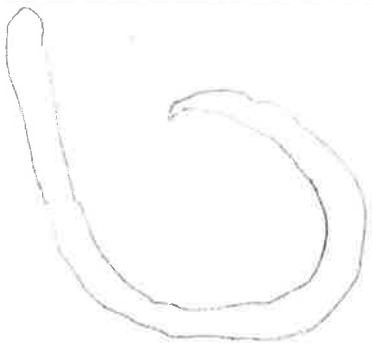
/0 Hook Size | Manufacturer/Style: | ° Degrees Offset

Shaft Length . in. Point to Shaft . in.

Hook Material: [ ] Steel [ ] Stainless Steel [ ] Other [ ] Unknown

Comments:

TRACE HOOK W / DIMENSIONS BELOW



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GEAR C

GEAR SPECIFICATION FORM - LONGLINE

ORG PRO: P S O - 0 4 — TRIP NO.

MO DAY YR: 0 6 0 2 1 6 — DATE

OBSERVER CODE: K X C

GEAR CODE: D

MAIN LINE LENGTH

1 . 0 — [ ] MILES [X] NAUTICAL MILES

MAIN LINE MATERIAL

[X] Mono [ ] Poly [ ] Nylon [ ] Cable [ ] Other

Main Line Diameter: 0 . 1 3 In.

Main Line Test: 6 0 0 lbs

Comments:

GANGION LENGTH

Length: 2 . 7 Feet

Comments:

GANGION MATERIAL

[X] Mono [ ] Cable [ ] Nylon [ ] Wire [ ] Other

Gangion Test: 3 0 0 lbs

Gangion Color: C L E A R

Construction: [ ] Twisted [X] Single

Comments:

NUMBER OF HOOKS

No. of Hooks on Board (per Captain): 6 5 9

Approx. Dist. between Hooks: 3 0 . 0 Feet

Comments:

HOOK TYPE # 1

Hook Type: [ ] J-Hook [X] Circular [ ] Treble [ ] Lure [ ] Other

Hook Shape: [ ] Straight [X] Offset [ ] Double [ ] Triple

12 /0 Hook Size — unknown Manufacturer/Style: — 10 ° Degrees Offset

Shaft Length 1 . 7 5 in. Point to Shaft 0 . 7 5 in.

Hook Material: [X] Steel [ ] Stainless Steel [ ] Other [ ] Unknown

Comments: Hook blue/model unknown

HOOK TYPE # 2

Hook Type: [ ] J-Hook [ ] Circular [ ] Treble [ ] Lure [ ] Other

Hook Shape: [ ] Straight [ ] Offset [ ] Double [ ] Triple

/0 Hook Size — Manufacturer/Style: — ° Degrees Offset

Shaft Length . in. Point to Shaft . in.

Hook Material: [ ] Steel [ ] Stainless Steel [ ] Other [ ] Unknown

Comments:

HOOK TYPE # 3

Hook Type: [ ] J-Hook [ ] Circular [ ] Treble [ ] Lure [ ] Other

Hook Shape: [ ] Straight [ ] Offset [ ] Double [ ] Triple

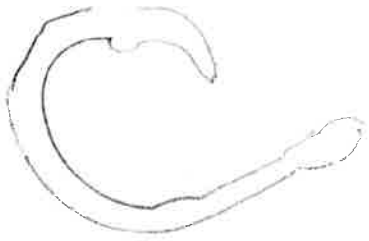
/0 Hook Size — Manufacturer/Style: — ° Degrees Offset

Shaft Length . in. Point to Shaft . in.

Hook Material: [ ] Steel [ ] Stainless Steel [ ] Other [ ] Unknown

Comments:

TRACE HOOK W / DIMENSIONS BELOW



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GEAR D