

Project Period	1/01/2017 - 1/31/2018
Project Location	The Gulf coast of Florida, from the Florida Keys (Key West) to the Florida Panhandle (Pensacola).
Description (from Proposal)	
Project Summary (from Proposal)	Enhance marine fisheries data collection program for development of stock assessments and fisheries management of important stocks in the Gulf of Mexico. Project aims to facilitate the replenishment and protection of living resources including red snapper, other reef fishes and associated marine resources through improved data collection.
Project Status and Accomplishments	Funding through the Gulf Environmental Benefit Fund (GEBF) has supported improved geographic coverage, year-round sampling, and the development of statistically rigorous sampling methods for data collection that give a better representation of the catch compositions of commercial and recreational fisheries in Florida. Level funding for the Fisheries Information Network (FIN), which supports fisheries dependent data collections in the Gulf, and rising costs of monitoring programs have forced the state to reduce staffing for the Marine Recreational Information Program (MRIP) and suspend biological sampling for commercial and recreational fisheries. Stable funding through the GEBF has enabled Florida to not only bridge these data gaps, but collect data that are higher quality and more representative of the fisheries. The process for sharing these data with regional partners for inclusion in stock assessments has also been improved with support from the GEBF. Data collected through Tasks 1, 2 and 4 are routinely incorporated into to the SEDAR process for assessing managed species in the Gulf of Mexico. Task 1 improves spatial and temporal coverage of the long-term Trip Interview Program (TIP). Task 4 extends an historic time-series that provides data on the size and age composition of harvested and discarded fish in the recreational for-hire fishery, and this cooperative research has increased stakeholders' trust in data inputs for regional stock assessments. Task 2 provides biological samples from the private boat segment of the recreational fishery, that in the past were under-represented in data provided for stock assessments. New methods developed through the Gulf Reef Fish Survey (Tasks 2 and 3) have also improved the precision of catch estimates for the private boat fishery, which is expected to support more flexible management for important stocks in the future. This new survey is also providing additional benefits that were not anticipated, including a quantitative measure of recreational fishing effort on artificial reefs and methods to evaluate potential changes in catch composition when effort is directed towards these structures. Funding for commercial sampling (Task 1) and monitoring discards at-sea (Task 4) will expire at the end of 2018, and no alternative source has been identified at this time. Tasks 2 and 3 to conduct the Gulf Reef Fish Survey will continue with support from the Gulf Environmental Benefit Fund through June 2020, and Agency staff are currently discussing ways to continue this work after this funding is exhausted. Alternative funding sources that have become available since Deepwater Horizon have not fit the tasks currently funded through GBEF; however, the State of Florida will continue to explore future options and work with other states and Gulf States Marine Fisheries Commission to seek support for Gulf-wide implementation.
Lessons Learned	The 2017 funding cycle of this project, otherwise known as Phase IV, has reinforced the importance of stable funding to extend sampling programs and the need for strong cooperative relationships with both industry and research partners. The improvements to the biosampling program through stable funding cannot be overstated. Staff are exploring options to maintain biosampling levels after Phase V, but dependent on funding, the ideal plan would be to continue enhancing the sampling program to meet the needs of the fishery. The At-Sea Observer program collects high-resolution catch data, namely discards, for the most important managed species which contributes to the stock assessment process in the region. We clearly understand the program supported by this award would not be possible without voluntary participation by the for-hire fishery, and the overall partnership in the collection of discard data has created a high level of stakeholder support for its use in stock assessments. Given the success of this sampling

program, the State of Florida is ready to coordinate with the other states and partners to develop a Gulf-wide observer program for recreational discards.

The integration of the Gulf Reef Fish Survey (GRFS) with the existing recreational survey (MRIP) conducted by the National Marine Fisheries Service (NMFS) has benefited both the State of Florida and NMFS. The collaboration allows data from both surveys to be used in tandem while avoiding duplication of sampling effort, and it has additionally allowed for the GRFS to leverage data already collected through intercept survey portion of MRIP. The GRFS has greatly benefitted from the survey design knowledge of MRIP staff and their statistical consultants during both the development of the survey and the current review process. The development of the GRFS has also benefitted MRIP with the incorporation of improvements to better allocate assignments to sites where reef fish trips are intercepted.

The design of the Gulf Reef Fish Survey was structured around a new requirement in 2015 that anglers must subscribe to a mail survey in order to legally harvest certain reef fish species. The subscription was included as a free option during the purchase of a saltwater fishing license. Anglers selected for the mail survey frequently contact FWC or include comments on the survey questionnaire to inquire about why they were selected for the survey or request that their address be removed. We've learned that outlets where fishing licenses are sold often select the option on behalf of their customers without verifying that individual anglers participate in the fishery and wish to subscribe to the survey. Oversubscription causes undue burden on anglers that do not wish to be surveyed for a fishery they do not participate in which also results in non-response bias and increased cost for the survey. Results presented in this report suggest that more than half of anglers subscribed to the mail survey are very unlikely to ever take a reef fish trip from a private boat off the Gulf coast of Florida. In the short term, non-response bias is being addressed through the stratified sampling design and by exploring variables to use as post-stratification weights in the estimation procedure. However, developing solutions for the increased cost and survey burden that result from oversubscription will require continued discussions within our Agency to refine and improve the subscription process.

Activities and Outcomes

Funding Strategy: Habitat Conservation

Metric: Gulf - Research - # studies used to inform mgmt

Required: Recommended

Description: Enter the number of studies completed whose findings are used to adapt management/ inform mgmt decisions

Starting Value	1.00 # studies used to inform mgmt
Value To Date	1.00 # studies used to inform mgmt
Target value	1.00 # studies used to inform mgmt

Note:

Funding Strategy: Planning, Research, Monitoring

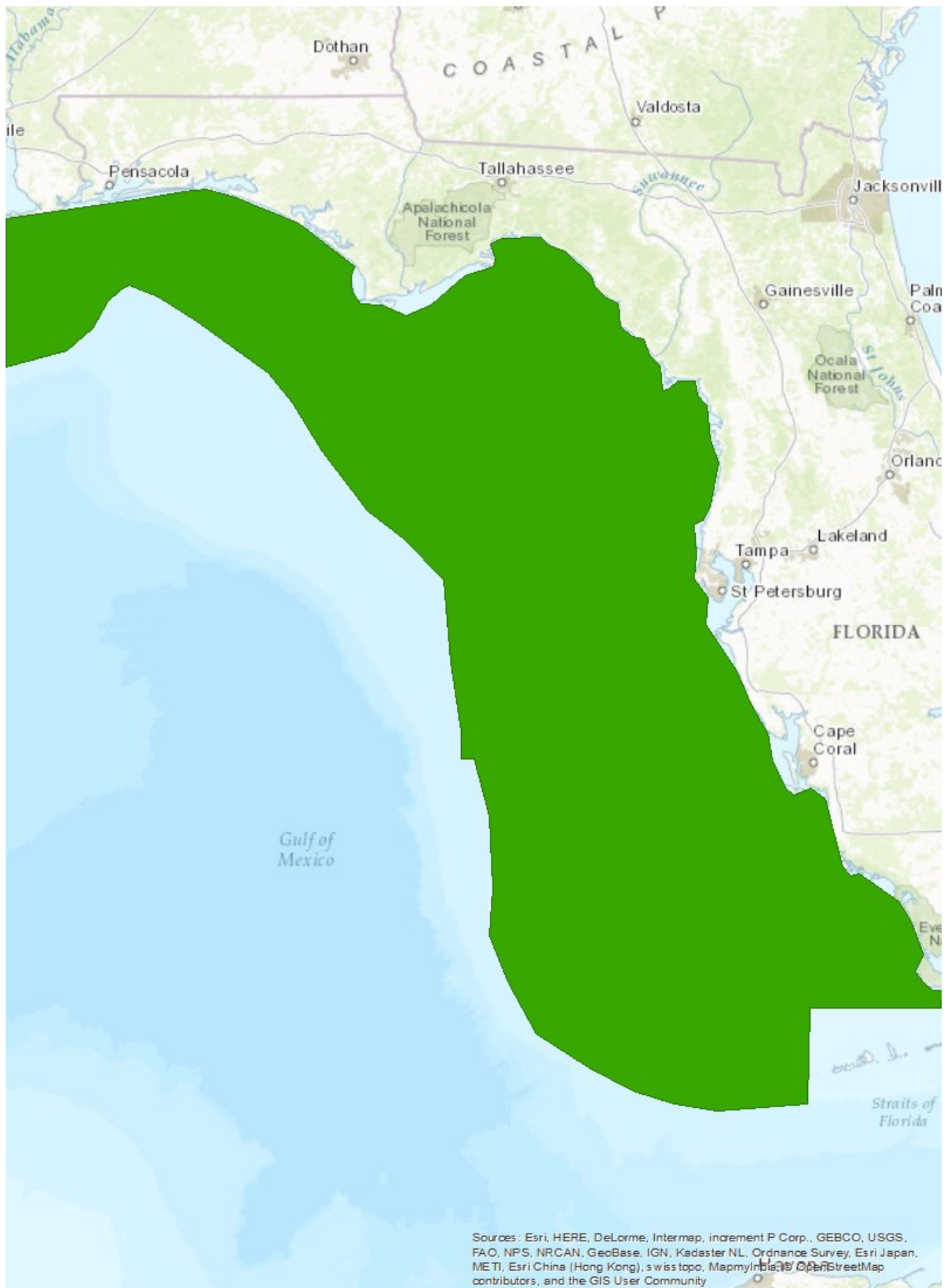
Metric: Gulf - Monitoring - # monitoring programs

Required: Recommended

Description: Enter the number of monitoring programs established or underway

Starting Value	5.00 # monitoring programs
Value To Date	5.00 # monitoring programs
Target value	5.00 # monitoring programs

Note:



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

The following pages contain the uploaded documents, in the order shown below, as provided by the grantee:

Upload Type	File Name	Uploaded By	Uploaded Date
GEBF Final Report Narrative	Final Programmatic Report Narrative 2-28-18.pdf	Barbieri, Luiz	03/01/2018
Photos - Jpeg	Photo 1.1.jpg	Barbieri, Luiz	03/01/2018
Photos - Jpeg	Photo 1.2.jpg	Barbieri, Luiz	03/01/2018
Photos - Jpeg	Photo 1.3.jpg	Barbieri, Luiz	03/01/2018
Photos - Jpeg	Photo 2.1.jpg	Barbieri, Luiz	03/01/2018
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Photos - Jpeg	Photo 3.1.jpg	Barbieri, Luiz	03/01/2018
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Photos - Jpeg	Photo 4.2.jpg	Barbieri, Luiz	03/01/2018
Photos - Jpeg	Photo 4.3.jpg	Barbieri, Luiz	03/01/2018
Other Documents	Phase IV Final Programmatic Report Tables.pdf	Barbieri, Luiz	03/01/2018
Other Documents	Phase IV Final Programmatic Report Figures.pdf	Barbieri, Luiz	03/01/2018
Other Documents	Appendix 1.1 thru 1.9.pdf	Barbieri, Luiz	03/01/2018

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**National Fish and Wildlife Foundation
Gulf Environmental Benefit Fund
Final Programmatic Report**

**Project Title: Enhanced Assessment for Recovery of Gulf of Mexico Fisheries
Phase IV: January 1, 2017 – December 31, 2017**

1) Work Performed and Results:

Task 1 – Commercial Sampling

Commercial sampling is conducted to provide biological information for harvested species and to validate commercial catch reporting under the State of Florida Trip Ticket Program. FWC field samplers follow the NOAA Fisheries Southeast Science Center commercial Trip Interview Program (TIP) protocols and sampling results are presented here in aggregate form to comply with Southeast Fisheries Science Center requirements for the protection of confidential data. Screen views of the TIP data entry application are shown in Appendix 1.1. Sampling is conducted year-round and sampling effort is based on the availability/accessibility of commercial fishing trips throughout the State. The NFWF funded effort is limited to commercial trips that land in Gulf Coast Counties (Escambia-Monroe).

NFWF fully funds the samplers and their efforts in Apalachicola, Cedar Key, and Charlotte Harbor, Florida and partially funds St. Petersburg. All commercial sampling in the Gulf is supported with materials, supplies, and/or vehicles funded by NFWF. Of the 45,671 fish measured and the 18,950 otoliths collected for age determination statewide, NFWF-based sampling accounted for 59.7% (N = 27,293) of the fish biosampled (measured) and 88.9% (N = 16,846) of the otoliths collected (Table 1.1.1). These numbers match the overall ratios for all NFWF sampling (Appendix 1.2). TIP interview totals are similar for both coasts, but sampling on the Gulf coast is more productive in terms of both biostatistical information obtained (Table 1.1.2) and the amount of structures extracted for age determination.

Charlotte Harbor had a data gap in April, May, and part of June due to the sampler being out for maternity leave and Pensacola had reduced sampling in September with the sampler out on paternity leave. Hurricane Irma minorly impacted much of the state due to lab closures, hurricane prep, and cleanup. Irma majorly impacted the Florida Keys with the lab being closed for the majority of September. There are fewer locations served by FWC samplers on the east coast of Florida and interviews tend to be productive in terms of measurements. Otoliths and spines used for age and growth are often difficult to obtain because of wholesale dealers' fears that product may be compromised and value lowered by allowing otolith extraction. NFWF samplers serve locations on the Gulf coast with a history of allowing access to product for the purposes of obtaining age structures. Figures 1.1.1 and 1.1.2 show monthly sampling effort by location in terms of the numbers of interviews and numbers of measurements, respectively. The plots illustrate that variation in productivities is more pronounced in the Florida Keys and Saint Petersburg areas relative to the rest of the state. These

locations tend to sample more of the federally regulated product (reef fish species) than other locations. Also, the Florida Keys accounts for vast majority of stone crab and spiny lobster sampled, which don't have age structures and have seasonal closures.

Summaries of data for commercial sampling by Gulf of Mexico FWC lab locations (Pensacola, Apalachicola, Cedar Key, St. Petersburg, Charlotte Harbor, and Marathon – Florida Keys) and NFWF funded relative to statewide sampling are presented in Appendices 1.3 and 1.4, respectively. Of a total of 140 taxa sampled throughout the state in 2017, 104 were sampled at NFWF funded locations. For all years of NFWF funding, 171 taxa have been sampled statewide and 130 taxa were sampled at NFWF funded locations (Appendix 1.5). Top species in terms of numbers of measurements included: stone crab, red grouper, red snapper, spiny lobster, vermilion snapper, gag, gray triggerfish, yellowtail snapper, striped mullet, Spanish mackerel, scamp, gray snapper, king mackerel, crevalle jack, and red porgy. In terms of otoliths collected for the top bony fish species, NFWF funded sampling accounted for just over 93% in 2017 and overall in NFWF sampling (Appendices 1.3 and 1.5).

Task 2 – Private Boat Catch

Angler Registry

Anglers fishing from private recreational boats off the west coast of Florida are required by FWC to register for the Gulf Reef Fish Survey in order to recreationally harvest certain reef fish species in the Gulf of Mexico (in addition to applicable state saltwater fishing license requirements). Registration is required for legal harvest of red and vermilion snappers; gray triggerfish; gag, red and black groupers; and amberjacks (including greater and lesser amberjacks, almaco jack, and banded rudderfish). Registration is required for any person 16 years of age and older fishing from a private recreational boat (not including for-hire trips) from the west coast of Florida, excluding the Gulf coast adjacent to Monroe County (the Florida Keys). Anglers are registered for the Gulf Reef Fish Survey through the state fishing licensing system during the purchase or renewal of a saltwater fishing license, or as a separate and free transaction if no license is purchased. Transactions are initiated by individual customers applying online, over the phone, at a local tax collectors' office, or at any approved state fishing license vendor (www.myfwc.com/license/recreational/saltwater-fishing/). During a transaction through the state fishing license system, anglers are required to provide a driver's license number or other state issued identification, which is used to confirm residency status (in-state or out-of-state) and automatically collect current mailing address data. Customers are also given the option to provide an email address.

Once anglers are registered for the Gulf Reef Fish Survey, they are eligible up to one year from that date to be contacted by mail and/or email (if provided) for the purpose of data collection. Registration for the Gulf Reef Fish Angler designation must be renewed on an annual basis for continued participation in the fishery. Enforcement is conducted by FWC officers in the field, who may request proof of registration during routine inspections of landed catch.

Combined Survey Approach

A monthly mail survey (described in Task 3) is used to estimate the total number of recreational fishing trips for reef fishes made by private boat anglers that are registered for the Gulf Reef Fish Survey. However, this estimate does not include any trips made by persons who are not registered, either because they are exempt (anglers under 16), unaware of the requirement, or out of compliance. Therefore, a separate angler intercept survey (described in this task) is necessary to estimate a correction factor for off-frame fishing effort (trips by unregistered anglers), and also estimate catch per-unit-effort (CPUE). The two survey methods are used in combination to estimate total landings (described below). Data collected through the Gulf Reef Fish Survey are compatible with data collected through an existing survey, the Marine Recreational Information Program (MRIP), which is conducted in Florida in cooperation with the National Marine Fisheries Service and used to monitor all saltwater recreational fishing activity. Data from the two complementary surveys are used in combination to achieve optimum sample sizes for reef fish trips, which are less frequently encountered in the general survey of all saltwater fishing activity. The intention of this supplemental survey approach is not to replace the existing MRIP survey, which provides vital statistics for a wide variety of state and federally managed recreational fisheries, but rather to improve timeliness and precision of catch estimates specifically for important reef fish species targeted by the private boat segment of the recreational fishery.

Intercept Survey

Intercept surveys were initiated in May 2015 and continued through 2017 to estimate CPUE for Gulf reef fish species during recreational fishing trips made by private boat anglers off the west coast of Florida. This supplemental intercept survey is also used to measure the proportion of reef fish trips that are taken by anglers not registered for the Gulf Reef Fish Survey during a given month. The State of Florida maintains a statewide list of sites used as the sample frame for the intercept portion of the MRIP survey in Florida, called the Access Point Angler Intercept Survey (APAIS). FWC has worked collaboratively with NOAA Science and Technology (S&T) to identify a sub-set of sites with relatively high historic proportions of private boat interviews that targeted or caught a key species indicative of an offshore fishing trip. The subset of offshore sites is used for two purposes: 1) a portion of sites randomly selected for APAIS assignments in Florida are allocated to the new offshore site group; and 2) additional offshore sites are randomly sampled at the same time that the APAIS sample is drawn, and this supplemental draw is used to assign Gulf Reef Fish intercept surveys. The supplemental assignments utilize a more streamlined access point intercept survey methodology that allows biologists in the field to target survey efforts towards anglers returning from trips specifically targeting and/or catching Gulf reef fish species. The objectives of this combined approach is to increase the numbers of offshore trips targeting reef fishes that are intercepted in the field and improve precision around estimates of CPUE used to calculate total landings and discards. Drawing assignments for the two surveys together serves two purposes: 1) to avoid overlapping survey effort at the same sites on the same days; and 2) to produce primary sample weights that are

compatible and allow data collected during both surveys to be combined. Sample selection weights are used in calculation of combined CPUE estimates for Gulf reef fish species.

Intercept Survey Procedures

During APAIS and supplemental Gulf Reef Fish Survey assignments, FWC staff arrive on site at the beginning of the selected time period and remain until the end of the period. During APAIS assignments, FWC staff interview all saltwater anglers following standard field interview procedures established for the MRIP survey (<http://www.st.nmfs.noaa.gov/recreational-fisheries/Surveys/survey-details>). During Gulf Reef Fish Survey assignments, FWC staff confirm what species an intercepted boat party fished for and the biologist continues with a more detailed trip interview if the anglers targeted and/or caught any Gulf reef fish species. This procedure allows biologists to hone in on reef fish trips and maximize the number of trip interviews and biological samples for Gulf reef fish species.

The expanded trip interview for Gulf reef fish trips includes details about the species targeted, percent of time fished in the EEZ, hours fished, and primary gear used which is recorded at the boat level. The number of anglers in the party that are under 16 years of age is also recorded. Each angler 16 years of age and older is asked to report whether they are registered for the Gulf Reef Fish Survey. Numbers of youth under 16 years of age, registered adults, and adults that are not registered for the Gulf Reef Fish Survey are tallied for each boat party. The boat operator is asked to identify on a gridded chart the area(s) where fishing took place. Catch data is collected at the angler level for discarded fish, and retained catch is consolidated at the boat level (similar to the APAIS).

Data Management and Estimation

Intercept data collected from private boat parties during supplemental Gulf Reef Fish Survey assignments are reviewed by regional coordinators and entered electronically into an SQL database using a data entry interface. The program includes quality control checks that prevent errors by the user during key entry. Once data recorded in the field are entered electronically, a routine error checking program is run at the end of each month to identify illogical values and flag records with potential errors. Each flagged record is checked against original data sheets and, if necessary, additional follow up is conducted with individual field staff to verify the validity of a record and to review errors. If a record can be resolved it is corrected in the database and the remainder are identified with warning flags to notify data users. Data are also formatted and stored as flat files that are compatible with APAIS public use files available through NOAA's website (<https://www.st.nmfs.noaa.gov/recreational-fisheries/data-and-documentation/downloads>).

An estimation program written in SAS code was developed collaboratively with staff from NMFS S&T to combine public use data files from the two surveys (APAIS and Gulf

Reef Fish Survey) and calculate monthly estimates of CPUE (catch per angler trip) for each reef fish species by area fished (STS and EEZ). The estimation program also uses data from Gulf Reef Fish Survey intercepts to calculate the ratio of total reef fish anglers intercepted to anglers that were registered for the Gulf Reef Fish Survey each month. This ratio is used in the estimation program to produce a final effort estimate, using monthly effort estimates produced from the private boat effort portion of the Gulf Reef Fish Survey (described in Task 3), that is adjusted to account for additional trips taken by off-frame anglers in STS and EEZ waters. Lastly, the estimation program combines final effort estimates with CPUE for each reef fish species to produce catch estimates, including total numbers and weight of fish landed, and total numbers of fish released by recreational anglers fishing from private boats. A full description of the catch estimation procedures is provided in a Power Point presentation produced by NMFS S&T (included as Appendix 1.6).

Results

A total of 1,070 supplemental Gulf Reef Fish intercept survey (GRFS) assignments were conducted during 2017 in addition to APAIS assignments conducted as part of the MRIP intercept survey (Table 1.2.1). During supplemental GRFS assignments, an additional 1,369 boat parties that targeted and/or caught reef fishes from the west coast of Florida were interviewed. Numbers of harvested fish sampled for managed reef fish species are provided in Tables 1.2.2 and 1.2.3. During GRFS intercepts, 705 harvested red snapper were measured (Table 1.2.2) and age structures were collected from 686 of those fish (Table 1.2.3). Vermilion snapper, red grouper, black grouper, and some amberjack species are open year-round in all state waters and all or most federal waters. For other species, the numbers of fish that were measured and sampled for age structures were impacted by the length of their recreational harvest season. During 2017, the recreational season for red snapper in federal waters was initially three days (June 1-3), but was later extended to a total of 42 days, a longer season than recent years (2015: 10 days, 2016: 11 days). Red snapper was also open an additional 23 days in state waters off the west coast of Florida for a total state season of 65 days. The recreational season for greater amberjack was 82 days in state and federal waters, and an additional 30 days in state only waters (for a total state season of 112 days). Gray triggerfish was closed in federal waters the entire year, and was open in state waters for only 14 days during 2017. Gag grouper was open in state waters off certain counties as early as April 1, but was not open in all state and federal waters until June 1 (through December 31).

Intercept assignments conducted through this task serve to supplement the number of Gulf reef fish species that are sampled through APAIS intercepts. Length frequency histograms provided in Figures 1.2.1 and 1.2.2 show samples obtained through this task supplement the APAIS by increasing the number and size distribution of fish sampled. Most notably, supplemental intercepts help improve sample sizes for species with short harvest seasons or otherwise low frequencies of occurrence that are not frequently encountered in the APAIS, such as Greater Amberjack, Gray Triggerfish and Gag (Figure 1.2.1). During APAIS intercept assignments, samplers conduct full interviews

with all boat parties as they return from saltwater fishing, and offshore trips that are less common may be missed when samplers are busy conducting interviews with inshore anglers. The Gulf Reef Fish Survey interview is designed to screen through inshore trips and maximize intercepts for less frequently encountered trips targeting reef fish species. In addition to supplementing length and weight measurements collected through APAIS, age structures are also collected during supplemental intercept assignments which is important for age-based stock assessments.

The ratio of reef fish anglers that were signed up for the Gulf Reef Fish Survey versus all reef anglers intercepted during GRFS assignments was calculated each month to account for additional fishing effort by unregistered anglers. Ratios close to 1.0 indicate months when most intercepted reef fish anglers were signed up for the Gulf Reef Fish Survey and higher ratios indicate months when a lower proportion of anglers were signed up (and thus, a higher adjustment to effort estimates to account for additional anglers not included in the mail survey for effort). The monthly ratios during 2017 ranged from 1.44 to 2.62 in state waters and 1.17 to 1.81 in federal waters (Figure 1.2.3). During 2015, ratios ranged as high as 3.48 in state waters and 5.18 in federal waters. The lower ratios in the third year of this study are likely due to improved awareness since the Gulf Reef Fish Survey was first initiated, including through enforcement checks and outreach efforts.

Monthly effort estimates adjusted for under-coverage are provided in Figure 1.2.4. The majority of fishing effort for reef fish species takes place in state waters; however, there was a noticeable increase in fishing effort in the EEZ during June, July, and August of 2017 that is likely due to the extended harvest season for Red Snapper in federal waters (Figure 1.2.4). The extended season for Red Snapper also coincided with the opening of the recreational season for Gag throughout all state and federal waters (June 1 to December 31). Hurricane Irma made landfall as a category 4 in the Florida Keys and Marco Island on September 10 and impacted the entire Florida peninsula as it continued on a northerly track. Fishing effort decreased in September 2017 relative to the previous months, although this estimate was comparable to the same month in 2016, but lower compared to 2015 (Figure 1.2.4). Prior to regional impacts from Hurricane Irma, red snapper was open in state and federal waters through September 4, 2017. Continued fishing effort in the northwestern panhandle, which was minimally impacted by the storm, may also explain why fishing effort was not more depressed during the month following a major hurricane. During September, gray triggerfish, which is abundant in the northern Gulf, was re-opened to recreational anglers for a short season in state waters only (including 6 days in September, 6 days in October, and 2 days in November). Prior to this limited season, gray triggerfish had been closed entirely in state and federal waters since June 1, 2016.

In general, point estimates for total estimated landings and discards using effort from the Gulf Reef Fish Survey and catch data combined with data collected through the APAIS were higher than estimates generated using standard MRIP estimation procedures; however, for confidence intervals between the two estimates overlap frequently (Figures 1.2.5 to 1.2.10). For several species, Gulf Reef Fish Survey

estimates yielded modest reductions in the coefficient of variation (c.v., standard error expressed as a proportion of the estimate) compared to MRIP estimates, thus the new integrated survey approach is providing more precise catch estimates. However, for certain species, including gray triggerfish (Figure 1.2.6) and greater amberjack (Figure 1.2.7) that have short harvest seasons, the c.v.s around estimated landings are still quite high. Generally, c.v.s below 0.20 are precise and estimates become unstable when c.v.s exceed 0.40.

Deliverables

Deliverables from this task include formatted public use files that allow the intercept data from this task to be easily combined with APAIS data, and the estimation program written in SAS code that was developed collaboratively with staff from NMFS Science and Technology (S&T) that combines data from the two surveys to produce monthly estimates of recreational private boat landings and discards for each reef fish species in state and federal waters. The integrated estimates produced from this program, using effort estimates from Task 2 and combined data from Task 3 and APAIS, yields estimates that are more precise for red snapper, gag, red grouper and vermilion snapper.

Samples collected through this task are currently being shared with the NMFS Southeast Fisheries Science Center so that ages may be assigned, and length, weight and age data collected through this task are being delivered to Gulf States Marine Fisheries Commission routinely for inclusion in the Gulf FIN database so they are available for inclusion in regional stock assessments. Sample weights are also available so size and age data from this task may be appropriately combined with data collected through the APAIS.

Task 3 – Private Boat Effort

Survey Design

Each month, anglers with a current subscription to the GRFS are eligible to receive a questionnaire mailed to their physical address to report their fishing activity over the most recent fishing month. Once an individual is selected, they are marked as ineligible for three months to minimize potential survey fatigue. Prior to drawing a sample for the fishing effort mail survey, subscribers to the GRFS are grouped into categories based on expected levels of participation in the recreational reef fish fishery. For example, subscribers that do not live near the Gulf coast or have direct access to a registered boat may be less likely to participate in the reef fish fishery in the Gulf of Mexico and may also be less likely to respond to the voluntary survey (avidity bias). By surveying homogenous groups separately, potential bias from varied survey response rates is partitioned and may be better accounted for. Participation rates within each group may also be measured more precisely. Stratification also accounts for regional variability that may influence participation rates. For example, fishing effort may vary regionally in response to different seasonal openings and closures for red snapper, which are more

abundant in northern region, versus gag grouper which are more abundant off the central and southern coast of Florida.

The mail survey is stratified by 14 separate survey groups (Table 1.3.1). Non-Florida residents are included in one of two possible strata based on their state of residence: 1) states adjacent to Florida, including Georgia and Alabama; and 2) all other states. Florida residents are divided into four main regions based on their county of residence (Table 1.3.1), and are further divided into sub-regions based on whether the county of residence is coastal (adjacent to the Gulf coast for the purpose of this survey) or non-coastal (inland or adjacent to the Atlantic coast). Within each Florida sub-region, anglers are further sub-divided based on whether a recreational boat is registered to the household. Vessel registration data provided by the Florida Department of Transportation are used to match households with a registered vessel to households with one or more anglers registered for the Gulf Reef Fish Survey.

At the beginning of each new month, 10% or up to 500 individuals (whichever is less) of registered participants from each stratum are selected to receive a paper questionnaire (Appendix 1.7) delivered to their mailing address on record. A cover letter explaining the purpose of the survey is included with the questionnaire, as well as a return envelope that is self-addressed with postage paid on delivery. Respondents are instructed to report fishing activity for the previous month and only for the person whose name is printed on the survey questionnaire. The respondent is asked to report specific dates for all recreational fishing trips taken from a private recreational boat in the Gulf of Mexico by marking dates on a calendar for the survey month provided on the questionnaire. Respondents are then asked to provide specific details for up to twelve trips. A map is provided on the questionnaire to assist with reporting the general zone where each trip took place (Figure 1.3.1). For each reported trip, the respondent is asked to recall the percent of time (if any) spent fishing greater than 10 miles from shore (in the EEZ), and to select from a list of reef fishes that were targeted or caught (if any) during each trip. A guide with pictures for each Gulf reef fish species is included in the survey packet to aid with positive identification. In May 2016, an additional question was added to determine whether an artificial reef was utilized during each fishing trip reported. This question was requested by FWC's Artificial Reef Program to help quantify human use and measure potential benefits from enhancement projects funded through NFWF following the Deepwater Horizon event.

One week after questionnaires are mailed, a reminder postcard is mailed to all selected households to prompt a timely response. One week after the reminder is mailed, a second questionnaire is mailed to households that have not yet returned the first survey to prompt them again for a response. Response to the mail survey is voluntary.

Effort Estimation

Survey responses were used to generate monthly estimates of the total number of Gulf reef fish trips taken by registered participants during a given month, as well as the

number of those fishing trips that used artificial reefs. The sample weight for individuals selected to receive a survey from a given stratum (h) was calculated as:

$$W_h = \frac{N_h}{n_h} \quad (1)$$

Where N_h is the total number of registered Gulf reef fish anglers in the angler population stratum, and n_h is the number of anglers selected from the stratum to receive the mail survey. To account for anglers that did not return the completed questionnaire, the survey response rate in each stratum was calculated as:

$$R_h = \frac{\sum_{i=1}^{n_h} W_h r_{h,i}}{\sum_{i=1}^{n_h} W_h} \quad (2)$$

where r_i is the binomial variable indicating whether selected individual i responded to the survey (1=yes, 0=no). The mean number of Gulf reef fish trips per response in each stratum was calculated as:

$$\bar{y}_h = \frac{\sum_{i=1}^{n_h} y_{h,i}}{n_h} \quad (3)$$

Where $y_{h,i}$ is the number of Gulf reef fish trips reported in state or federal waters by the i th respondent in stratum h , and n_h is the number of people in stratum h that responded to the survey. This value was also calculated separately including only reported trips where the respondent indicated an artificial reef was utilized. Variance was calculated as:

$$var(\bar{y}_h) = \frac{\sum_{i=1}^{n_h} (y_{h,i} - \bar{y}_h)^2}{n_h - 1} \quad (4)$$

The overall mean weighted number of trips per response across all 14 strata was calculated as:

$$\bar{y} = \sum_{h=1}^{14} W_h \frac{1}{R_h} \bar{y}_h \quad (5)$$

And overall variance was calculated as:

$$var(\bar{y}) = \sum_{h=1}^{14} (W_h \frac{1}{R_h})^2 var(\bar{y}_h) \quad (6)$$

The total number of trips taken by all anglers registered for the Gulf Reef Fish Survey during a given month was calculated as:

$$\hat{Y} = N \bar{y} \quad (7)$$

where N is the total number of Gulf reef fish anglers that were registered during the survey month. Variance is calculated as:

$$var(\hat{Y}) = N^2 var(\bar{y}) \quad (8)$$

An adjustment for off-frame anglers (anglers that participated in the fishery but did not register for the Gulf Reef Fish Survey) was calculated separately using data collected from the Private Boat Catch task (described in Task 2).

Evaluation of Oversubscription

Subscription to the Gulf Reef Fish Survey is a free option that may be selected during the purchase of a saltwater fishing license. Anglers choose this option if they anticipate going on a fishing trip where they may have an opportunity to harvest one or more of the species for which the subscription is required. Since the requirement took effect in 2015, there has been a steady increase in the number of subscribers across all strata, which may be indicative of oversubscription. Oversubscription refers to anglers subscribed to the survey who are likely to never fish for Gulf Reef Fish species from a private boat off the west coast of Florida. Oversubscription by non-participants in the fishery is an issue for two reasons: 1) it increases the cost of the survey if a large proportion of registered anglers do not need to be included in the sample population; and 2) it potentially introduces bias into estimates of fishing effort if over-subscribers are more or less likely to respond to the survey than anglers that actually participate in reef fish trips. If a known source of non-response can be identified, it may at least be accounted for by applying an additional post-stratification weight when calculating the overall weighted mean trips per response (equation 5). A post-stratification weight may be calculated as:

$$P_k = \frac{N_k}{\sum_{i=1}^{n_k} w_{h_{R_h}} \frac{1}{n_k}} \quad (9)$$

Where N_k is the total number of Gulf Reef Fish Survey subscribers that share a particular characteristic for a given k predictor (for example, $k=1$ for anglers aged 65 years and older, and $k=0$ for anglers under 65), and n_k is the total number of mail survey respondents that possess the characteristic.

Two approaches were used to explore potential oversubscription and account for non-response bias. The first approach was a multi-step process that used a domain analysis of the responses received to identify potential variables that predict whether subscribers were likely to report a Gulf Reef Fish Survey qualified trip. This analysis included the stratification variables (i.e. boat ownership, coastal households, and region), month and year as a single variable (Month/Year), and an indicator variable that denoted whether the angler signed up for the Gulf Reef Fish Survey on the FWC website via the internet, or by some other means. The "internet" variable was included to test whether anglers who sign up for the survey themselves report differently than those who are signed up through a second person, such as a retail vendor or a tax

collector, who may not verify that a person wishes to subscribe to the survey. Next, we entered these variables into a zero-inflated negative binomial model (ZINB) to quantify overall oversubscription in the survey, as well as identify non-response bias. The model assumes that zero trips per response can occur either because the respondent participates in the fishery but did not take a trip during the survey month, or the respondent never participates in the fishery. The two parts of the model include a binary logit model to predict whether a respondent is an active participant in the fishery, and a negative binomial model to evaluate counts of trips for active participants. To ground-truth results from the ZINB model, an avidity survey was also initiated with new subscribers in the Gulf Reef Fish Survey. Beginning in October 2016, a short survey was conducted with new or recently renewed subscribers to determine their anticipated level of participation in the fishery over the coming year. The three questions included in this initial survey are:

1. In the past 12 months, did you recreationally fish at least once from a private boat that departed from the western (Gulf) coast of Florida (excluding Monroe County)?
 - Yes
 - No
 - Not Sure/Do Not Recall
2. In the next 12 months, how likely are you to recreationally fish on a private boat off the western (Gulf) coast of Florida (excluding Monroe County)?
 - Very likely
 - Maybe/Not Sure
 - Very Unlikely
 - I never fish on the west coast of Florida
3. Whenever you recreationally fish from a private boat, do you attempt to harvest any of the following types of reef fish?
 - Red snapper
 - Vermilion snapper
 - Gray triggerfish
 - Gag grouper, red grouper, black grouper
 - Amberjack, almaco jack, banded rudderfish
 - I never attempt to harvest any of these species

Responses were used to characterize anglers as those who are very likely or may participate in a Gulf reef fish trip, and those who are very unlikely or never expected to participate in the fishery.

New subscribers that only provided a mailing address were sent a postcard. Respondents simply tore off the portion that included the questionnaire and returned it to FWC free of charge (postage paid on receipt). The postcard survey was conducted over three months, October to December 2016. New subscribers who provided a valid e-mail address received an e-mail invitation that contained a link to an electronic survey. The email survey was initiated in October 2016 and was conducted every month through 2017.

Results

The numbers of anglers that were registered for the Gulf Reef Fish Survey increased each month during 2017 and ranged from 500,856 during January to 528,750 during December (Figure 1.3.2). An average of 6,674 individuals were selected each month to

receive an effort survey questionnaire in the mail, and the percentage that returned the survey back to FWC ranged from 17.6% to 28.1% (average = 18.7% in 2017; Figure 1.3.3).

During 2017, the highest percentage of registered anglers were from households in the SW region (32.8%), followed by the Big Bend region (27.3%), out-of-state (22.7%), Northwest region (11.6%), and Keys or Southeast Florida (5.7%). Within each Florida region, the highest percentage of registered anglers were from households without a registered boat (Figure 1.3.4). However, anglers that lived in a household with a registered boat were more likely to respond to the survey, and were also more likely to participate in a Gulf Reef Fish trip during the month surveyed (Figure 1.3.5). Anglers that live in coastal counties are also more likely to respond and participate in the fishery, compared to those who live in non-coastal counties (Figure 1.3.5). These results demonstrate the necessity of the stratified survey design.

The domain analysis identified the following variables as significant predictors of a GRFS-qualified trip being reported: Month/Year, Boat, Internet, and a combination of Region and Coast variables (Region/Coast). We used these variables to inform the ZINB model. The best fitting models of the ZINB model were as follows:

Zero model: 0 GRFS trips/response = Boat + Internet + Region/Coast

Count model: GRFS trips/response = Month/Year + Internet

A total of 34,935 responses were used in the analysis. The Pearson's Goodness of Fit statistic was 1.05, indicative of a good fit. The zero model predicted that 77.5% of the responses that reported zero GRFS trips are due to oversubscription. The Boat and Internet variables were negative predictors of zero GRFS trips reported per response ($p < 0.0001$), while non-coastal strata were strong positive predictors of zero GRFS trips reported per response ($p < 0.0001$). The count model predicted that 11.3% of the responses that reported zero GRFS trips are due to natural sampling variability, i.e. the angler participates in the Gulf Reef Fish fishery but didn't take a trip during that survey month, and 11.2% of the responses reported greater than or equal to one GRFS trip. Within the Month/Year variable, June and July across all years were significant positive predictors of Gulf Reef Fish trips reported per response ($p \leq 0.02$), while December, January, February, and March were significant negative predictors of Gulf Reef Fish trips reported per response ($p \leq 0.001$).

New or renewed subscribers to the Gulf Reef Fish Survey varied from 6,530 anglers in October 2017 to 23,148 anglers in July 2017. On average, 9,356 anglers received the postcard avidity survey each month in the last quarter of 2016, and 7,701 anglers received the email avidity survey each month since October 2016 (Figure 1.3.6). The average response rate for the postcard survey was lower than the email survey (9.5% and 13.7%, respectively). The results indicate that 66% of the respondents to the postcard survey are very unlikely to or will never participate in the Gulf Reef Fish fishery, which is indicative that anglers who are not self-registered via the internet are

less likely to be participants in the Gulf Reef Fish fishery and supports the findings of the ZINB model. Furthermore, anglers who live in coastal counties and own boats were very likely to participate in the Gulf Reef Fish fishery within the next year (Figure 1.3.7). Thus, results of both the avidity survey and the ZINB model support the need to continue the stratified sampling design for the monthly mail survey.

To account for non-response bias, an indicator variable was created to identify whether a respondent self-subscribed via the internet (internet = 1 for yes, 0 for no), a post-stratification weight (equation 9) was applied to each response, and the overall weighted mean trips per response was recalculated. New post-stratified estimates were reduced by up to 15,451 angler trips during a single month, compared to original effort estimates (Figure 1.3.8).

A map depicting the location of artificial reefs on the west coast of Florida is provided in Figure 1.3.9. Between May 2016 and December 2017, 46% (360,522 $\pm$ 35,472) of angler trips that targeted Gulf Reef Fish species also utilized artificial reefs. Of those, 71% of trips occurred in state waters. Trips that utilized artificial reefs occurred most frequently in the northwest panhandle region, followed by the southwest and big bend regions (Figure 1.3.10). Similarly, the northwest panhandle region reported the highest proportion of trips to artificial reefs in state waters, followed by the southwest peninsula and Big Bend regions, respectively (Figure 1.3.10).

Deliverables

The deliverables from this task are described in the Dissemination section of this report.

Task 4 – At-Sea Discards

Methods

Operators of more than 160 for-hire vessels on the Gulf coast of Florida have been recruited to voluntarily participate in this research. Cooperative vessels that operate in each of five regions are randomly selected each week throughout the year for observer coverage. The regions where vessels are based include the northwestern panhandle (counties adjacent to fishing areas 8, 9 and 10), Big Bend (area 7 and a portion of counties in area 6), Tampa Bay (a portion of area 6 and area 5), Southwest (areas 3 and 4), and the Florida Keys (areas 1, 2, and 748). A map of fishing areas, which is also used by dealers in Florida to report the location of commercial landings on trip tickets, is available online at <http://www.myfwc.com/media/3427370/FAC-map-2015.pdf>.

During a sampled trip, the captain is asked to provide the bottom depth and locational coordinates each time their vessel moves to a new fishing location. Biologists observe fishing activity for all anglers on the vessel. As anglers fish with recreational hook-and-line gear, biologists record for each angler the types of terminal tackle used and the amount of time fishing. For each fish caught they also record the species, length (in mm), and whether the fish was harvested or discarded. For each managed species caught, observers also record hook location (lip, mouth, gill, throat, gut, eye, or

externally snagged). If a managed species is discarded, the release method (unvented, swim bladder vented, stomach punctured, recompressed) and condition at the surface (submerged immediately; submerged slowly or initially disoriented; floating at surface; unresponsive; consumed by a predator) is also recorded. Prior to release, each discard is marked with a Hallprint plastic-tipped dart tag with an external monofilament streamer that is labeled with a unique tag number and the word "REWARD". The tag also has an email address and a toll-free phone number for a central tag return hotline to report recaptures. Anglers who capture and report tagged fish received a t-shirt with an artist's image of a Red Snapper (art courtesy of the artist Diane Rome Peebles).

When vessels return to the dock, biologists collect additional samples from harvested fish that may include hard parts for ageing, reproductive tissue samples for histological analyses, fin clips for genetic stock structure, and tissue samples for fish health monitoring. Sagittal otoliths are removed from the head, cleaned, dried and stored in vials. Otoliths are either shipped to the NMFS Southeast Science Center Lab in Panama City, Florida or processed in-house at the Fish and Wildlife Research Institute's Age and Growth Lab (<http://www.myfwc.com/research/saltwater/fish/age-growth-lab/>), depending on the species. Otoliths are processed on a Buhler Isomet low speed saw equipped with four equally-spaced diamond wafering blades. One transverse cut yields three ~400 µm thick sections that encompass both the core and the entire region surrounding the core (VanderKooy 2009). After processing, sections are mounted on glass slides and examined on a stereo microscope. Ages are assigned using established procedures that are standardized throughout the Gulf of Mexico region (VanderKooy 2009). Age and growth data from this task are routinely delivered to Gulf States Marine Fisheries Commission (GSMFC) for inclusion in the Gulf FIN Biological Database, which serves as the warehouse for biological data collected throughout the Gulf of Mexico. For regional stock assessments, Gulf FIN is the "one-stop-shop" to obtain Gulf-wide data for a given species that is being assessed.

Synthesis of Length Data for Use in Stock Assessments

The size distribution of regulatory discards collected as part of this task is an important model input used in regional stock assessments conducted through the Southeast Data Assessment and Review (SEDAR). Length data from discarded fish are synthesized by FWRI staff, who serve as appointed data providers to SEDAR. A synthesized data set is provided to the lead analyst from National Marine Fisheries Service assigned to a stock assessment, and is accompanied by a working paper that describes how data were collected and processed and summarizes results. Working papers are submitted to SEDAR staff to be posted on the public website (<http://sedarweb.org/>).

To synthesize length data, mid-line lengths for each observed fish are first converted to the standard unit of measure for a given SEDAR (if different from mid-line). Each measured fish is assigned to one cm length bin categories (40 cm bin = fish 39.6 cm to 40.5 cm) and the number in each bin is summed by year, trip-type (single-day or multi-day), and disposition (harvested or discarded). For headboat samples, counts of fish in each length bin are multiplied times a sample weight (W_i) to account for

disproportionate sampling of multi-day trips (for example, see SEDAR working paper <http://sedarweb.org/sedar-52-wp-19-summary-data-size-distribution-and-release-condition-red-snapper-discards>). Multi-day trips are not sampled from the charter fishery and a sample weight is not applied. The proportion of fish in each length bin is calculated as:

$$p_x = \frac{n_x}{\sum_{x=1}^i n_x} \quad (4.1)$$

Where n_x is the number of fish measured in length bin x . Annual proportions are calculated separately for headboats and charter boats and used to characterize the size distribution of discarded fish for a given species.

Red Snapper Discard Mortality

To assess latent mortality of Red Snapper following catch and release, recreational discards observed in this study were combined with previous tag-recapture records for Red Snapper discards collected since 2009 in the same region (west coast of Florida, see report at <http://sedarweb.org/s41rd16-directed-study-recreational-red-snapper-fisheries-gulf-mexico-along-west-florida-shelf>). Tagged fish were assigned to one of three categories based on their release condition at the time they were initially tagged and released (Table 1.4.1) and a proportional hazards regression model was developed to assess the relative survival of fish released in different condition categories. This approach has been used previously to evaluate relative survival of discards in a recreational fishery for gag (*Mycteroperca microlepis*) in the Gulf of Mexico (Sauls 2014). For the proportional hazards model, the response variable was the number of days a fish was at large before it was either reported as a recapture (coded as 1) or censored (coded as 0) at the end of the study. The treatment tested was release condition category, which was included as an independent class variable in the proportional hazards model, and fish released in good condition were assigned as the reference group. Control variables were also tested for inclusion in the proportional hazards model. To control for variable tag return rates across regions (due to different fishing pressures), a class variable for zone was included as a covariate and was defined at intervals of one degree of latitude for the eastern and western peninsula regions, or one degree of longitude for the northwestern panhandle. Other effects tested for influence on recapture rates included total length (TL) and potential interaction between TL and zone.

To estimate depth-dependent discard mortality for red snapper, the number of live discards observed in good, vented (and otherwise unimpaired), or impaired conditions (N_1 , N_2 , and N_3 , respectively) at each 10-meter depth interval (e.g., where $d = 1-10$ meters, 11–20 meters) were summed and multiplied by the proportion of fish in each condition category estimated to survive. Discard mortality at each depth interval (M_d) was expressed as a percentage using the equation:

$$M_d = [(1 - (N_1 \cdot \hat{S}_1 + N_2 \cdot \hat{H}_2 + N_3 \cdot \hat{H}_3)) / (N_1 + N_2 + N_3)] * 100 \quad (1)$$

where S_1 is the absolute survival following catch-and-release for fish released in good condition (which is not truly known), and H_2 and H_3 are the estimated survival proportions derived from the proportional hazards model for fish that were vented or impaired (respectively), relative to fish released in good condition. To estimate overall discard mortality across all depths fished in a given fishery, the numbers of fish observed in each release condition category were summed and multiplied by the point estimate for discard mortality, as well as the upper and lower confidence limits.

Because fish had to be captured in order to be tagged and released, there was no true control to reference the good condition category treatment group to; therefore, a range of values was assigned for S_1 . The majority (>95%) of red snapper released in good condition were captured from depths 40 meters or less, and a meta-analysis of 11 separate discard studies for red snapper estimated 15.5% mortality for discards in the recreational fishery captured at 40 m (Campbell et al. 2014). Since fish with visible injuries or swimming impairments were excluded from the good release condition group and a large portion were caught from depths less than 40m, their survival is expected to be somewhat higher. Therefore, for this analysis, overall depth-dependent discard mortality was calculated separately under three assumptions for S_1 : 1) a maximum of 100% released in good condition survive ($S_1 = 1.000$); 2) a minimum of 85% survive ($S_1 = 0.850$); and 3) a median of 92.5% survive ($S_1 = 0.925$). To calculate overall discard mortality estimates for each depth interval, the median value for S_1 was used as the point estimate in equation 1, and uncertainty was calculated by substituting the minimum and maximum assumed values of 0.85 and 1.0 for S_1 , and substituting point estimates for H_2 and H_3 with lower and upper 95% confidence limits for H_2 and H_3 .

To explore the relationship between release condition, fish size, and capture depth, the numbers of red snapper observed in each release condition were summarized in 3x3 contingency tables with rows composed of three ordinal size classes (large $\geq 20''$, medium 16" to $<20''$, and small $<16''$) and columns composed of the response variable for release condition. Separate tables were constructed to test the overall association (observations from all depths and regions), two depth strata (capture depths up to 30 meters and >30 meters), and two regions (north Gulf, central Gulf). The Chi Square Mantel-Haenszel (CSMH) statistic was used to test significance of the linear association between degree of impairment and increased size.

Results

At-Sea Sampling

During the period of January 2015 to December 2017, the FWC sampled a total of 1,528 trips from for-hire vessels operating off the west coast of Florida (Table 1.4.2). A total of 786 charter trips, 727 headboat trips and 15 multi-day trips were completed over the course of this project. Trips occurred in five regions: Northwest Panhandle ($n=624$), Big Bend ($n=28$), Tampa Bay ($n=447$), Southwest ($n=193$), and the Florida Keys ($n=236$). The majority of trips sampled originated in the Northwest (NW) and Tampa Bay (TB) regions, which correspond to the areas with the greatest concentration of the for-hire activity (Figures 1.4.1 and 1.4.2).

Data entry has been completed for all trips, proofing through 2016 is finished, and proofing for 2017 is almost completed. Sampling was suspended or reduced following Hurricane Irma in September 2017, and was recovered to full strength in all regions by the end of 2017.

A total of 213 unique taxa were observed with 91,463 harvested and discarded fish measured over the three years (Appendix 1.8). The ten most frequently measured fish (in order of decreasing abundance) include: vermilion snapper, white grunt, red grouper, red snapper, gray triggerfish, red porgy, yellowtail snapper, lane snapper, gray snapper and tomtates. These 10 species alone accounted for 75.7% of all fish measured. A yearly summary of regulated species is contained in Table 1.4.3 (harvested fish) and Table 1.4.4 (discarded fish). Figure 1.4.3 shows the percentages of fish that were harvested and released. Since 2015, a total of 36,881 discarded fish have been measured during sampled trips, and of these, 28,617 were regulated species (Appendix 1.9). Length data for Red Snapper discards were synthesized and provided to stock assessment analysts for SEDAR 52 (Figure 1.4.4). The percentages of fish released in good (submerged immediately), fair (disoriented and submerged), bad (floating), dead, or preyed upon at the surface (by a mammal, bird, shark, etc.) are shown in Figure 1.4.5.

Table 1.4.5 summarizes numbers of otoliths collected by year for species that are frequently harvested. Table 1.4.6 summarizes additional bio-statistical data collected during sampled trips from 2015 to 2017, including weights, reproductive histology, genetics, and spines. Biological sample numbers are preliminary and final totals will be included in future reports.

Since 2015, 22,806 discarded fish have been tagged and released and to date almost 1,600 have been recaptured at least once (Table 1.4.7). Overall, the recapture rate is 6.92% with the highest rate coming from gray triggerfish (over 9%). Cumulative recapture rates of 8.16% and 6.73 % were achieved for red grouper and red snapper, respectively (Figure 1.4.6). We expect the percentage of fish recaptured to continue to improve over time.

Red Snapper Discard Mortality

When mark-recapture records from this work were combined with previous records collected from 2009 to 2013, sample sizes for the proportional hazards model included a total of 27,070 Red Snapper in the northern Gulf of Mexico and 2,838 in the central Gulf that were captured with recreational hook-and-line gear, tagged, and released alive off the west coast of Florida (Table 1.4.8). Red Snapper were most abundant off the coast of the northwestern panhandle, and discarding in this area occurred relatively close to shore. More than 85% of discards observed from both charter boats and headboats in the northwestern panhandle were caught from depths less than 40 meters (Figure 1.4.7). In contrast, for-hire vessels operating off the peninsula discarded red snapper farther from shore and a greater proportion were caught from depths of at least 40 meters (Figure 1.4.7).

A higher percentage of red snapper discards retrieved from depths >29 meters were vented or impaired, compared to discards caught from shallower depths (Figure 1.4.8). Red snapper that were released unvented in good condition exhibited the highest recapture percentages, followed by fish that were vented and otherwise unimpaired (Table 1.4.8). Controlling for the variable effect of depth, there was a significant linear correlation between increased size and the severity of condition for released fish (Cochran-Mantel-Haenszel Statistic, or CSMH = 448.9, $p < 0.0001$). Medium (404–507 mm TL) and large (>507 mm TL) sized fish were increasingly more likely to be vented or released in an impaired condition compared to smaller (<404 mm) fish (Figure 1.4.8). The size composition of released fish also varied across years, which has potential implications for annual removals attributed to discard mortality. The annual proportions of red snapper observed in the for-hire fishery that were less than 404 mm total length (the legal size limit for recreational harvest in the Gulf of Mexico) ranged from 24–72% off the Gulf coast of Florida (Figure 1.4.9).

After controlling for covariates on recapture reporting rates, the effect of release condition was significant in both regions. Red snapper that were able to submerge immediately without the assistance of venting survived at higher rates compared to those that were vented or impaired (Figure 1.4.10). Red snapper that were vented and otherwise unimpaired were 75.2% as likely to be reported as recaptured compared to unvented fish. Discards with an impairment were 45.6% as likely to be recaptured. Confidence intervals (95%) around hazard ratios for vented and impaired fish did not overlap with 1.0, indicating a significantly reduced recapture rate relative to unvented fish (Figure 1.4.10). Relative survivals were also significantly reduced for impaired fish compared to fish that were vented, suggesting that venting may help mitigate some impairments (Figure 1.4.10). When relative survival rates were applied to fish observed in each release condition at 10 meter depth intervals, point estimates for the percentage that suffered discard mortality increased with depth (Figure 1.4.11). When the numbers of fish observed in each release condition category were summed for each fishery, the overall estimated percentage of discard mortalities across all depths ranged from 21.06% to 29.85% (Figure 1.4.12).

Deliverables

Samples collected through this task are currently being shared with the NMFS Southeast Fisheries Science Center so that ages may be assigned. Length, weight and age data collected through this task are being delivered to Gulf States Marine Fisheries Commission routinely for inclusion in the Gulf FIN database so they are available for inclusion in regional stock assessments. Since this project began, age and growth data for harvested catch and length frequency data for discards have been provided to stock assessment analysts for gag (SEDAR 33 update), greater amberjack (SEDAR 33 update), black grouper (SEDAR 48), gray snapper (SEDAR 51), and red snapper (SEDAR52). Below is a list of working papers submitted to SEDAR that describe data that were provided for regional stock assessments:

SEDAR 52 – Gulf of Mexico Red Snapper

Red snapper discard mortality in Florida's recreational fisheries

- o <http://sedarweb.org/sedar-52-wp-09-red-snapper-discard-mortality-florida%E2%80%99s-recreational-fisheries>

A summary of data on the size distribution and release condition of red snapper discards from recreational surveys in the eastern Gulf of Mexico

- o <http://sedarweb.org/sedar-52-wp-19-summary-data-size-distribution-and-release-condition-red-snapper-discards>

Below are links to the final reports for assessments that this task provided data for: SEDAR 33, update report Gulf of Mexico gag grouper (*Mycteroperca microlepis*) and greater amberjack (*Seriola dumerili*), <http://sedarweb.org/sedar-33>

SEDAR 48, data workshop report for Southeastern U.S. Black Grouper (*Mycteroperca bonaci*), <http://sedarweb.org/sedar-48>

SEDAR 51, data workshop report for Gulf of Mexico Gray Snapper (*Lutjanus griseus*), <http://sedarweb.org/sedar-51>

Task 5 – Angler e-Log

Methods

In an effort to collect information on the condition of red snapper discards from private boat trips, anglers have been encouraged to voluntarily record information on paper catch cards during a single fishing trip and return via mail to FWC. The objective for Task 5 was to develop an electronic reporting application to replace the paper catch card, and to expand the platform to collect information for a variety of reef fish species. In May 2015, an online submission form was made available on FWC's public website for anglers to report numbers and condition of red snapper discarded during their fishing trips. The form can be found at:

<http://www.myfwc.com/research/saltwater/fishstats/recreational-fisheries/catch-card/>. In

the first quarter of 2017, FWC staff began development of a mobile version of the catch card to be housed within FWC's Reporter mobile application. The Reporter app encourages Florida residents and visitors to take an active role in conservation by reporting fish and wildlife observations to FWC. The mobile application already had an active user base of anglers and other stakeholders who used the application to report a wide variety of activities, such as fish kills, poaching and injured wildlife. On May 24, 2017, the Angler e-Log was pushed out as an update to the FWC Reporter application, available on both Apple and Android platforms. A brief advertisement for the Angler e-Log was also placed at the end of the monthly e-mail survey sent out to new subscribers of the Gulf Reef Fish Survey (discussed in Task 3). However, during the third quarter of 2017, the Angler e-Log was removed from the FWC Reporter mobile application at the behest of upper-level FWC-FWRI staff, as they felt it did not fit with the overall purpose of the application. At that time, Information Science & Management (IS&M) staff decided that the best option for the Angler e-Log was for a mobile-

optimized webpage. The entire FWC-FWRI website is in the process of becoming mobile-optimized in March 2018, and the Red Snapper Catch Card webpage will be mobile-optimized at that time. The mobile-optimized webpage version of the catch card will have a similar appearance and functionality to the FWC Reporter App.

Results

Since the launch in early 2015, 162 total responses were received through the online submission form, (Table 1.5.1). The majority of those responses were from anglers who fished in the Panhandle region (Figure 5.1). Anglers reported fishing up to 120 miles offshore, with an average distance from shore of 18.9 miles ($SD \pm 16.8$ miles). Fishing depths ranged from 9 to 290 feet and averaged 88.5 feet ($SD \pm 35.8$ feet). A summary of depths and distances from shore fished by private anglers during open versus closed harvest seasons for red snapper is given in Table 1.5.2. During the reporting period, 606 harvested red snapper were reported (Table 1.5.3), and a total of 2,648 discards were reported, of which 59.8% were of legal size (≥ 16 " total length; Figure 1.5.2). The majority (74%) of anglers reported using non-offset circle hooks, and anglers also reported using offset circle hooks, J hooks and spears to target fish.

The proportion of red snapper discards in each size class reported by private boat anglers (this Task) was compared to discards observed on charter boats and headboats during at-sea surveys conducted through Task 4. When the Red Snapper harvest season is closed, private boats tend to release a higher proportion of fish >16 " total length; and when the season is open, private boats and charter boats release larger fish in equal proportions (Figure 1.5.3). In contrast, a very low proportion of legal sized red snapper are released from headboats during the open season. By comparing the private boat fishery (for which it is not possible to observe discarding at-sea) to for-hire segments of the recreational fishery (with high quality data collected by fishery observers) analysts can make more informed inferences about mortality rates in this segment of the fishery that is difficult to survey.

Deliverables

Red Snapper Catch Card data were summarized and presented in a working paper submitted for SEDAR 52 Gulf of Mexico Red Snapper (D. Lazarre et al., 2017). The figure using Red Snapper Catch Card data from that working paper is provided as Figure 1.5.3, with the alternate name of "volunteer angler catch logs". The data was used to compare the proportion of fish discarded in each size bin by private boat, headboat and charter fishermen.

Task 6 – Administrative

Phase IV was the continuation of the Performance Improvement Plan (PIP) with focused administrative oversight and tracking of project expenditures in line with the budget. The OPS Administrative Assistant met support goals in Phase IV by closely monitoring and accurately tracking expenditures, submitting reimbursement requests and quarterly programmatic reports within the NFWF deadlines, and requesting budget

amendments when reallocation of funds was needed. The following budget amendments were requested in this phase:

- The project transitioned from an Advance Payment Request to a Cost Reimbursable basis and because of that, broad cost categories were more appropriate. There are expenditures incurred that cannot be predicted (such as vehicle repairs, sunscreen, printer ink, etc.). Therefore, condensed categories are a more efficient way of identifying those expenses. The field supplies and materials category were collapsed to Miscellaneous Biological Sampling Supplies and Miscellaneous Data Collection Supplies.
- In past phases there was not a line item in Task 1 in Supplies and Materials to account for shipping charges. Shipping charges were incurred during Phase IV to ship biological samples to St. Petersburg, Florida. Surplus funds in the amount of \$400.00 allotted for foul weather gear were moved to a new category, FedEx Shipping Charges.
- In Task 2, the OPS Field Biologist #3 during Phase III moved into the OPS Research Biologist position at the start of phase IV. The Research Biologist was budgeted at a higher rate, and the difference in hourly rate was used for one salary adjustment. A new OPS Field Biologist #2 was hired at a higher rate (\$15.00 per hour) than the previous staff member (\$14.00 per hour). The new OPS Field Biologist #3 was hired at a lower rate (\$14.00 per hour) than the previously budgeted staff member (\$16 per hour). A staff member from another project was moved to Task 2, filling the vacant position OPS Field Biologist #7 at a rate of \$16.00 per hour, but the position was originally budgeted at \$14.00 per hour. Additionally, funds needed to be reallocated to cover the changes in salaries. Therefore, Surplus funds from the OPS Field Biologist #3 were reallocated to OPS Field Biologist #7. Surplus funds from the OPS Research Biologist were reallocated to OPS Field Biologist #2.
- In Phase IV a total of 800 at-sea trips are budgeted in Task 4. In order to be able to accomplish this amount of trips it was necessary to reclassify the OPS Research Biologist – Tagging Analyst to OPS Field Biologist #7.
- In the Travel cost category for each task there are expenditures incurred that cannot be predicted (such as mileage reimbursements, tolls, parking fees, meals for multi-day sampling trips) and; therefore, condensed categories are a more efficient way of identifying those expenses. Travel cost categories for Tasks 1, 2, and 4 were condensed and are tracked internally and reported as Sampling Travel, State Vehicle Fuel, or Trip Fares.
- Due to the addition of an OPS Field Biologist #7 position in Task 2 – GRFS Catch in Phase IV, more sampling trips were completed, increasing the amount of travel expenses being incurred. Surplus funds in Task 2 – Materials and Supplies were reallocated to Task 2 – Travel.
- Due to the addition of an OPS Research Biologist – Database Manager position in Task 2, a Dell computer, monitor, and mouse had to be purchased and was

not originally budgeted in this phase. Funds allocated and approved for the purchase of Panasonic Toughbook Tablets in Task 2 – Materials and Supplies were reallocated to Task 2 – Data Collection Supplies, “Computer”.

- In Task 3 – GRFS Effort the OPS Field Biologist #1 was originally budgeted at \$15.50/hr. for 1,980 regular hours and \$23.25/hr. for 40 overtime hours. The OPS Research Biologist was originally budgeted at \$21.00/hr. for 1,980 regular hours and \$31.50/hr. for 40 overtime hours. Both positions have received salary increases. The OPS Field Biologist #1 is currently at \$16.00/hr. regular hours and \$24.00/hr. overtime hours and the OPS Research Biologist is currently at \$22.00/hr. regular hours and \$33.00/hr. overtime hours. Funds allocated for Bulk Mailing Postage in Miscellaneous Data Collection Supplies in the amount of \$1,020.00 for salary and \$14.79 for benefits for the OPS Field Biologist #1 and \$2,040.00 for salary and \$29.58 for benefits for the OPS Research Biologist were moved to Task 3 – Salaries and Benefits for a total of \$3,104.37.
- The line items in Personnel were collapsed to include like positions into one single line item for both Salary and Benefits.
- In Task 6 – Administrative there was no travel originally budgeted. The OPS AAll attended training on the State of Florida’s financial system to enable her to have greater knowledge, skills, and responsibility for fiscal management and accurate reporting to NFWF on this project. Due to the training requiring travel, a Travel category was created in this task.
- In Task 3 - The OPS Research Biologist in Task 3, Tiffanie Cross, facilitates the effort component of the Gulf Reef Fish Survey (GRFS) and is playing a large role in the current Marine Recreational Information Program (MRIP) Certification process for GRFS. An in-person MRIP Certification conference was scheduled. Due to the OPS Research Biologist residing in North Bend, OR, travel was required to attend the meeting. No travel category exists in Task 3. Therefore, a new category "Travel - Miscellaneous" was created to facilitate the OPS Research Biologist attending the MRIP Certification process for GRFS.
- In Task 1 – Commercial in the first two phases enhanced NOAA TIP sampling only supported 3 staff members. One of our samplers went on maternity leave in between the 1st and 2nd quarters of Phase IV and was replaced by one of our other TIP samplers. The replacement TIP sampler was highly productive and when the other TIP sampler returned from maternity leave the replacement sampler was moved off of NFWF funds. A budget amendment was submitted to bring the replacement sampler back onto Task 1 with surplus funds from Task 5 for the 12.5 pay periods from July through the end of Phase IV.
- In Task 2 – GRFS Catch, OPS Field Biologist #5 was originally budgeted for health insurance at \$8,356.92 and FICA at \$428.91. The sampler added a spouse to the health insurance causing a deficit in the budgeted amount. Surplus funds from OPS Field Biologist #6 who does not have State of Florida health insurance were moved to OPS Field Biologist #5 to cover the increase in costs.

- In Task 2 – GRFS Catch was over budget in two categories: Travel (Sunpass) and Printing. Due to increased sampling the originally budgeted \$240.00 for Sunpass had been exceeded. In Printing, the original quote for printing of data forms was \$1,000.00. The actual expense charged was \$1,189.00. Surplus funds in Salary – OPS Research Biologist were reallocated to Travel (Sunpass) and Printing to cover the deficiency.
- In Task 3 – GRFS Effort –Materials and Supplies, there was no office supplies category originally budgeted. Due to more surveys being processed, it was necessary to purchase some additional office supplies (computer peripherals, shipping services, date stamp) and in order to properly classify them we created an “Office Supplies” category and reallocated surplus funds from Postage – Bulk Mailing.
- In Task 3 – GRFS Effort, the amount of \$10,200.00 was allocated for Postage – Business Reply. This category was over budget in the amount of \$5,485.00 due to financial staff requesting postage funds to be added to the USPS Business Reply Permit account (returned surveys) before checking the balance of the permit which resulted in the line item being over budget. Extra funds deposited in the account were moved internally by USPS to the Bulk Mailing Permit (distributed surveys). For budget purposes, surplus funds in Postage – Bulk Mailing were reallocated to Postage – Business Reply.
- In Task 1 – Commercial – Travel – State Vehicle Fuel, an increase in sampling allowed for more data to be processed and also incurred additional State Vehicle Fuel use. The original amount budgeted was \$2,250.00 which would have been exhausted by the end of the third quarter. Each sampler uses an assigned state vehicle and does not incur mileage reimbursement; therefore, surplus funds in Travel – Sampling Mileage were reallocated to State Vehicle Fuel.

Weekly PIP meetings were held with the FWRI Grants Office to discuss any changes in reporting, issues that may have been occurring, and to ensure that the project was proceeding within the proper guidelines.

2) Project Goals and Objectives

Outcomes: Short-term

Bridging Data Gaps

The Fisheries Information Network (FIN) is a cooperative program among state and federal agencies to collect, manage, and disseminate statistical data and information on the commercial and recreational fisheries. Funds in the Gulf of Mexico are administered through Gulf States Marine Fisheries Commission (GSMFC). In Florida these funds support the APAIS portion of the MRIP survey, the For-Hire Telephone Survey of charter fishing effort, and biological sampling of commercial and recreational catch on the west coast of Florida. Biological data that are representative of the commercial and

recreational fisheries are vital inputs for age-based stock assessments in the region. However, due to rising costs to conduct fishery dependent surveys, coupled with level funding to the Gulf FIN, the program is no longer able to support year-round biological sampling programs in the region. In order to maintain core programs for catch and effort statistics, funding for biological sampling has been cut and if partial funds are available, they have been dispersed late in the year after harvest seasons for highly regulated species have passed. Without dedicated year-round funding, biological data collection in Florida has been irregular and limited to opportunistic sampling. Thus, age and growth information collected through tasks 1, 2, and 4 of this project have become increasingly important for bridging data gaps in Florida.

In 2017, Gulf FIN funds that support the APAIS portion of the MRIP survey in the State of Florida were also reduced, resulting in 618 fewer APAIS assignments on the west coast of the state this past year. This cut is expected to continue through 2018. Consequently, angler intercepts collected through the Gulf Reef Fish Survey are becoming increasingly important for maintaining acceptable precision around catch estimates for managed reef fish stocks and for offsetting reductions in length and weight data collected through the APAIS. The Gulf Environmental Benefit Fund has also benefitted commercial sampling through Task 1 by providing continued support for full geographic coverage throughout the range of the fishery, which would not be possible following cuts to funding through Gulf FIN.

Supporting Regional Stock Assessments

Data from harvested and discarded fish collected through Tasks 1, 2, and 4 currently are being provided to SEDAR analysts and incorporated into the process for assessing managed species in the Gulf of Mexico (see <http://sedarweb.org/> for a description of the SEDAR process). Staff from FWC are appointed as data providers and panel members during SEDAR assessment workshops. This provides staff the opportunity to provide data that fill data gaps in the assessment, along with valuable input on the best way to use each data set. In recent years, the number of discarded fish has increased dramatically, and for some species, can represent a larger number than those harvested. Data collected in Task 4 are used to characterize the length distribution of fish released at sea, which is information that is not currently provided through any other fishery dependent monitoring program in the Gulf of Mexico. Data from this program have been incorporated into multiple stock assessments over the last three years, including updates for gag grouper, greater amberjack and red snapper (in progress). Trip level data associated with each fish helps characterize the depths where discarding takes place, size selectivity of the fishery, and the size distribution of discards allows analysts to track strong recruitment classes through time and forecast the future harvest potential for a stock. Also, mark-recapture data have been used to model species specific post-release mortality rates, measured directly within the recreational hook-and-line fishery, to help analysts assess total removals attributed to a combination of harvest and regulatory discarding.

Outcomes: Long-term

Representative Biological Sampling

In addition to the short-term benefit that stable funding has provided for continuing biological sampling in the Gulf of Mexico, a long term benefit is the development of improved data collection methods to representatively sample the composition of recreational landings. The recreational fishery in Florida is comprised of large numbers of participants dispersed across numerous landing points; a well-designed survey that samples the fishery representatively as a whole is far more robust than the opportunistic sampling approach that has been taken in the past. Tasks 2 and 4 employ random sampling designs for the for-hire and private boat segments of the recreational fishery, and data are collected across all seasons throughout the year. This level of fishery dependent monitoring is not possible without stable, recurring funding.

Improved Data Sharing with Regional Partners

In the past, the State of Florida has provided length and age data separately for use in stock assessments. With funding through this work, the state has been able to work collaboratively with Gulf States Marine Fisheries Commission and NMFS to establish a new process for providing standardized data to the regional Gulf FIN database (Figure 2.1). The Gulf FIN database serves as a warehouse for biological data collected in all five states throughout the Gulf of Mexico, and has become a one-stop shop for stock assessment analysts to obtain uniform, clean data sets. In addition, the state data management team has increased quality control measures to improve the accuracy of the data stored and shared with regional partners. After assignments are conducted, field staff enter their data into an application connected to the SQL Server database. The programs contain several validations to prevent common data entry errors. When data entry is complete, project managers manually review data and run automated programs that identify missing fields, general errors, and use species specific parameters to identify length and weight outliers. Once data are entered and checked, age structures collected in the field are processed in-house by the age and growth lab at the Florida Fish and Wildlife Research Institute (FWRI) or delivered to federal partners based at the Southeast Fisheries Science Center. After the aging process is completed at FWRI, age data is linked to the original records in the Florida Biological Database. Data maintained by FWRI are formatted to Gulf FIN standards and delivered to the Regional Gulf FIN Biological database. In addition, our staff have also developed region specific data queries to perform preliminary analysis and synthesize the available data for discards. For each SEDAR, data are delivered directly to analysts in the requested format for that stock assessment. Automated programs have been developed to improve the speed with which data can be delivered.

Continuation of Discard Time Series

For-hire discard monitoring (Task 4) extends an important time series that began prior to the Deepwater Horizon disaster in the Gulf of Mexico. This work was originally initiated in June 2009 through a federal earmark approved by the United States

Congress, which expired at the end of 2013, to conduct a directed study of the recreational red snapper fisheries along the West Florida Shelf (<http://sedarweb.org/s41rd16-directed-study-recreational-red-snapper-fisheries-gulf-mexico-along-west-florida-shelf>). Mark-recapture data from this original work is now being used in combination with data from this study to model discard mortality for Red Snapper. As tagged fish continue to accumulate through this work, more models will be developed for other important managed species. Tag and recapture data for each individual discarded fish observed before and after Deepwater Horizon have also been shared with researchers at Arizona State University for a Gulf-wide evaluation of the effects of the oil spill on fisher decision-making and behavior. The project P.I., Dr. Steven Saul, is currently funded through the Gulf of Mexico Research Institute (GOMRI) to conduct this research. We anticipate other collaborative opportunities to result from this work in the future.

Certification of the Gulf Reef Fish Survey

The Gulf Reef Fish Survey is currently being reviewed through a formal process developed by the MRIP to provide support during development of new surveys, with the ultimate goal of certifying methods that are statistically sound and suitable for official use in management and assessment. The review was initiated in 2017, and a team of experts in survey design from universities across the country have been recruited to serve as reviewers. The formal review is scheduled for 2018 and will be followed up with a report by the reviewers with their recommendations for improvements to the survey design and estimation methods. Formal certification, which the state expects to pursue in 2018, will also be followed up with methods to calibrate the historic MRIP time series with new estimates generated through the Gulf Reef Fish Survey.

Monitoring Catch Limits

Methods developed through Tasks 2 and 3 are expected to improve the way we monitor catch and effort in the private recreational fishery for reef fishes, and promise to yield several long-term benefits. The new mail survey provides effort estimates over a one-month period (as opposed to two-month waves) that improves timeliness and more closely matches the duration of recreational fishing seasons for tightly managed species. Also, by reducing the recall period for respondents, more trip level details are collected through this survey, which allows for direct estimates of effort in state versus federal jurisdictions and at the regional scale. When combined with area and region-specific measures of CPUE, finer scale effort estimates may provide assessment analysts with a clearer picture of the spatial distribution of effort and catch and support greater flexibility for regional fisheries management in Florida. For example, there is an interest in Florida to manage red snapper with different seasons in the northwestern panhandle, where the species is abundant nearshore in state waters, and the western peninsula, where catch rates are lower and anglers must travel farther distances to target the species. There is a desire among all five states in the Gulf of Mexico to move towards state-level management of red snapper, and new survey methods are being developed in each jurisdiction to support this goal. This year, the State of Florida submitted a Draft Amendment to the Fishery Management Plan for the Reef Fish

Resources of the Gulf of Mexico (<http://gulfcouncil.org/wp-content/uploads/B-6e4-Florida-State-Management-1-8-2018.pdf>) that would assign a share of the Gulf-wide recreational annual catch limit (ACL) for red snapper to Florida and transfer responsibility for managing this share to the state. Improving precision of state-level estimates is a key component of this plan and could potentially allow the state to set the annual catch target closer to the ACL, thus giving anglers more fishing opportunities.

Outcomes – Additional

Artificial Reef Use

The development of methods to quantify human use of artificial reefs was not originally proposed in the statement of work for this project. The addition of new questions to the Gulf Reef Fish Survey pertaining to artificial reef use was in response to requests within FWC by staff responsible for restoration work, also funded through NFWF, to restore recreational fishing opportunities following the Deepwater Horizon disaster. New questions added to the effort portion of the survey in 2016 have allowed us to generate estimates of artificial reef usage. In addition, a new question on the intercept survey questionnaire was tested in 2017, and this new procedure is being fully implemented in 2018. In the future, we hope to be able to develop catch estimates using this habitat variable.

As new artificial reef habitats continue to be deployed in coastal areas of Florida, there is a need to monitor potential changes in angler behavior that may explain variable catch rates and size composition of landed and discarded fish over time. Generally, increased abundance of reef fishes on artificial reefs improves catch per unit effort (CPUE), and thus enhances recreational fishing. Mitigation from potential environmental damage related to the Deepwater Horizon oil spill has increased efforts to deploy artificial reefs throughout Florida's northwestern panhandle region. Measuring the recreational fishing effort component of an artificial reef program is an important metric for gauging the success of this effort, as well as understanding how large-scale artificial reef programs influence fishing behavior, change CPUE, and potentially alter the average size of fish caught. To date, we are unaware of a study that has quantified recreational fishing effort on artificial reefs, and this additional outcome is expected to prove useful for monitoring future trends in recreational fishing effort with respect to artificial reefs in the future.

Discrepancies between achieved and proposed outcomes

All tasks achieved their proposed outcomes with the exception of Task 5, with the Angler eLog. Volunteer angler based reporting systems are increasing in popularity, with many tools adopting the format of web-based electronic logbooks that allow trip data to be submitted via smart phones or tablets. In Task 5, the State of Florida proposed the creation of an Angler eLog which would be a mobile version of Florida's red snapper catch card, and the new platform would collect information for a variety of reef fish species in addition to red snapper. Florida's red snapper catch card was originally a paper postcard that later transitioned into a webpage. The mobile

application of the catch card was incorporated into the FWC Report Application in May 2017 and made available on both major platforms, but the scope of the agency's reporting application changed shortly after the card was incorporated, which resulted in the catch card being removed. Florida's Fish and Wildlife Research Institute webpage will be mobile-optimized in March 2018. The mobile-optimized webpage version of the catch card is an improvement from the previous online version, but it lacks the functionality that was intended with the electronic logbook being in the form of a mobile application.

Sustainability

The funding level in this phase supported all the proposed metrics which were monitoring programs in Tasks 1-5. Funding beyond Phase V is the main risk to continue the sampling efforts supported by the GEBF.

Funding of the enhanced commercial sampling in Task 1 will expire at the end of 2018. A project proposal was submitted by the State of Florida to Open Ocean TIG to continue fishery-independent and dependent sampling supported by GEBF, including commercial sampling in the Apalachicola, Big Bend, and Tampa Bay regions. Initial feedback indicated the project proposal will be better suited for the Monitoring and Adaptive Management portion of the Deepwater Horizon Natural Resource Damage Assessment, and we are awaiting notice of the associated request for proposals. The three samplers in Task 1 are involved in the Trip Interview Program (TIP), a cooperative with NOAA Fisheries' Southeast Fisheries Science Center, and the State of Florida has communicated to the Science Center when funding for these TIP samplers would end.

Tasks 2 and 3 to conduct the Gulf Reef Fish Survey will continue with support from the Gulf Environmental Benefit Fund through June 2020, and Agency staff are currently discussing ways to continue the survey after this funding is exhausted. One method is to transition to a fee-based approach, where participants in the reef fish fishery provide funding support for the survey. Introducing a fee would also force state vendors to ask anglers if they wish to incur the additional charge when purchasing a saltwater fishing license, which would help address the issue of oversubscription in the mail survey. However, implementing such an approach is contingent upon approval by the State Legislative body, which may not support an additional fee. If a fee cannot be charged, the Agency may have to consider shifting funds away from other monitoring and research programs if continued support for the Gulf Reef Fish Survey is a higher priority.

At this time, no alternative funding source has been identified to continue Task 4 beyond 2018. Long-term, stable funding is crucial for the sustainability of this time series, which was initiated in 2009 with a Congressional earmark and extended with funding through the Gulf Environmental Benefit Fund. A project proposal was submitted to Open Ocean TIG by Gulf States Marine Fisheries Commission to not only continue this work in Florida, but also expand implementation to other states. Agency staff in Alabama and Mississippi have expressed interest in adopting the approach used in Florida and are currently working with their for-hire industry to test similar methods.

Agency staff in Louisiana also have a strong interest in improving data collections for discards, and helped organize a national Release Catch Workshop in 2017 to explore potential methods. At the time this report was prepared, a response to the proposal submitted through Open Ocean TIG was not available. Other funding sources that have become available since Deepwater Horizon have not fit this project, and the State of Florida will continue to explore future options, along with Gulf States Marine Fisheries Commission and other state Agencies in the Gulf region.

As we continue to receive funds in Phase V, we will continue to closely and accurately track expenditures and submit reimbursement requests, reconciliations, and quarterly programmatic reports within the NFWF deadlines (Task 6).

3) Lessons Learned

Stable funding for biological sampling has allowed us to improve geographic coverage, sample catch throughout the year, and develop statistically rigorous sampling methods to provide data that give a better representation of the compositions of commercial and recreational landings, as well as discards. We will continue to look at regional and seasonal needs for commercial sampling and ensure that available personnel resources are utilized as effectively as possible. It is important that current levels of sample coverage be maintained and preferably enhanced to better meet state, regional and federal data needs.

Working cooperatively with representatives of the for-hire fishery, Task 4 characterizes recreational fisheries for important managed species, particularly with regard to discards, so that stock assessments may better quantify total removals. Decisions made during stock assessment workshops pertaining to the percentage of discard mortality that should be applied to estimated catch often draw criticism from fishermen participating in panel discussions. This work addresses the need for methods to collect catch data from recreational fisheries that takes into account the fundamental shift from harvest to largely catch-and-release fishing. Actively engaging fishery participants in the collection of this data has fostered a high level of stakeholder buy-in.

Primary objectives of this work were to collect high-resolution data for the most important target species in the recreational hook-and-line fishery operating from the west coast of Florida, including size and age composition, detailed information on depth and area fished, and release condition measures; and to develop models that predict survival of fish released within the recreational fishery that may be applied to estimates of numbers of discards. The products of this work are contributing to stock assessments in the region. This work would not be possible without voluntary participation by the for-hire fishery, and through this cooperative research we have strengthened stakeholder support for data collection and stock assessment results. Project PI's represent the State of Florida on a variety of workgroups and oversight committees, and are sharing results of this work with state, regional and federal partners at national workshops and regional Fishery Management Council meetings (dissemination efforts described in Section 4). If and when funding becomes available, the State of Florida is ready to work cooperatively with partners throughout the Gulf of

Mexico to develop a coordinated Gulf-wide monitoring program that would improve data collection for recreational discards.

We have also worked cooperatively with federal partners to integrate existing recreational survey data with new information collected through Tasks 2 and 3. The MRIP survey provides recreational catch estimates for a large suite of state and federally managed species, and developing a new survey specifically for reef fishes to replace the MRIP survey was not a practical solution for Florida. Creating a new survey that overlaps with the APAIS portion of the MRIP survey would also be inefficient. Instead, by collaborating with NMFS, data from the two surveys can be used together and ensures that we do not duplicate effort by sampling the same sites on the same days. Coordination with NMFS has allowed the Gulf Reef Fish Survey to leverage data already collected through APAIS, and improvements to both surveys have resulted from this collaboration. By partnering with NMFS, we have benefitted from the expertise of MRIP staff and their statistical consultants during the development of this new survey. Lessons learned through the development of this project have also led to improvements that have been incorporated into the APAIS design to better allocate samples to sites where reef fish trips are intercepted. As a result of this effort, other states have also begun to make similar improvements to their APAIS sample design.

The design of the Gulf Reef Fish Survey was structured around a new requirement in 2015 that anglers must subscribe to a mail survey in order to legally harvest certain reef fish species. To make it convenient for anglers to subscribe, it was included as a free option during the purchase of a saltwater fishing license. However, as the project has progressed, it is apparent that outlets where fishing licenses are sold often select the option on behalf of their customers without verifying that individual anglers participate in the fishery and wish to subscribe to the survey. This causes undue burden on anglers that do not wish to be surveyed for a fishery they do not participate in. Anglers selected for the mail survey frequently contact FWC or include comments on the survey questionnaire to inquire about why they were selected for the survey or request that their address be removed. Oversubscription also has other implications, including non-response bias and increased cost for the survey, which were discussed previously in this report (Section 1.3). Results presented in this report suggest that more than half of anglers subscribed to the mail survey are very unlikely to ever take a reef fish trip from a private boat off the Gulf coast of Florida. In the short term, non-response bias is being addressed through the stratified sampling design and by exploring variables to use as post-stratification weights in the estimation procedure. However, developing solutions for the increased cost and survey burden that result from oversubscription will require continued discussions within our Agency to refine and improve the subscription process.

4) Dissemination

Professional Meetings

The American Fisheries Society (AFS) held an annual meeting in Tampa, Florida, during August 20-24, 2017. The meeting was attended by more than 1,500 fisheries scientists from across the country and around the world. A special symposium titled,

“Characterizing Recreational Fisheries for Reef Fishes: Current Methods and Future Data Needs”, was organized for the national meeting by Beverly Sauls (PI on this project), Gregg Bray (Gulf States Marine Fisheries Commission) and Dr. Chip Collier (staff for the South Atlantic Fishery Management Council). The symposium was moderated by Tiffanie Cross (survey coordinator on this project). The purpose of the symposium was to bring together researchers working on a range of specialized survey methods currently in use or being developed to improve marine recreational data for reef fishes to share methods, experiences, and results, as well as to identify data gaps in the region that will require more attention in the future and discuss the emerging need for collaboration to ensure data collected through different surveys throughout the region are compatible. During this symposium, T. Cross gave an oral presentation titled, “Development of a Specialized Survey to Directly Estimate Angler Trips Targeting Reef Fishes from Private Boats in Florida”. The presentation described methods and current results of the GRFS effort survey, including an evaluation of reporting rates and methods that are being explored to account for non-response bias (Task 2). B. Sauls gave an oral presentation titled, “Monitoring Regulatory Discarding of Red Snapper, *Lutjanus campechanus*, in recreational fisheries operating off the Atlantic and Gulf of Mexico coasts of Florida”. This presentation described methods used in Florida to monitor recreational discards and summarized ways that data from Task 4 are contributing to regional stock assessments. A total of 12 presentations were given at the symposium on topics that included data needs in the Gulf of Mexico and South Atlantic; new catch and effort survey methods in Louisiana, Alabama, and Texas; monitoring of regulatory discards in Florida; electronic reporting in the South Atlantic; and methods for quota monitoring.

Project staff also participated in a special Artificial Reef Symposium that was held during the national AFS meeting in Tampa, FL. A poster titled, “Estimated Recreational Fishing Effort on Artificial Reefs Using the Gulf Reef Fish Survey”, was presented, and a manuscript describing the methods and results has been accepted with minor revisions for publication in a peer-reviewed proceedings (Task 2). The manuscript provides a quantitative measure of the portion of recreational trips targeting reef fishes off the west coast of Florida that utilize artificial reefs. The results of this effort will be used to gauge current success of the state’s artificial reef program and the methods described provide a useful tool to monitor future changes in angler usage as man-made habitats continue to be deployed in the region.

During the June 2017 meeting of the Gulf of Mexico Fishery Management Council a representative from each state was asked to present methods currently being developed to provide improved recreational statistics for Red Snapper and other managed species in the reef fish complex in the Gulf. On behalf of Florida, Dr. Luiz Barbieri presented an overview of the Gulf Reef Fish Survey, including methods, coordination with the Marine Recreational Information Program (MRIP) and other Gulf states, preliminary results, and progress made towards formal statistical review for eventual certification through MRIP.

In November 2017, B. Sauls was invited to participate in a national workshop to discuss methods to improve data collection for recreational discards (Task 4). The Released Catch Workshop was hosted by Gulf States Marine Fisheries Commission in New Orleans, LA. During the workshop, a presentation was given to highlight Florida's at-sea observer program and ways that data from Task 4 are contributing to regional stock assessments. Participants included state and federal representatives from the Gulf of Mexico and South Atlantic regions, as well as other regions of the country.

In December 2017, B. Sauls was invited to give a presentation to the South Atlantic Fisheries Management Council to describe methods currently being developed in Florida through Tasks 2 and 3 to improve catch and effort data collection for reef fish species.

Stock Assessments

Biological samples collected through Tasks 1, 2, and 4 are currently being shared with the age and growth labs at FWRI and NMFS Southeast Fisheries Science Center so that ages may be assigned. Length, weight and age data collected through this task are being delivered to Gulf States Marine Fisheries Commission routinely for inclusion in the Gulf FIN database so they are available for inclusion in regional stock assessments. Sample weights are also available so that size and age data from Task 2 may be appropriately combined with data collected through the APAIS. Discard length data are synthesized and shared with NMFS analysts for inclusion in regional stock assessments. Private boat discard data from Task 5 was compared with for-hire fishing fleets for a recent stock assessment (SEDAR 52).

State staff participate as data providers and panel participants during SEDAR Data Workshops and Assessment Workshops and disseminate information on data that are available as a result of this work. Two working papers were submitted to SEDAR 52 Gulf of Mexico Red Snapper and are available to the public on the SEDAR website:

Red snapper discard mortality in Florida's recreational fisheries

- o <http://sedarweb.org/sedar-52-wp-09-red-snapper-discard-mortality-florida%E2%80%99s-recreational-fisheries>

A summary of data on the size distribution and release condition of red snapper discards from recreational surveys in the eastern Gulf of Mexico

- o <http://sedarweb.org/sedar-52-wp-19-summary-data-size-distribution-and-release-condition-red-snapper-discards>

Commercial harvest data (Task 1) for marine life as well as food and bait are available through FWC online at: <https://publictemp.myfwc.com/FWRI/PFDM/>. Queries can be used to generate a variety of landings reports. A screen capture of the query form is shown in Figure 4.1. Because of confidentiality concerns reports of bio-statistical data from TIP sampling efforts are limited to aggregate form in the annual reports to NOAA for the Cooperative Statistics Program (CSP) and the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA).

SAS Visual Analytics Dashboards

During 2017, a SAS Visual Analytics platform was used to help create visualizations of data from the At-Sea Discard (Task 4) and Florida Biological (Task 2) databases that can be accessed from state computers and mobile devices, via a web portal. The tool uses a virtual copy of the data sets, which is refreshed every 24 hours, allowing for access to the data once the device is securely connected to the internet. Reports and dashboards have been created to act as data scoping tools that aggregate and describe the data without the requirement of using memory intensive or license restricting analysis software (e.g. R, SAS, Microsoft Excel). The reports have been tailored to allow users to explore and visualize data without needing to use a programming language to manipulate the data. For example, the At-Sea Discard data was used to create a species snapshot that shows how samples are distributed by trip level characteristics such as: region, fishing mode, distance from shore, and fishing depth (Figure 4.2). Additionally, discard data is aggregated to provide raw estimates of hook-related trauma, barotrauma, and release condition. These visualizations have been used to determine the extent of available data prior to stock assessments or when considering collaborations between state employees. The tool has also helped the data management team to track and link individual biological samples to funding sources, sampling protocols, regions, fishing mode, and species (Figure 4.3). It has also been used to monitor the quantities of biological samples being collected in real time to ensure samplers are optimizing opportunities to collect biological samples in the field.

Gulf Reef Fish Survey Outreach

Field biologists that administer intercept interviews for the Gulf Reef Fish Survey (GRFS) continue to distribute literature to anglers who are unfamiliar with the survey or its requirements in the Gulf of Mexico (Task 2). The brochure describes the purpose of the survey, and how the data will be used to improve management of reef fish in the Gulf of Mexico (Figure 4.4). High quality illustrations of the major reef fish species monitored with the GRFS are displayed, with important characteristics for each species highlighted to aid anglers with identification. The second page of the brochure highlights other common reef fish species that are not monitored with the GRFS. In addition to the brochure, anglers are given a Gulf Reef Fish Survey participant sticker (Figure 4.5). The goal is to provide a visual reminder of the survey, and includes a web link to connect anglers to additional information about the survey (bit.ly/FWC-GulfReefFish).

References

Lazarre, D., B. Sauls, and R. Germeroth. 2017. A Summary of Data on the Size Distribution and Release Condition of Red Snapper Discards from Recreational Fishery Surveys in the Eastern Gulf of Mexico. SEDAR52-WP-19. SEDAR, North Charleston, SC. 17 pp.

VanderKooy, S. (ed.).2009. A practical handbook for determining the ages of Gulf of Mexico fishes. Gulf States Marine Fisheries Commission Publication Number 167.

5) Project Documents

Specific project documents are listed by task below.

Appendix 1.1. Overview of the NOAA Fisheries Trip Interview Program data entry.

Appendix 1.2. NMFS Trip Interview Program interviews, fish measured, and hard parts (otoliths and spines) collected for the determination of age by FDM commercial samplers during the NFWF award period. Hard parts are collected from bony fish but not invertebrates sampled from both coasts.

Appendix 1.3. A comparison by taxa sampled in 2017 based on the relative contribution from NFWF funded sampling effort at Gulf locations. Taxa are ranked by percentage of measurements from the Gulf Coast (NFWF funded) from the entire State (Gulf and Atlantic coasts), this includes invertebrates as well as vertebrates. GEBF contribution is shown in terms of estimated numbers expressed as a percentage of State totals.

Appendix 1.4. A summary of Trip Interview Program sampling for the Gulf Coast of Florida by FWC field lab locations (AP = Apalachicola, CK = Cedar Key, SP = Saint Petersburg, PN = Pensacola, KY = Florida Keys). Taxa are shown in order of decreasing abundance and are representative of the entire state with some species exclusive to either coast. AP, CK, CH, and SP are all completely or partially funded by NFWF.

Appendix 1.5. A comparison by taxa sampled based on the relative contribution from NFWF funded sampling effort at Gulf locations. Taxa are ranked by percentage of measurements from the Gulf Coast (NFWF funded) from the entire State (Gulf and Atlantic coasts), this includes invertebrates as well as vertebrates. GEBF contribution is shown in terms of estimated numbers expressed as a percentage of State totals.

Appendix 1.6. Estimation methods for private boat catch.

Appendix 1.7. Mail survey instrument for private boat effort.

Appendix 1.8. Numbers (N) of harvested and discarded fish observed during at-sea sampling from 2015 to 2017; and the mean, standard deviation (SD), minimum, and maximum fork length (in mm) by species.

Appendix 1.9. Numbers of discards by species and year observed during at-sea surveys.



Image 1.1. FWC biologist removes the age structure (otolith) from a golden tilefish (*Lopholatilus chamaeleonticeps*) harvested on a commercial fishing vessel.



Image 1.2. Harvested yellow edge grouper (*Epinephelus flavolimbatus*) landed by a commercial fishing vessel stored in large bucket before FWC biologist collects biological data from the catch.



Image 1.3. FWC biologist obtains a fork length measurement from a grouper harvested on a commercial fishing vessel.



Image 2.1. FWC biologist approaches anglers returning to the dock to initiate a Gulf Reef Fish Survey intercept interview.



Image 2.2. FWC biologist approaches harvested red snapper (*Lutjanus campechanus*) and gray snapper (*Lutjanus griseus*) at a boat ramp cleaning station, to begin collecting biometric data.



Image 2.3. FWC biologist measures and removes age structure from a red snapper (*Lutjanus campechanus*).

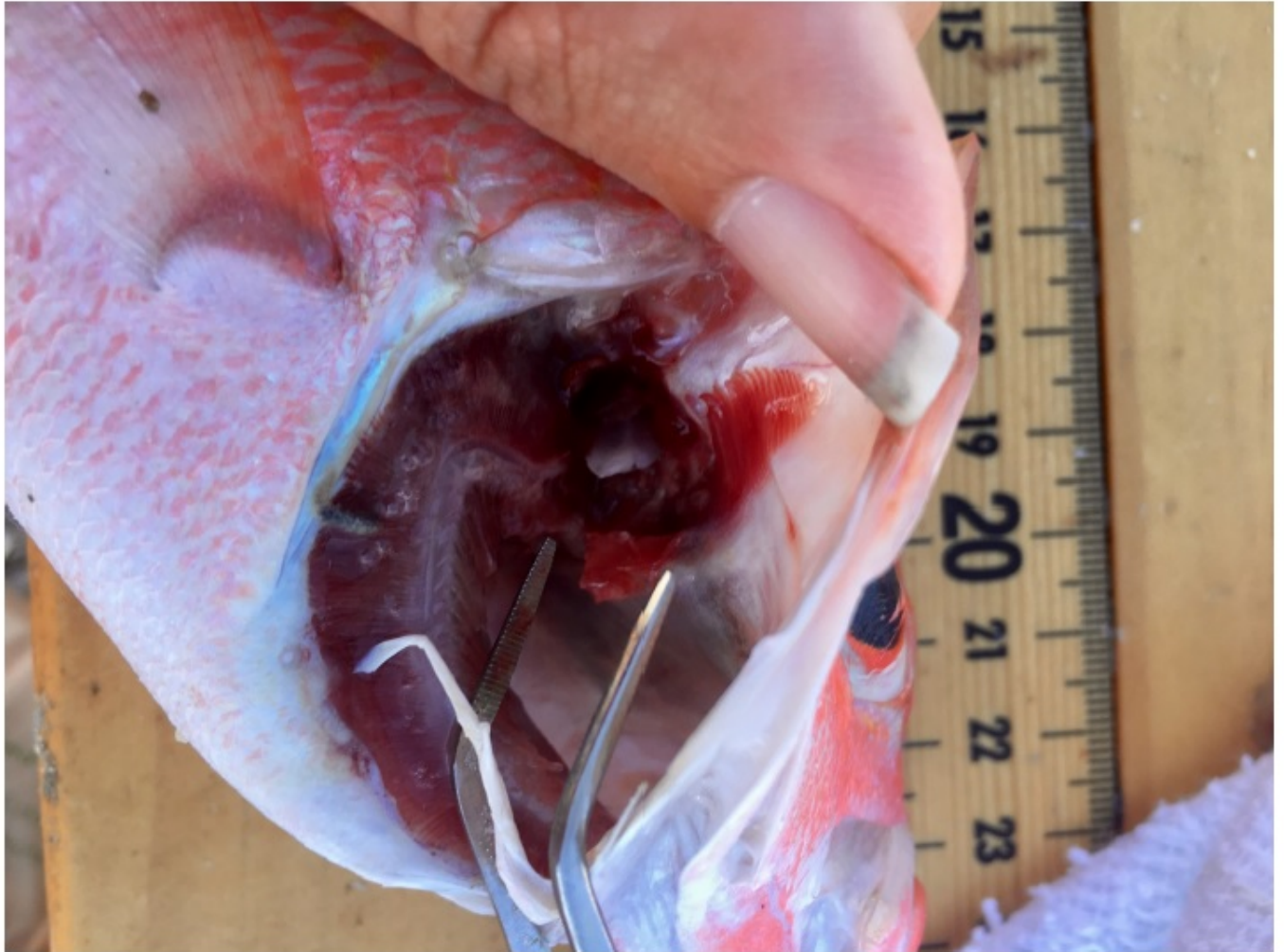


Image 2.4. Removal of age structure (i.e. otoliths) from a small red snapper (*Lutjanus campechanus*).

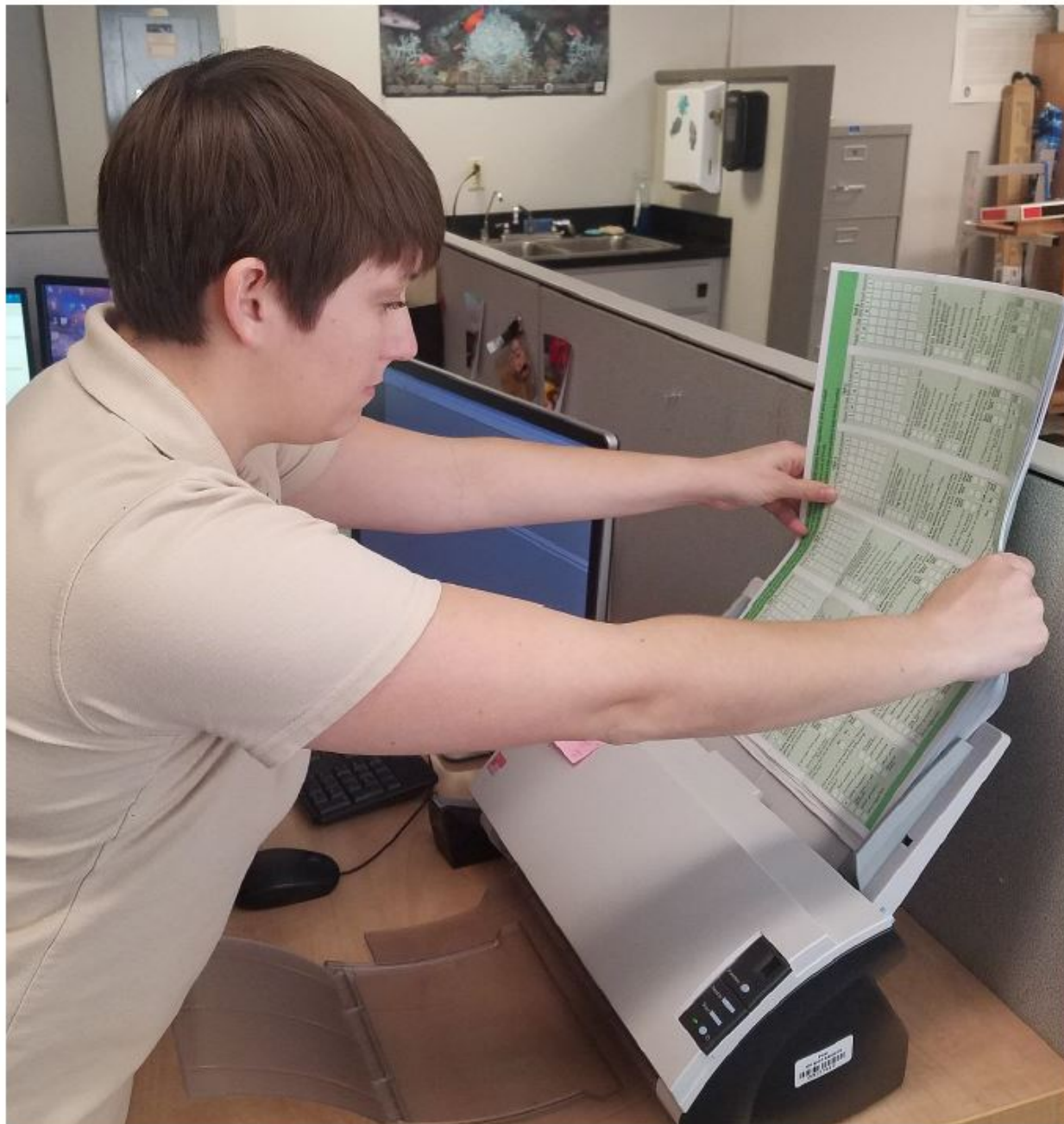


Image 3.1. FWC biologist digitally scans Gulf Reef Fish Survey responses received through the mail for upload to the database.



Image 4.1. FWC biologist tags and collects data from a red snapper (*Lutjanus campechanus*) caught out of season prior to release.



Image 4.2. FWC biologist releasing a gag grouper (*Mycteroperca microlepis*) at sea, after collecting biometric data and tagging the fish.



Image 4.3. FWC biologist verifies the release condition and biometric data for the last fish sampled.

Table 1.1.1. NMFS Trip Interview Program interviews, fish measured, and hard parts (otoliths and spines) collected for the determination of age by FDM commercial samplers during 2017. Hard parts are collected from bony fish but not invertebrates sampled from both coasts.

Region	TIP Interviews	%	Product Measured*	%	Hard Parts	%
Atlantic Coast	799	51.72%	18,378	40.24%	2,104	11.10%
Gulf Coast	746	48.28%	27,293	59.76%	16,846	88.90%
Statewide Total	1,545		45,671		18,950	

Table 1.1.2. A summary of sampling by location showing monthly totals for the numbers of measurements (Meas) and interviews (Ints). AP = Apalachicola, CK = Cedar Key, SP = Saint Petersburg, CH = Charlotte Harbor, PN = Pensacola, KY = Florida Keys. AP, CK, CH, and SP are all completely or partially funded by NFWF.

Month	Gulf Coast													
	AP		CK		SP		CH		PN		KY		Total	
	Meas	Ints	Meas	Ints	Meas	Ints	Meas	Ints	Meas	Ints	Meas	Ints	Meas	Ints
Jan	161	7	87	3	498	13	175	8	266	7	1,222	16	2,409	54
Feb	197	9	128	2	776	20	192	7	250	4	1,529	29	3,072	71
Mar	178	13	132	3	1,125	31	93	3	559	9	1,390	21	3,477	80
Apr	95	6	242	4	626	17	.	.	166	3	600	12	1,729	42
May	236	13	350	7	797	19	.	.	409	7	440	17	2,232	63
Jun	148	8	267	6	422	11	12	1	177	5	191	22	1,217	53
Jul	122	7	413	8	673	20	146	7	222	5	374	18	1,950	65
Aug	110	5	177	3	549	18	127	7	460	12	796	24	2,219	69
Sep	124	6	388	4	546	18	91	6	80	2	102	2	1,331	38
Oct	92	7	179	4	804	20	244	10	213	6	365	9	1,897	56
Nov	123	5	247	4	909	26	281	12	287	6	1,289	23	3,136	76
Dec	192	9	171	5	826	28	198	7	185	6	1,052	24	2,624	79
Total	1,778	95	2,781	53	8,551	241	1,559	68	3,274	72	9,350	217	27,293	746

Table 1.2.1. Numbers of APAIS and Gulf Reef Fish Survey (GRFS) assignments and boat level interviews collected. Wave 6 APAIS data for (November and December) for 2017 were not available for this report.

Year	Month	APAIS assignments-private boat mode	APAIS boat parties that targeted or caught reef fish	Supplemental GRFS assignments	GRFS boat parties that targeted or caught reef fish
2015	May	120	186	40	81
	Jun	130	227	50	123
	Jul	92	157	47	45
	Aug	96	173	69	80
	Sep	78	174	89	136
	Oct	81	152	87	79
	Nov	72	89	89	86
	Dec	65	56	86	66
	Total	1,005	271	557	696
2016	Jan	45	44	88	49
	Feb	70	27	87	50
	Mar	70	35	55	38
	Apr	86	96	67	112
	May	129	281	46	81
	Jun	118	285	73	172
	Jul	101	184	73	95
	Aug	93	87	74	82
	Sep	77	152	83	174
	Oct	83	114	86	99
	Nov	83	169	81	148
	Dec	65	85	70	74
	Total	1,020	402	883	1,174
2017	Jan	41	41	72	35
	Feb	54	63	119	126
	Mar	55	56	101	103
	Apr	64	66	96	94
	May	74	166	79	81
	Jun	74	268	82	258
	Jul	78	218	64	129
	Aug	67	137	74	128
	Sep	53	77	78	100
	Oct	63	60	101	45
	Nov	41	Not available	99	121
	Dec	54	Not available	105	149
	Total	718	250	1,070	1,369

Table 1.2.2. Numbers of harvested fish measured during supplemental GRFS intercepts.

Year	Month	Red snapper	Vermilion snapper	Gray triggerfish	Red grouper	Gag	Greater amberjack
2015	May	19	5	1	43	4	3
	Jun	105	9	1	34	3	3
	Jul	3	2	1	19	7	
	Aug		4		39	18	
	Sep	35	13		36	17	2
	Oct	11	7	1	8	7	1
	Nov				1	23	1
	Dec		1		3	2	
Total		173	41	4	183	81	10
2016	Jan		3	15	5		1
	Feb		1	10	10		2
	Mar		2	11	7		
	Apr		22	16	9	10	1
	May	65	5	5	11		1
	Jun	153	11		21	19	
	Jul	6	20		27	3	
	Aug		7		20	9	
	Sep	75	40		23	22	
	Oct	28	11		14	12	
	Nov	23	18	3	13	17	
	Dec		1	4	9	7	
Total		350	141	64	169	99	5
2017	Jan		3		2		
	Feb		35		17		7
	Mar		14	1	7		
	Apr		20		9		
	May	44	3		6	1	
	Jun	369	25	1	28	41	
	Jul	168	26		16	11	
	Aug	89	14	1	25	10	
	Sep	35	18	21	8	5	
	Oct		4			13	
	Nov		7	8	12	28	
	Dec		2	3	9	22	
Total		705	171	35	139	131	7

Table 1.2.3. Numbers of harvested fish sampled for age structures during supplemental GRFS intercepts.

Year	Month	Red Snapper	Vermilion Snapper	Gray Triggerfish	Red Grouper	Gag	Greater Amberjack
2015	May	16	1		13	2	3
	Jun	40	3				
	Jul				3	4	
	Aug		2		14	10	
	Sep	11	5		6	13	2
	Oct	11	3	1	6	5	
	Nov					9	
	Dec		1		3	1	
	Total	78	15	1	45	44	5
2016	Jan						
	Feb		1	7			
	Mar			2	2		
	Apr		16	7		9	1
	May	49	4	3	7		
	Jun	147	11		9	15	
	Jul	6	18		10	3	
	Aug		7		1	2	
	Sep	74	16		9	13	
	Oct	26	9		14	8	
	Nov	11	18	3	4	6	
	Dec		1	3	8	4	
	Total	313	101	25	64	60	1
2017	Jan		3		2		
	Feb		10		4		2
	Mar		14	1	4		
	Apr		10		3		
	May	40	2		3		
	Jun	357	14	1	11	26	
	Jul	166	12		16	11	
	Aug	88	14	1	16	8	
	Sep	35	14	16	6	4	
	Oct					10	
	Nov		7	8	12	25	
	Dec			3	3	17	
	Total	686	100	30	80	101	2

Table 1.3.1. Mail survey strata, defined by residence of GRFS registrants.

Stratum	Region	Sub-region	Boat registration
110	NW (FL panhandle)	Coastal	No
111	NW (FL panhandle)	Coastal	Yes
200	BB (FL Big Bend)	Non-coastal	No
201	BB (FL Big Bend)	Non-coastal	Yes
210	BB (FL Big Bend)	Coastal	No
211	SW (FL peninsula)	Coastal	Yes
300	SW (FL peninsula)	Non-coastal	No
301	SW (FL peninsula)	Non-coastal	Yes
310	SW (FL peninsula)	Coastal	No
311	SW (FL peninsula)	Coastal	Yes
400	KY (Keys and SE FL)	Non-coastal	No
401	KY (Keys and SE FL)	Non-coastal	Yes
500	AL/GA (nearby states)	Non-coastal	na
600	Other states	Non-coastal	na

Table 1.4.1. Description of live release condition categories for reef fishes observed during recreational hook-and-line fishing (modified from Sauls 2014).

Condition category	Description
Unvented (not impaired and not vented)	Fish immediately submerged without the assistance of venting, and did not exhibit any impairments
Vented (not impaired and vented)	Fish immediately submerged after the swim bladder was vented, and did not exhibit any impairments
Impaired	Any fish that exhibited one or more of the following impairments: 1) chased by a predator near the surface 2) disoriented or unresponsive at the surface before submerging 3) buoyant at the surface and unable to submerge 4) improperly vented by puncturing the stomach or anus 5) hook embedded in gill, eye, esophagus, or gut 6) released with hook still embedded 7) bleeding from the gills 8) exophthalmia, indicative of severe barotrauma

Table 1.4.2. At-sea sampling trips by year and trip type. Regions are the Northwest (NW), Big Bend (BB), Tampa Bay (TB), Southwest (SW), and the Florida Keys (KY). Note: n indicates the number of trips sampled by vessel type for all 3 years.

Vessel Type	Region	2015	2016	2017	Region Totals
Charter n=786	NW	111	126	93	330
	BB	7	13	8	28
	TB	57	72	56	185
	SW	28	36	52	116
	KY	0	58	69	127
Headboat n=727	NW	105	103	86	294
	BB	0	0	0	0
	TB	66	92	97	255
	SW	13	31	26	70
	KY	2	50	56	108
Multi Day n=15	TB	2	2	3	7
	SW	0	3	4	7
	KY	0	1	0	1
Sub Total		391	587	550	1528

Table 1.4.3. Numbers of harvested fish measured for regulated species by year.

Common Name	Scientific name	2015	2016	2017	Totals
Red grouper	<i>Epinephelus morio</i>	1,904	2,903	3,365	8,172
Gray triggerfish	<i>Balistes capriscus</i>	1,714	2,573	1,927	6,214
Red snapper	<i>Lutjanus campechanus</i>	1,110	2,257	2,090	5,457
Yellowtail snapper	<i>Ocyurus chrysurus</i>	67	1,181	942	2,190
Vermilion snapper	<i>Rhomboplites aurorubens</i>	452	759	446	1,657
Gag	<i>Mycteroperca microlepis</i>	259	662	627	1,548
Greater amberjack	<i>Seriola dumerili</i>	357	439	291	1,087
Black sea bass	<i>Centropristis striata</i>	251	488	281	1,020
Gray snapper	<i>Lutjanus griseus</i>	63	157	329	549
Scamp	<i>Mycteroperca phenax</i>	82	114	93	289
Mutton snapper	<i>Lutjanus analis</i>	18	88	174	280
King mackerel	<i>Scomberomorus cavalla</i>	4	44	71	119
Black grouper	<i>Mycteroperca bonaci</i>	0	8	27	35
Sub Totals by Year		6,281	11,673	10,663	28,617

Table 1.4.4. Numbers of discarded fish for regulated species by year.

Common name	2015	2016	2017	Totals
Red grouper	1,904	2,903	3,365	8,172
Gray triggerfish	1,714	2,573	1,927	6,214
Red snapper	1,110	2,257	2,090	5,457
Yellowtail snapper	67	1,181	942	2,190
Vermilion snapper	452	759	446	1,657
Gag	259	662	627	1,548
Greater amberjack	357	439	291	1,087
Black sea bass	251	488	281	1,020
Gray snapper	63	157	329	549
Scamp	82	114	93	289
Mutton snapper	18	88	174	280
King mackerel	4	44	71	119
Black grouper	0	8	27	35
Totals by Year	6,281	11,673	10,663	28,617

Table 1.4.5. Numbers of otoliths by year and species.

Common name	2015	2016	2017	Total
Vermilion snapper	869	914	696	2,479
White grunt	125	962	627	1,714
Red snapper	717	326	506	1,549
Yellowtail snapper	5	777	501	1,283
Gray snapper	142	499	422	1,063
Red grouper	235	307	201	743
King mackerel	87	214	112	413
Gag	47	95	145	287
Black sea bass	9	58	85	152
Greater amberjack	36	24	17	77
Black grouper	3	4	27	34
Mutton snapper	1	3	3	7
Totals	2,276	4,183	3,342	9,801

Table 1.4.6. Numbers of additional biological samples collected since 2015 by region.

Region	Weights	Histology	Genetics	Spine	Totals
NW	4,188	3,896	98	225	8,407
BB	141	78	1	0	220
TB	2,120	2,768	8	2	4,898
SW	1,294	963	93	1	2,351
KY	1,505	1,688	126	5	3,324
Total	9,248	9,393	326	233	19,200

Table 1.4.7. Numbers of fish tagged by year, cumulative number recaptured, and percent recaptured.

Common name	2015	2016	2017	Total Tagged	Total Recaptured	% Recaptured
Red grouper	1,587	2,838	3,229	7,654	623	8.14
Gray triggerfish	1,670	2,383	1,719	5,772	520	9.01
Red snapper	1,025	2,136	1,368	4,529	305	6.73
Yellowtail snapper	20	1,019	861	1,900	39	2.05
Gag	255	653	619	1,527	67	4.39
Gray snapper	46	131	282	459	6	1.31
Vermilion snapper	124	177	85	386	3	0.78
Scamp	80	111	87	278	7	2.52
Mutton snapper	10	86	170	266	8	3.01
Black grouper	0	8	27	35	1	2.86
Annual totals	4,817	9,542	8,447	22,806	1,579	6.92

Table 1.4.8. Numbers of Red Snapper tagged in each release condition category, the percentage (and numbers) reported as recaptured at least once; mean size and capture depth of tagged fish; and numbers of trips that fish were tagged from.

	Northwest Florida Panhandle	West Florida Peninsula
Numbers of fish tagged:		
Condition 1	9,743	732
Condition 2	14,131	1,522
Condition 3	3,196	584
Percent of fish recaptured:		
Condition 1 (number)	13.5 (1,316)	9.0 (66)
Condition 2 (number)	11.1 (1,571)	6.4 (97)
Condition 3 (number)	6.9 (219)	4.3 (26)
Mean length (mm TL)	459.23 ± 102.72	479.62 ± 116.86
Mean capture depth (m)	32 ± 7	39 ± 12
Number of trips:		
Single-day charter	486	60
Single-day headboat	387	44
Multi-day headboat	-	54
Directed research	135	28

Table 1.5.1. Total number of responses received through the online Red Snapper Catch Card webpage by region, 2015-2017.

Region	2015	2016	2017
1 - Panhandle	41	16	32
2 - Big Bend	2	19	5
3 - West Central	9	8	3
4 - Southwest	3	0	0
5 - Southeast	0	0	0
6 - East Central	0	1	3
7 - Northeast	4	4	5
8 - Florida Keys	0	3	0
Totals	59	51	48

Table 1.5.2. Mean and mean minimum and maximum depth (in feet) fished by volunteer angler participants during red snapper open and closed seasons.

SEASON	YEAR	N	Depth (ft)		Distance From Shore (mi)	
			<i>Mean</i>	<i>Range</i>	<i>Mean</i>	<i>Range</i>
Closed	2015	2	16.2	11-21	7.0	6-8
	2016	17	18.9	0-32	20.1	6-47
	2017	7	21.6	9-37	14.6	2-52
Open	2015	48	27.4	6-55	19.1	0-100
	2016	28	32.6	18-61	21.3	3-52
	2017	23	25.3	14-46	15.6	1-61

Table 1.5.3. Number of harvested red snapper reported through the online Red Snapper Catch Card webpage by region, 2015-2017.

Region	2015	2016	2017
1 - Panhandle	195	56	135
2 - Big Bend	6	80	19
3 - West Central	67	21	10
4 - Southwest	17	0	0
5 - Southeast	0	0	0
6 - East Central	0	0	0
7 - Northeast	0	0	0
8 - Florida Keys	0	0	0
Totals	285	157	164

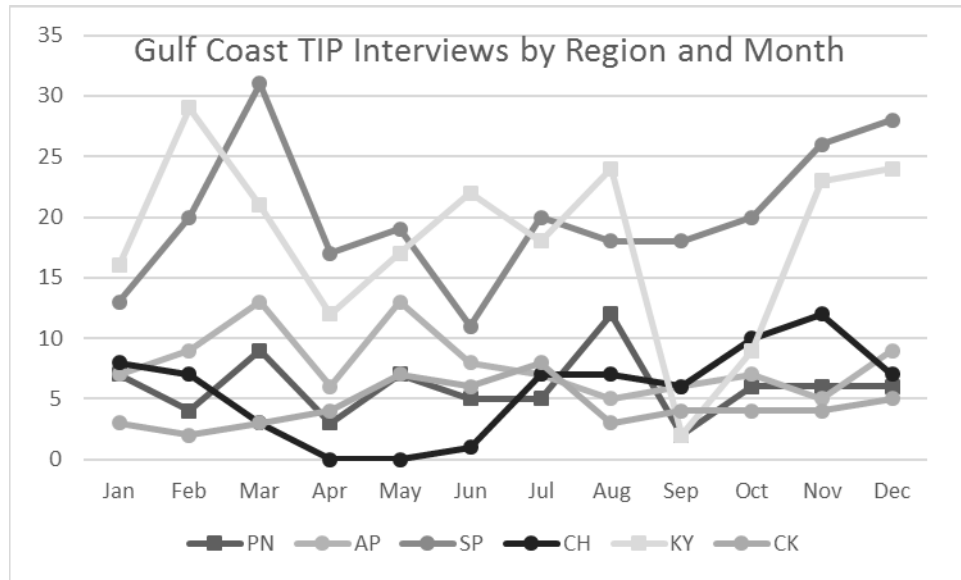


Figure 1.1.1. Monthly totals of NMFS TIP interviews by West coast locations. PN = Pensacola, AP = Apalachicola, SP = Saint Petersburg, CH = Charlotte Harbor, KY = Florida Keys, CK = Cedar Key. Circle markers indicate NFWF funded positions.

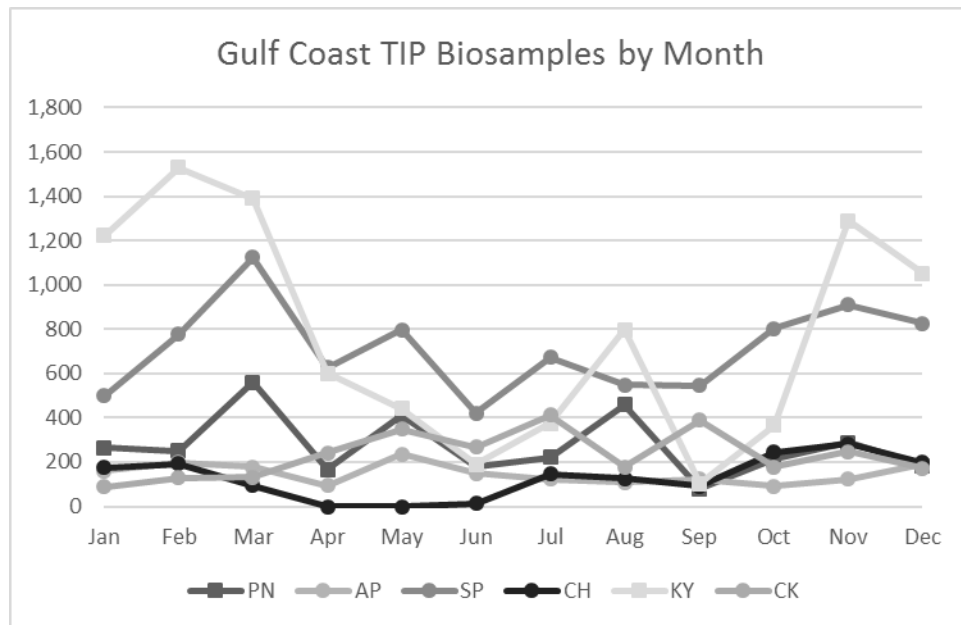


Figure 1.1.2. Monthly totals of commercial biosamples for West coast locations. PN = Pensacola, AP = Apalachicola, SP = Saint Petersburg, CH = Charlotte Harbor, KY = Florida Keys, CK = Cedar Key. Circle markers indicate NFWF funded positions.

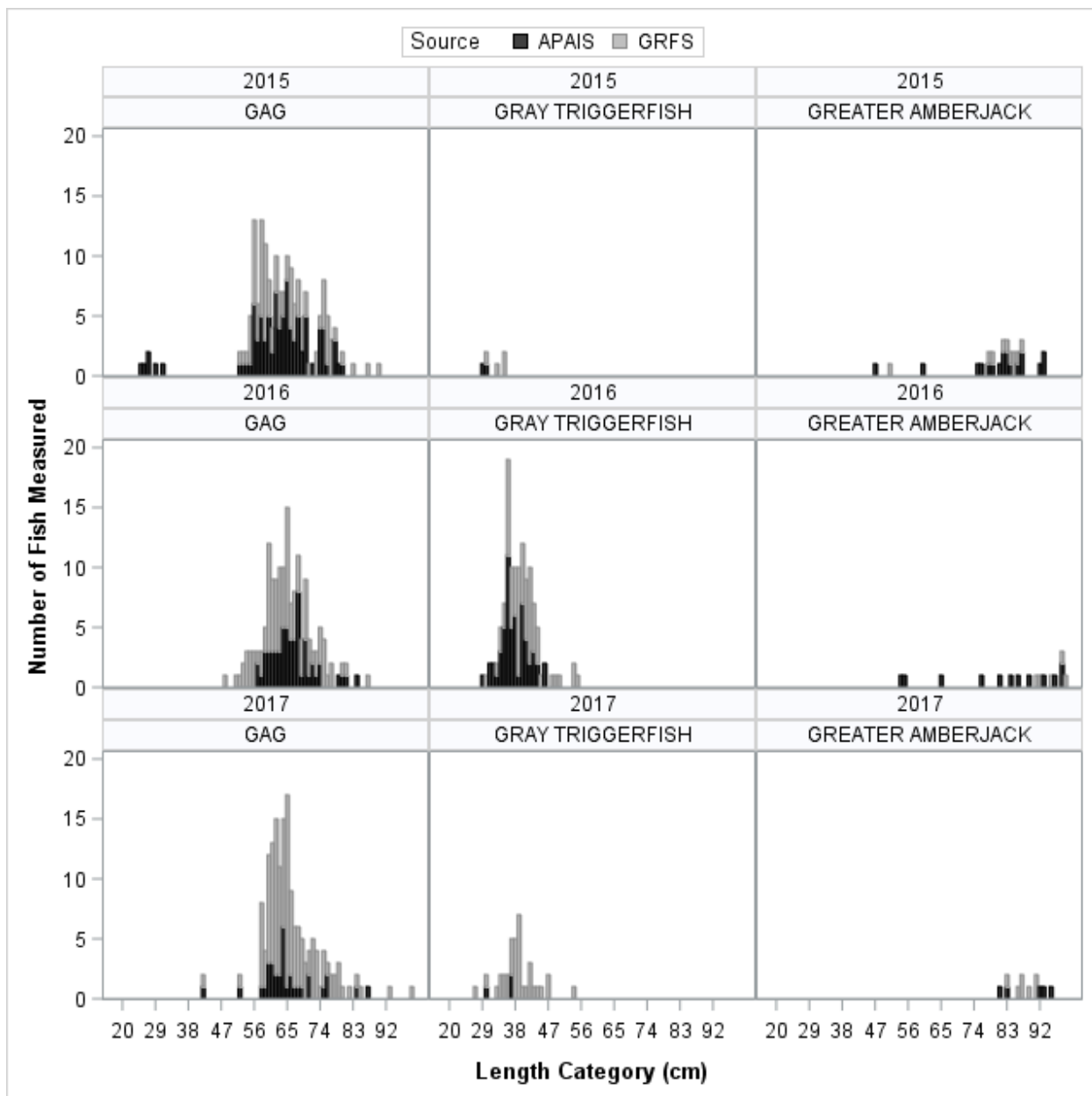


Figure 1.2.1. Length frequencies histograms, by year, for gag grouper, gray triggerfish, and greater amberjack measured during APAIS intercepts (black bars) and supplemental intercepts through this task (gray bars).

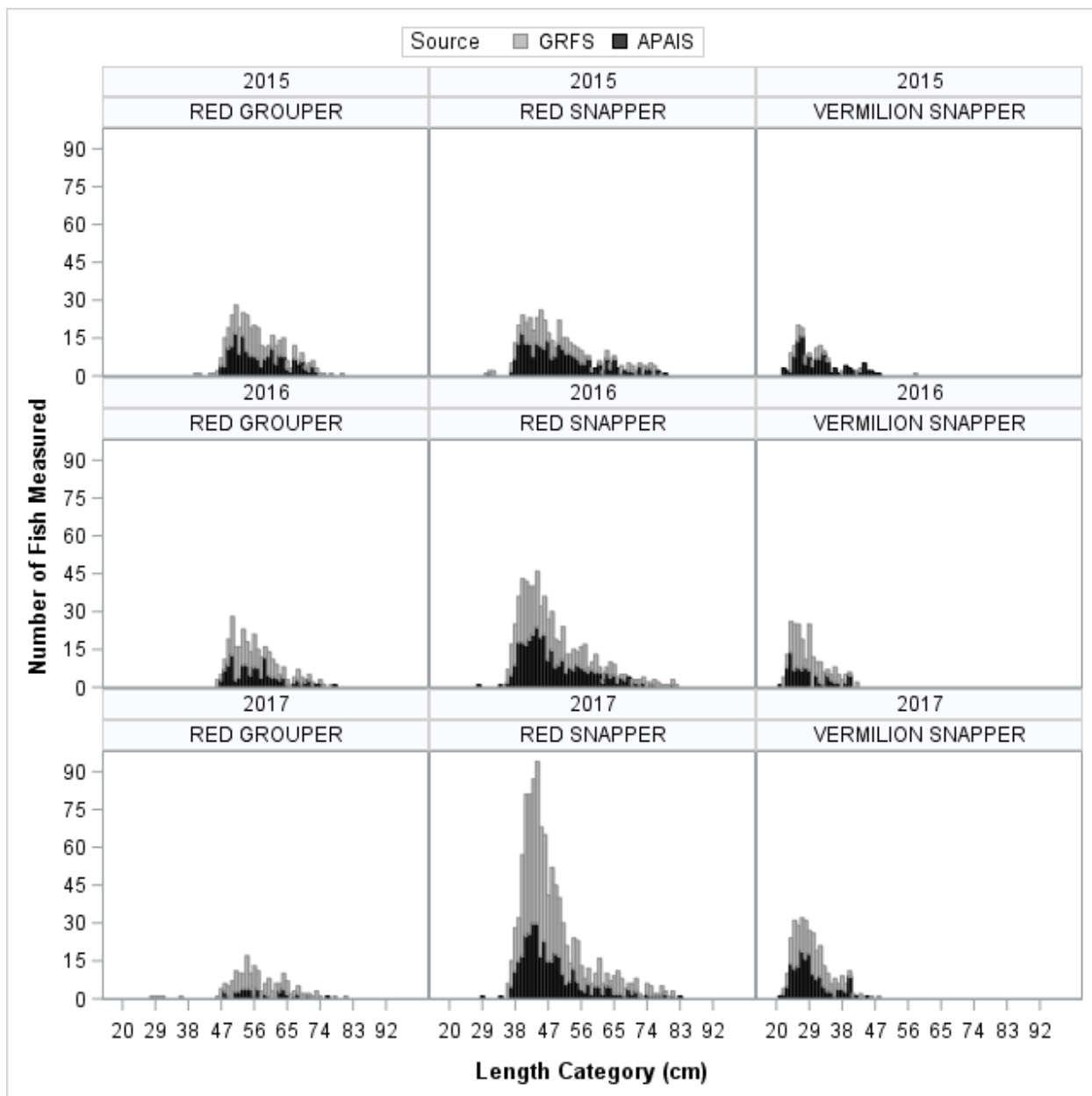


Figure 1.2.2. Length frequency histograms, by year, for red grouper, red snapper, and vermilion snapper measured during APAIS intercepts (black bars) and supplemental intercepts through this task (gray bars).

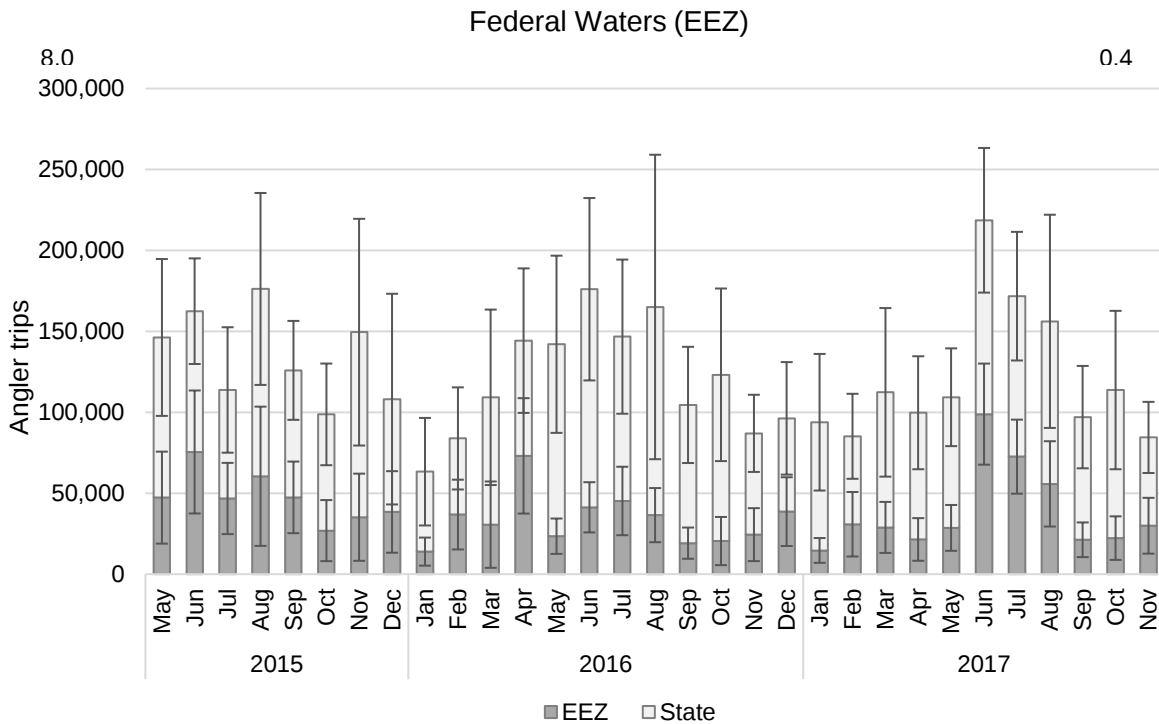


Figure 1.2.4. Estimated private boat effort (from Task 3) in federal (EEZ) and state waters after adjusting for under-coverage measured in the private boat intercept survey (Task 2).

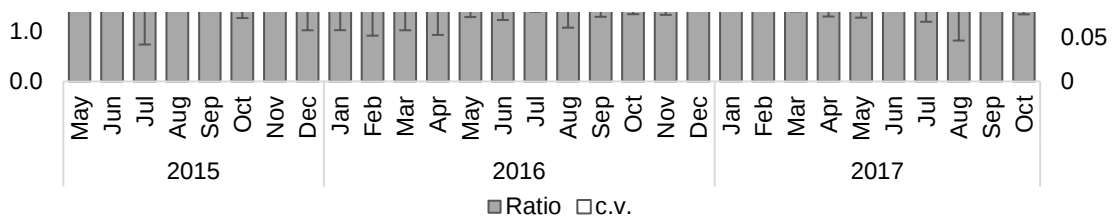


Figure 1.2.3. Ratio of total reef fish anglers intercepted (during supplemental GRFS assignments) versus anglers registered for the Gulf Reef Fish Survey by month in the federal Exclusive Economic Zone (EEZ; top graph) and state waters (bottom) with 95% confidence intervals and coefficient of variation (c.v.). This ratio is applied to unadjusted estimates of private boat effort in federal waters to account for under-coverage in the mail survey, described in Task 3.

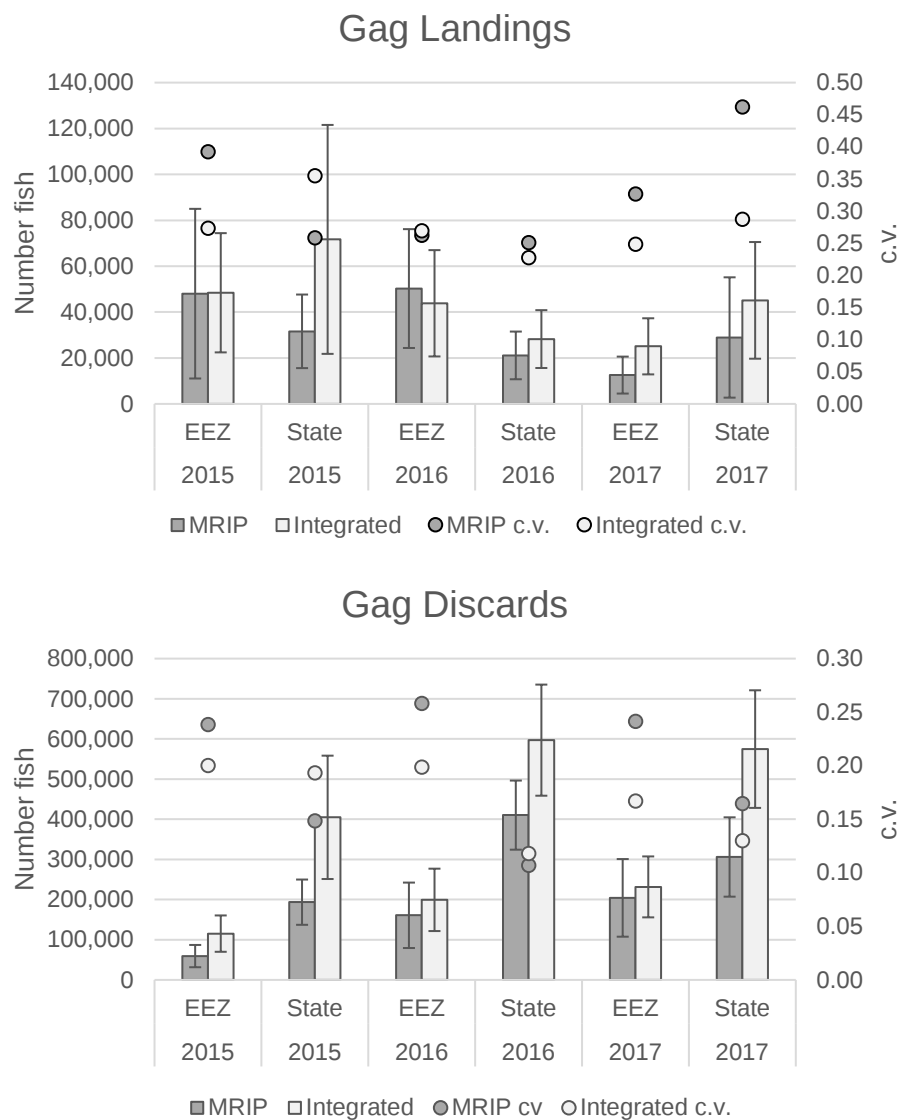


Figure 1.2.5. Estimated Gag landings (top) and discards (bottom), in numbers of fish, in federal (EEZ) and state waters calculated using: 1) MRIP effort and APAIS catch data (dark gray bars), and 2) Gulf Reef Fish Survey effort and integrated GRFS and APAIS catch data (light gray bars). Also shown are 95% confidence intervals and coefficient of variation (c.v.).

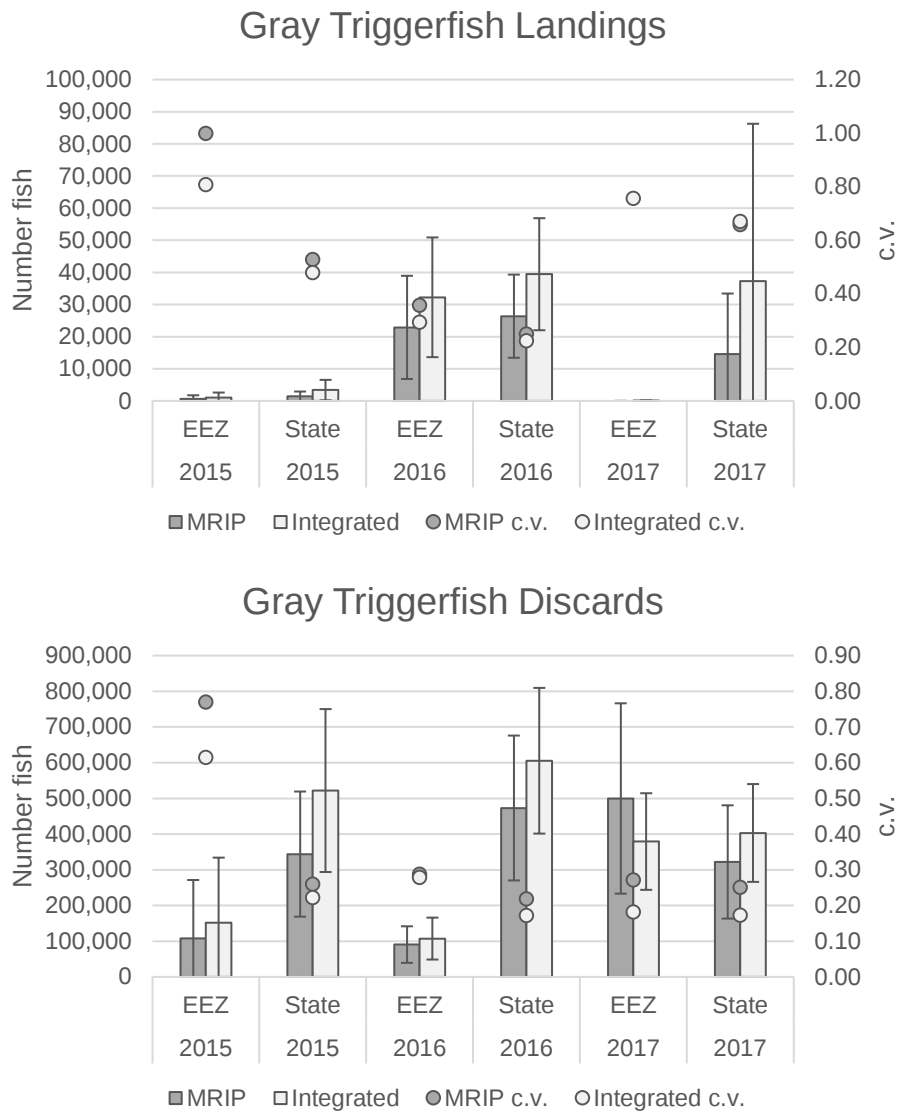


Figure 1.2.6. Estimated Gray Triggerfish landings (top) and discards (bottom), in numbers of fish, in federal (EEZ) and state waters calculated using: 1) MRIP effort and APAIS catch data (dark gray bars), and 2) Gulf Reef Fish Survey effort and integrated GRFS and APAIS catch data (light gray bars). Also shown are 95% confidence intervals and coefficient of variation (c.v.).

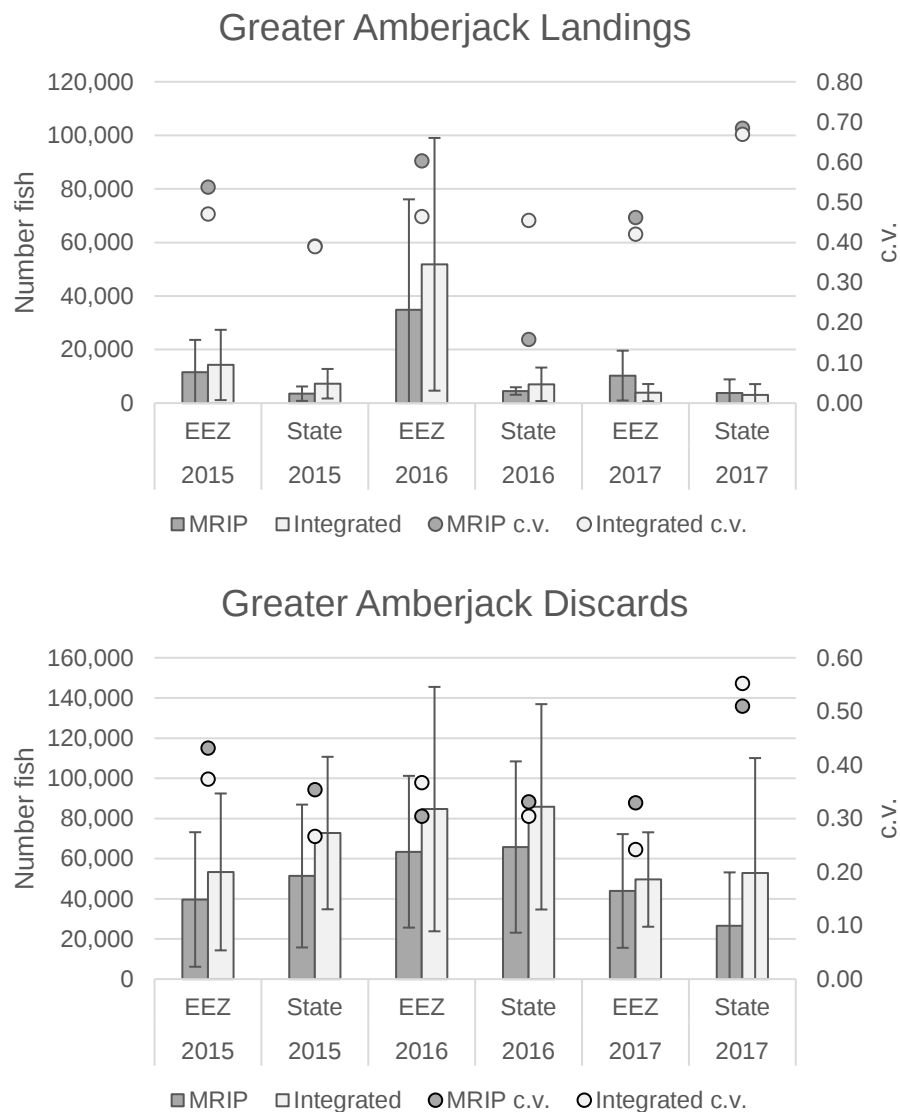


Figure 1.2.7. Estimated Greater Amberjack landings (top) and discards (bottom), in numbers of fish, in federal (EEZ) and state waters calculated using: 1) MRIP effort and APAIS catch data (dark gray bars), and 2) Gulf Reef Fish Survey effort and integrated GRFS and APAIS catch data (light gray bars). Also shown are 95% confidence intervals and coefficient of variation (c.v.).

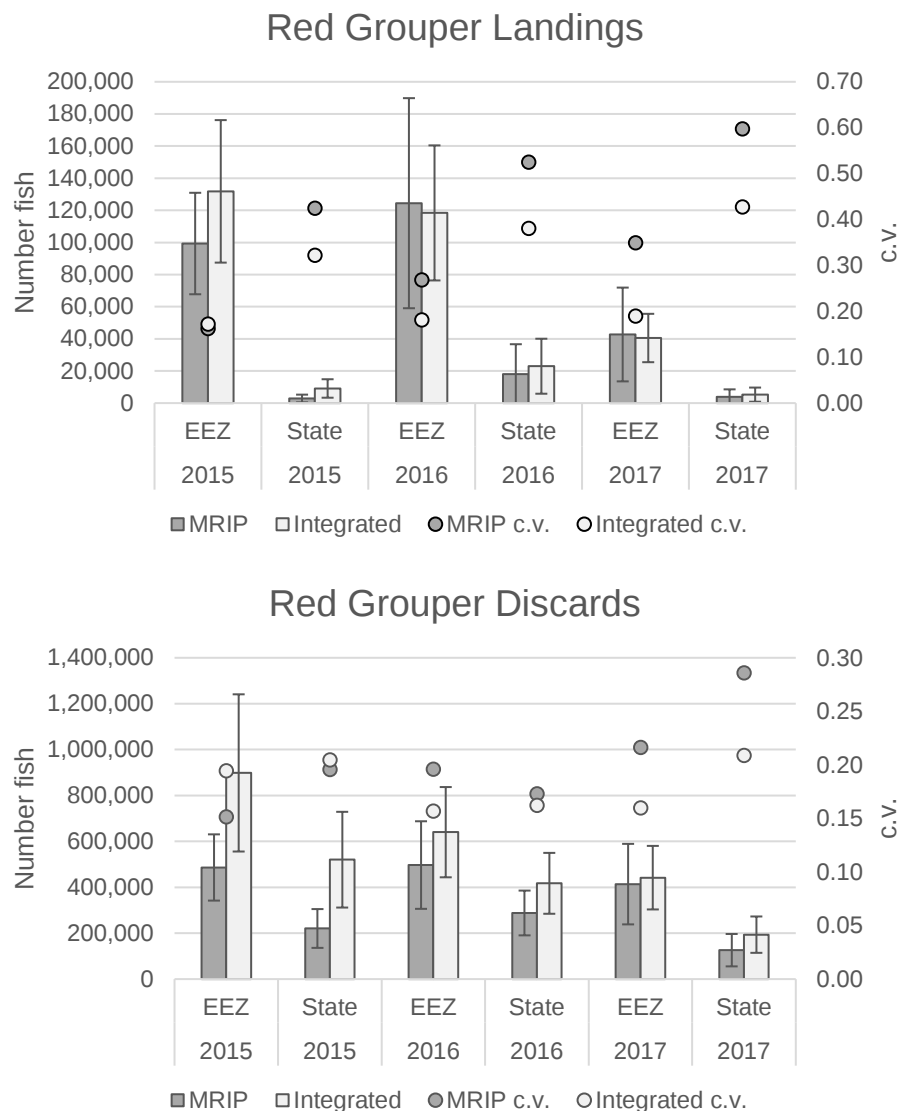


Figure 1.2.8. Estimated Red Grouper landings (top) and discards (bottom), in numbers of fish, in federal (EEZ) and state waters calculated using: 1) MRIP effort and APAIS catch data (dark gray bars), and 2) Gulf Reef Fish Survey effort and integrated GRFS and APAIS catch data (light gray bars). Also shown are 95% confidence intervals and coefficient of variation (c.v.).

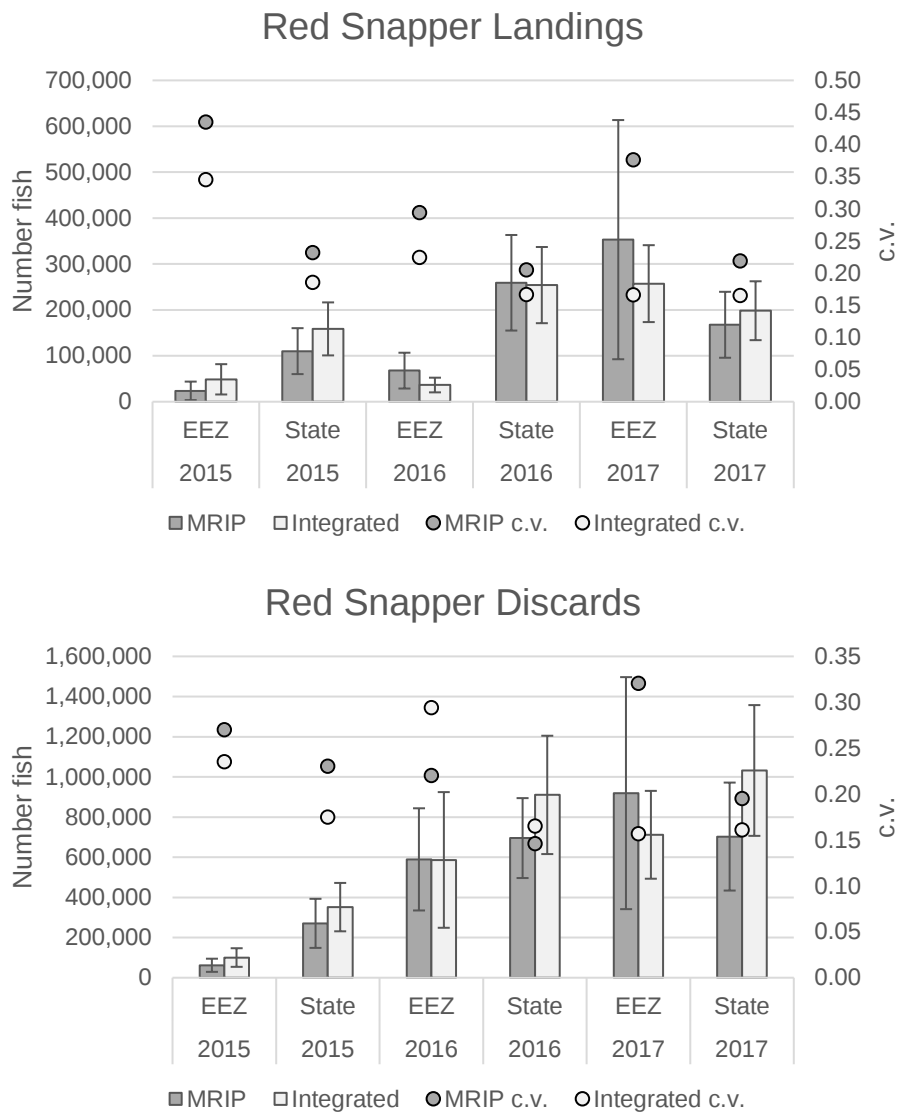


Figure 1.2.9. Estimated Red Snapper landings (top) and discards (bottom), in numbers of fish, in federal (EEZ) and state waters calculated using: 1) MRIP effort and APAIS catch data (dark gray bars), and 2) Gulf Reef Fish Survey effort and integrated GRFS and APAIS catch data (light gray bars). Also shown are 95% confidence intervals and coefficient of variation (c.v.).

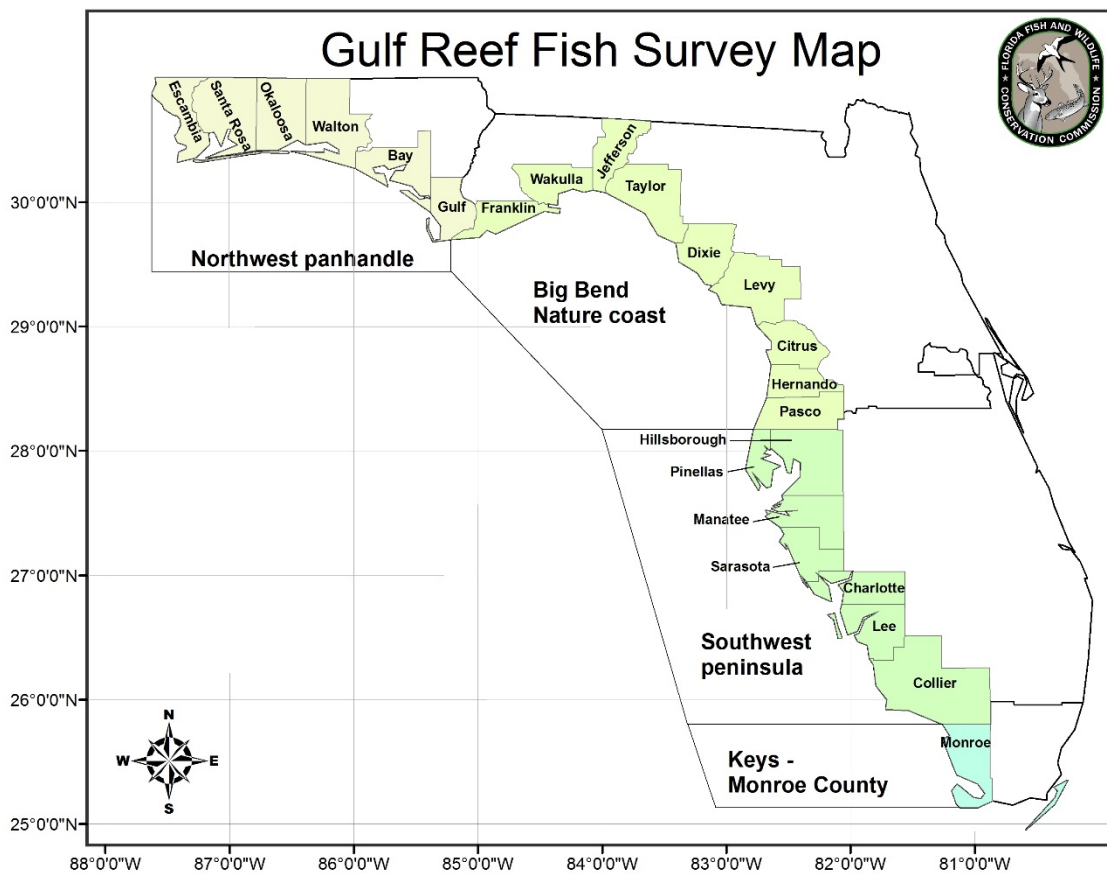


Figure 1.3.1. Map provided to survey recipients to assist in determining the region from which their boat departed.

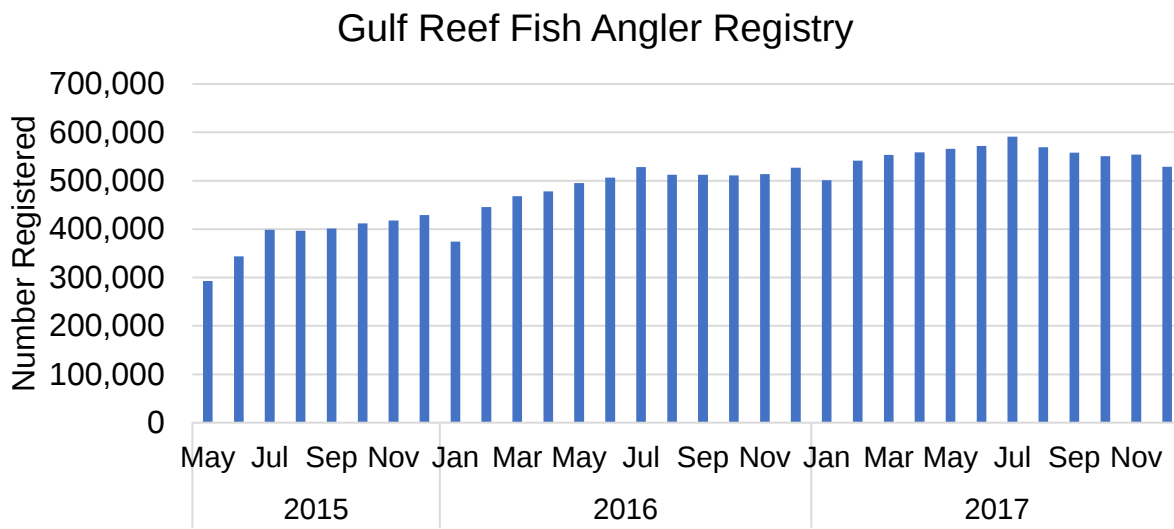


Figure 1.3.2. Total numbers of individuals registered for the Gulf Reef Fish Survey.

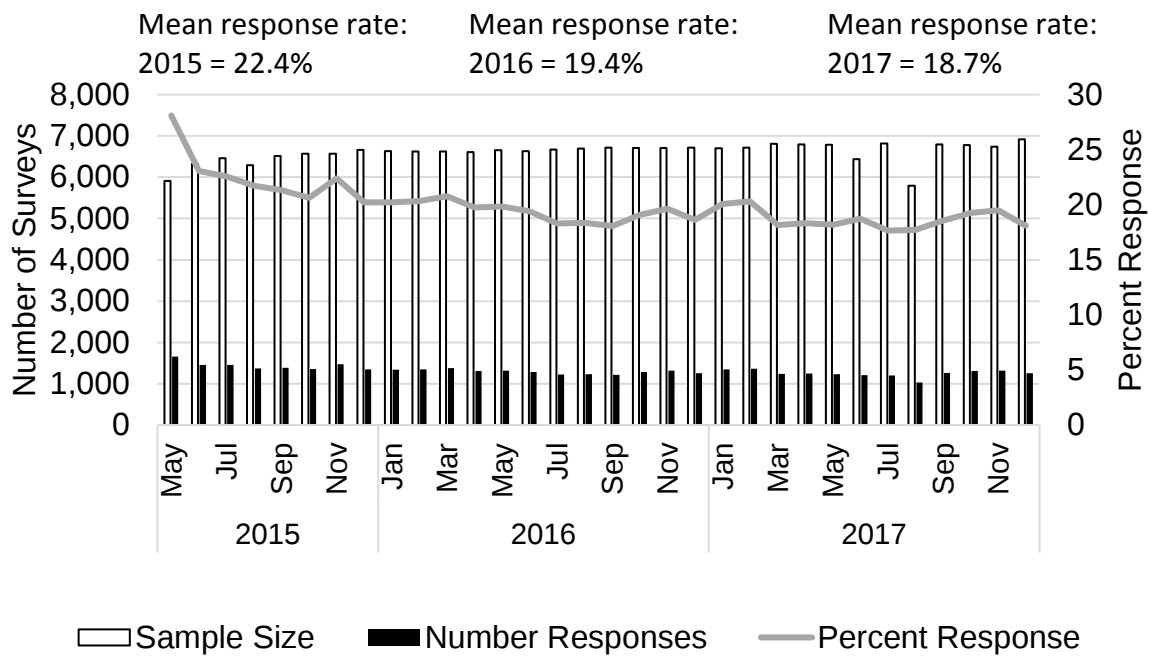


Figure 1.3.3. Gulf Reef Fish Survey sample sizes, numbers of responses, and response rates by survey month and survey year.

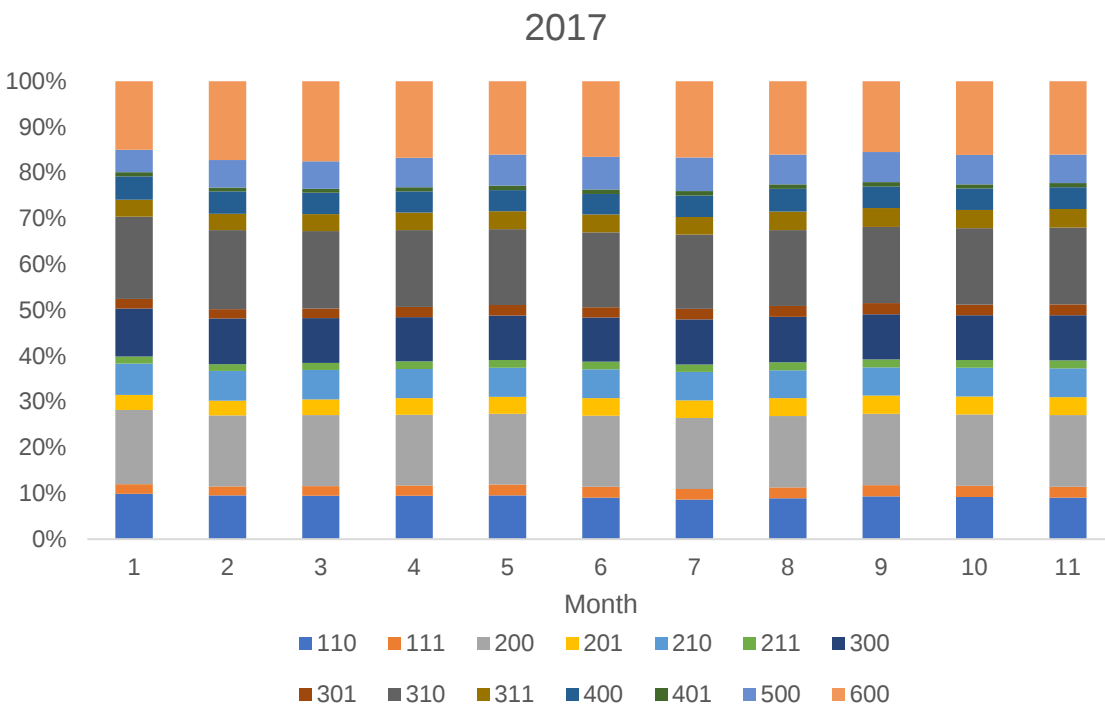


Figure 1.3.4. Percent of Gulf Reef Fish Survey subscribers by strata. See table 1.3.1 for description of strata.

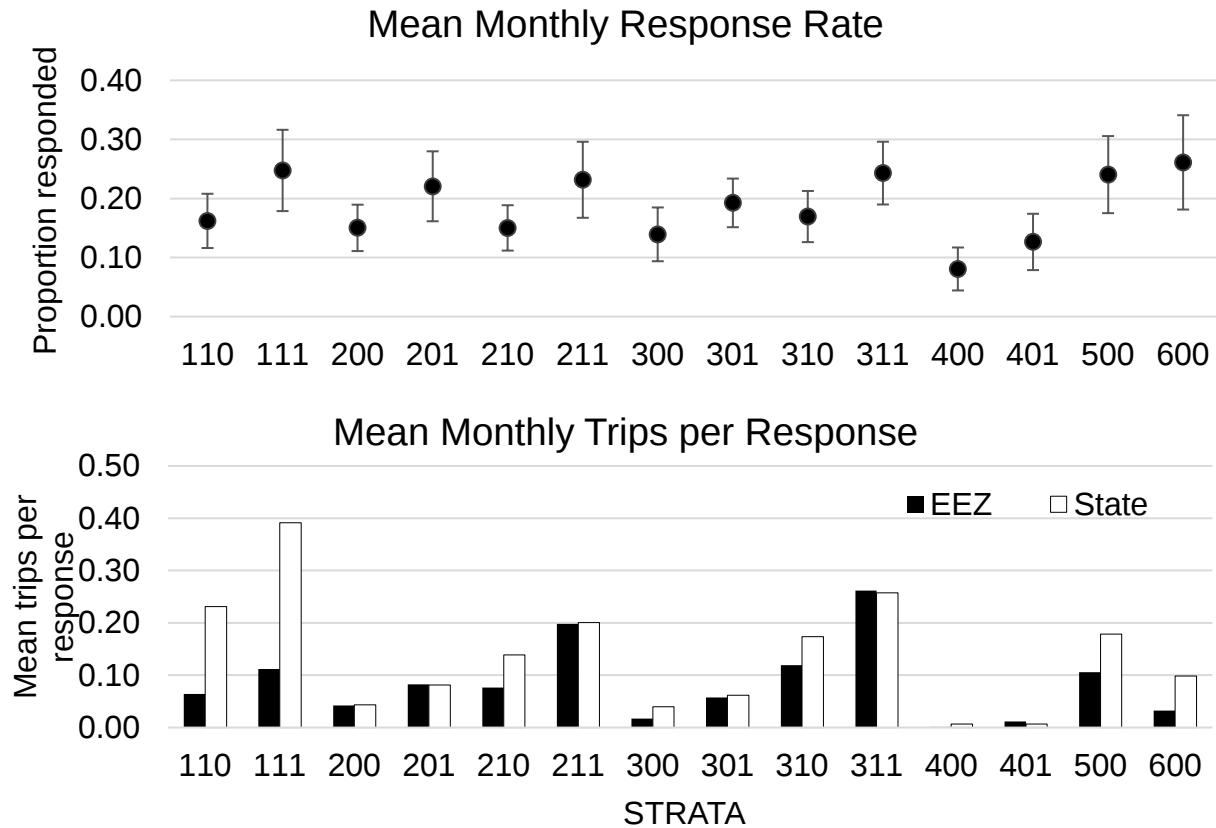


Figure 1.3.5. Mean monthly response rates (top) and mean trips per response (bottom) across strata. See table 1.3.1 for description of strata.

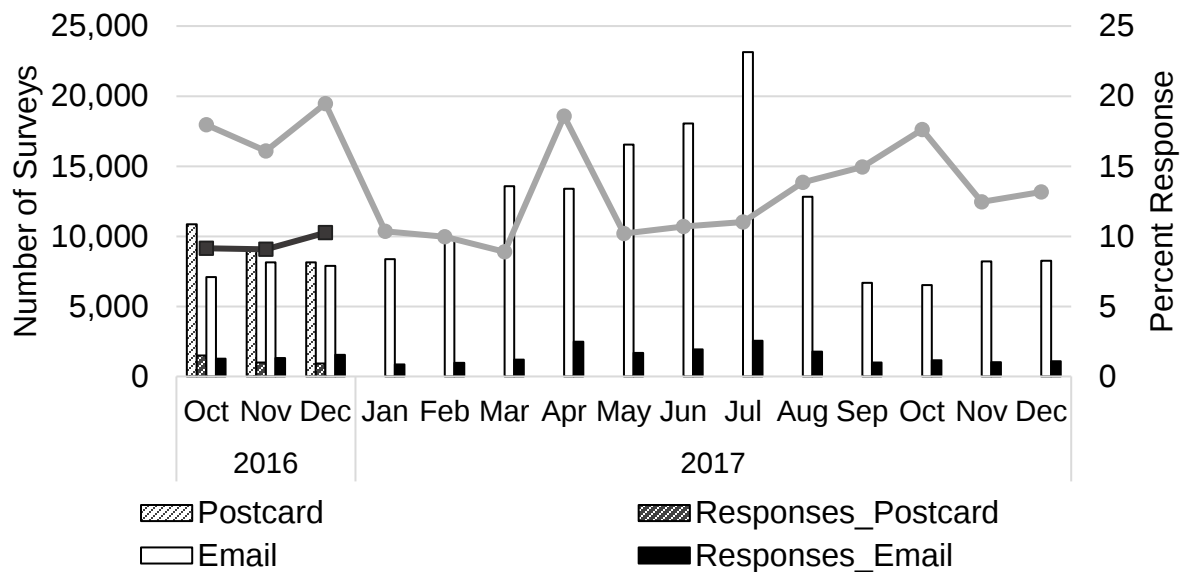


Figure 1.3.6. Total numbers of avidity surveys sent and received for anglers newly subscribed or renewed to the Gulf Reef Fish Survey, numbers of responses, and response rates by survey month and survey year.

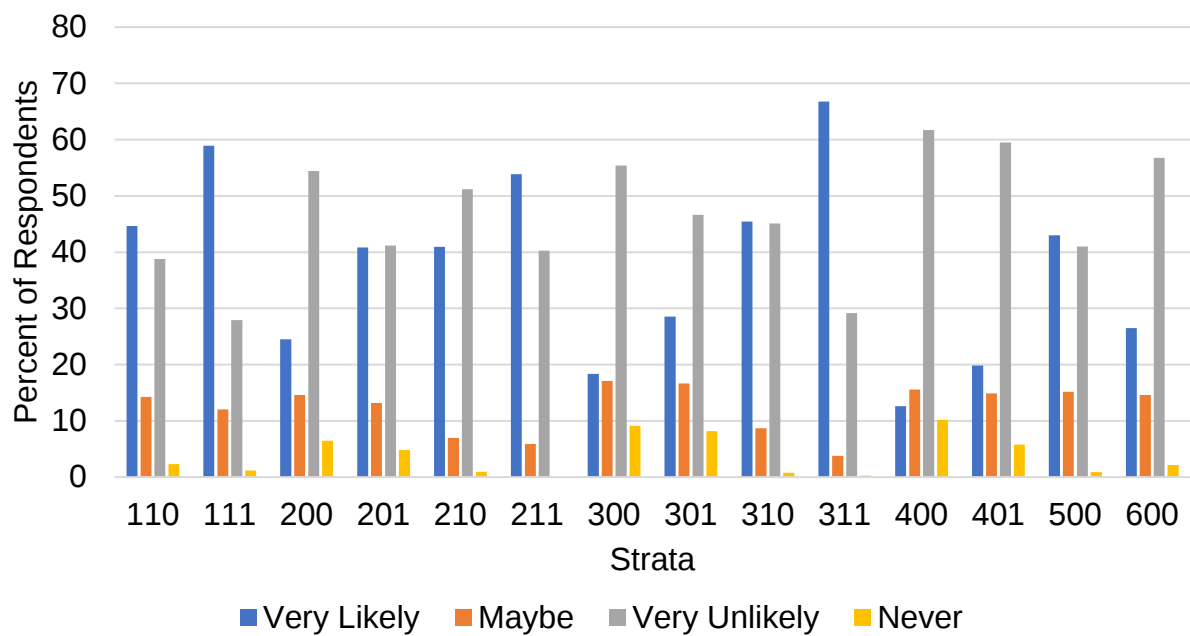


Figure 1.3.7. Likelihood of respondents to the avidity survey to participate in the Gulf Reef Fish fishery reported here as a percentage of respondents in a stratum.

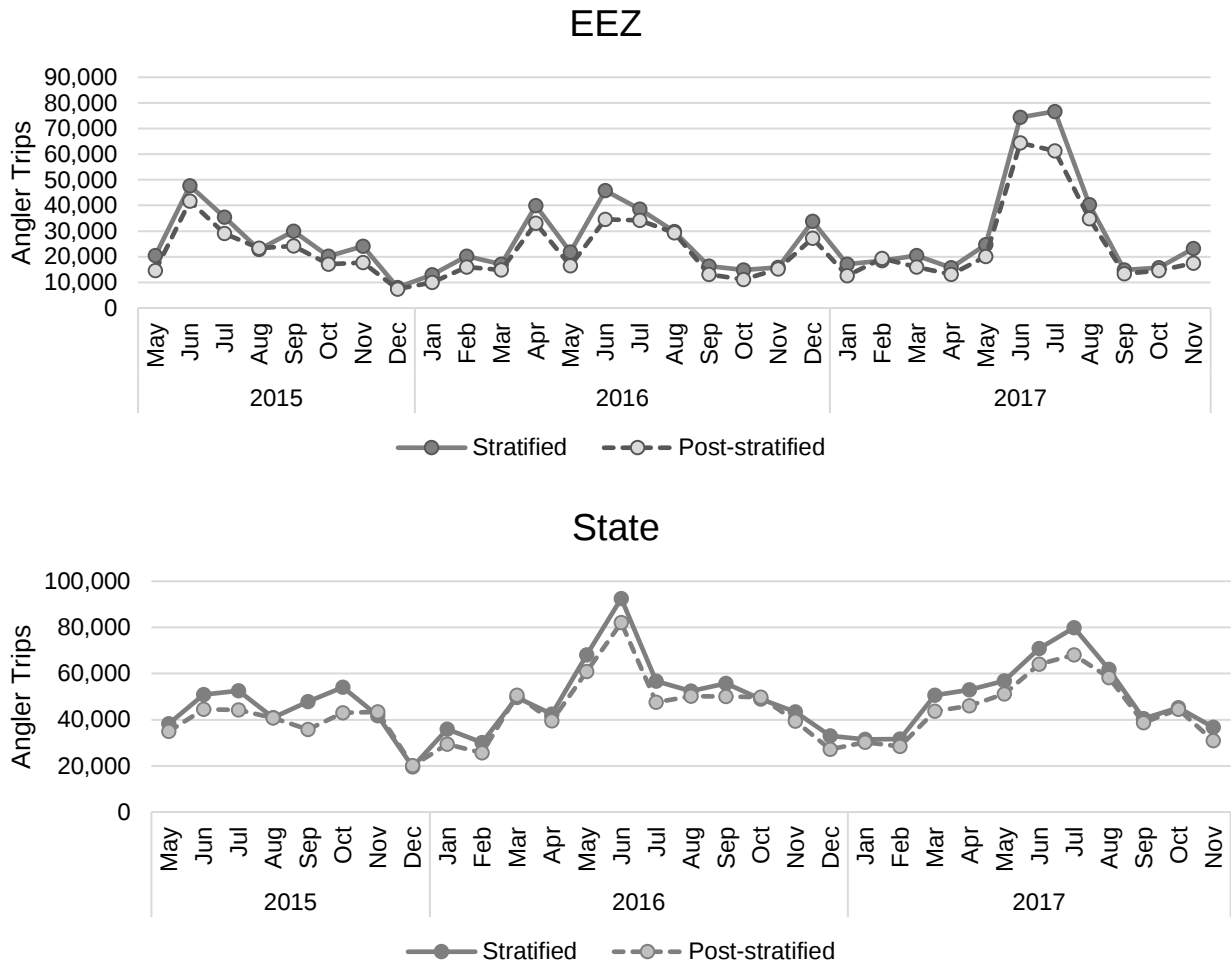


Figure 1.3.8. Monthly estimated numbers of trips taken in federal waters (EEZ, top graph) and state waters (bottom) by anglers subscribed to the Gulf Reef Fish Survey (unadjusted for off-frame effort by unregistered anglers, see adjustment factor described in Task 2). Stratified estimates (solid line) only take into account the varied response rates and reported trips per response among survey strata. Post-stratified estimates (dashed line) account for additional differences among anglers within each strata that self-subscribed to the Gulf Reef Fish Survey via the internet, versus those who subscribed through a second party, such as a tax collector or retail vendor. Note: December surveys were still being received and processed at the time this report was prepared.

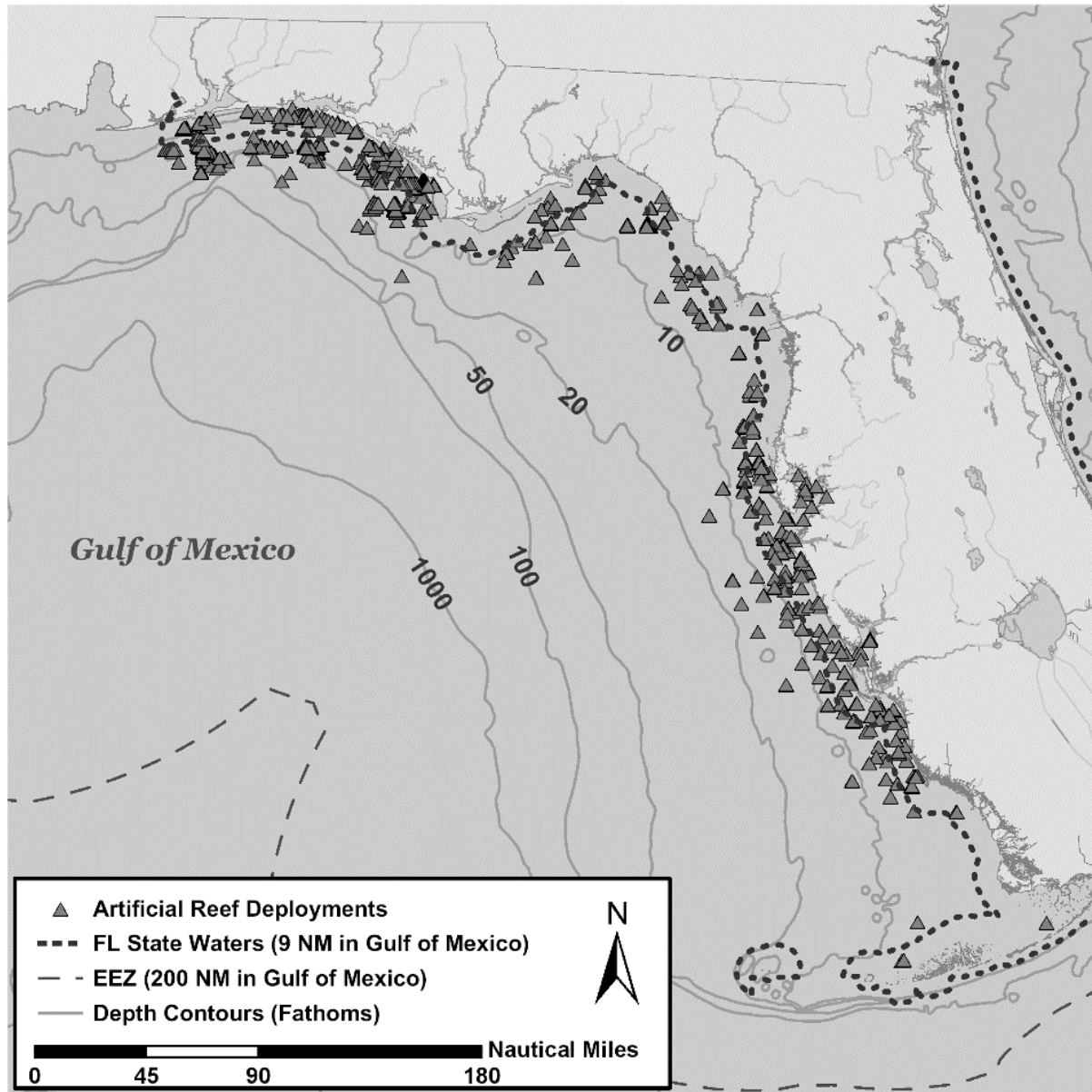


Figure 1.3.9. Locations of permitted artificial reefs off Florida's Gulf coast.

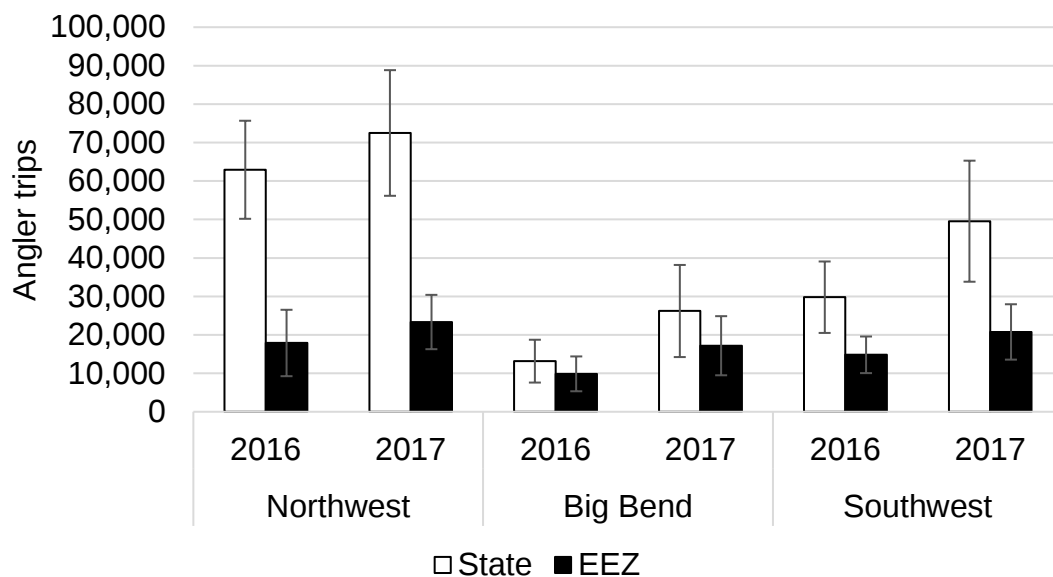


Figure 1.3.10. Numbers of Gulf Reef Fish angler trips that utilized artificial reefs in state and federal waters by region and survey year. See figure 1.3.1 for map of regions.

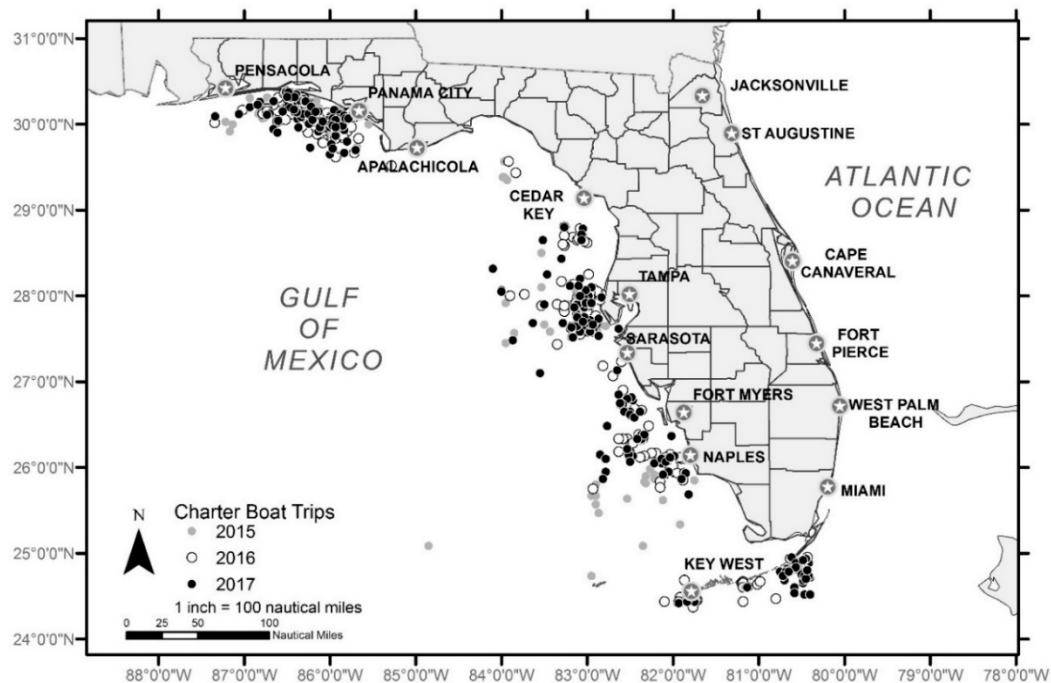


Figure 1.4.1. Location of sampled charter boat trips during 2015 (gray), 2016 (white) and 2017(black).

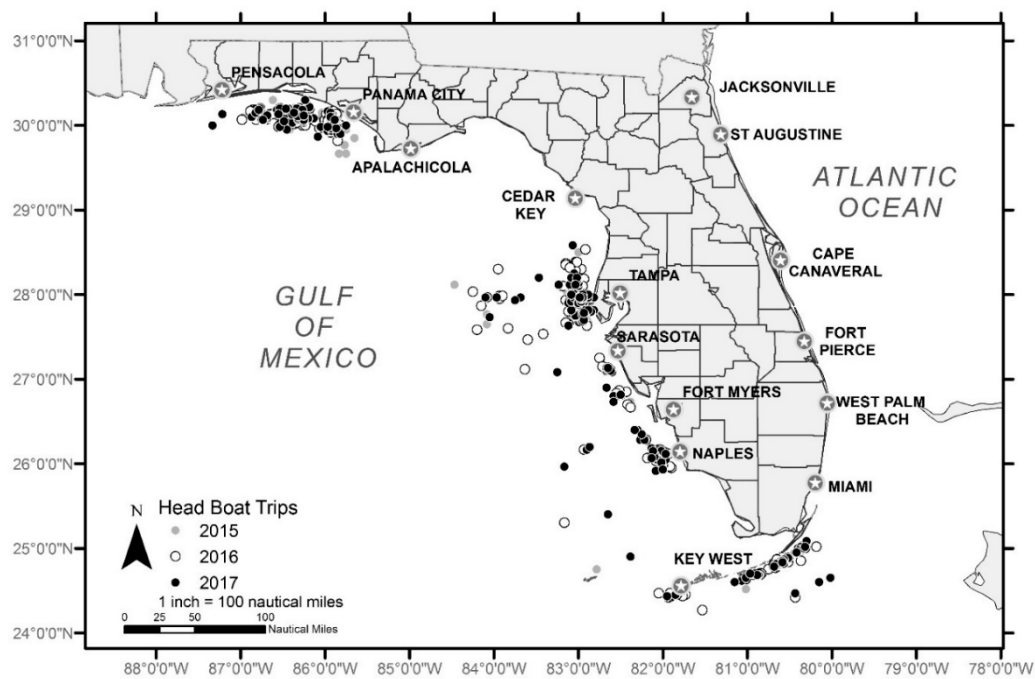


Figure 1.4.2. Location of sampled headboat trips during 2015 (gray), 2016 (white) and 2017(black).

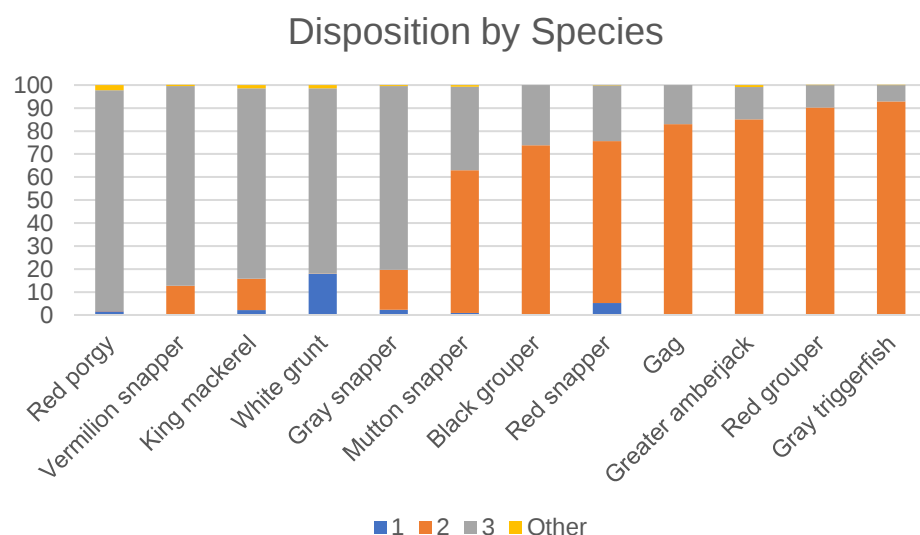


Figure 1.4.3 Percent of fish by disposition Released Legal (1), Released Not Legal (2), Harvested (3) Used for bait (Other).

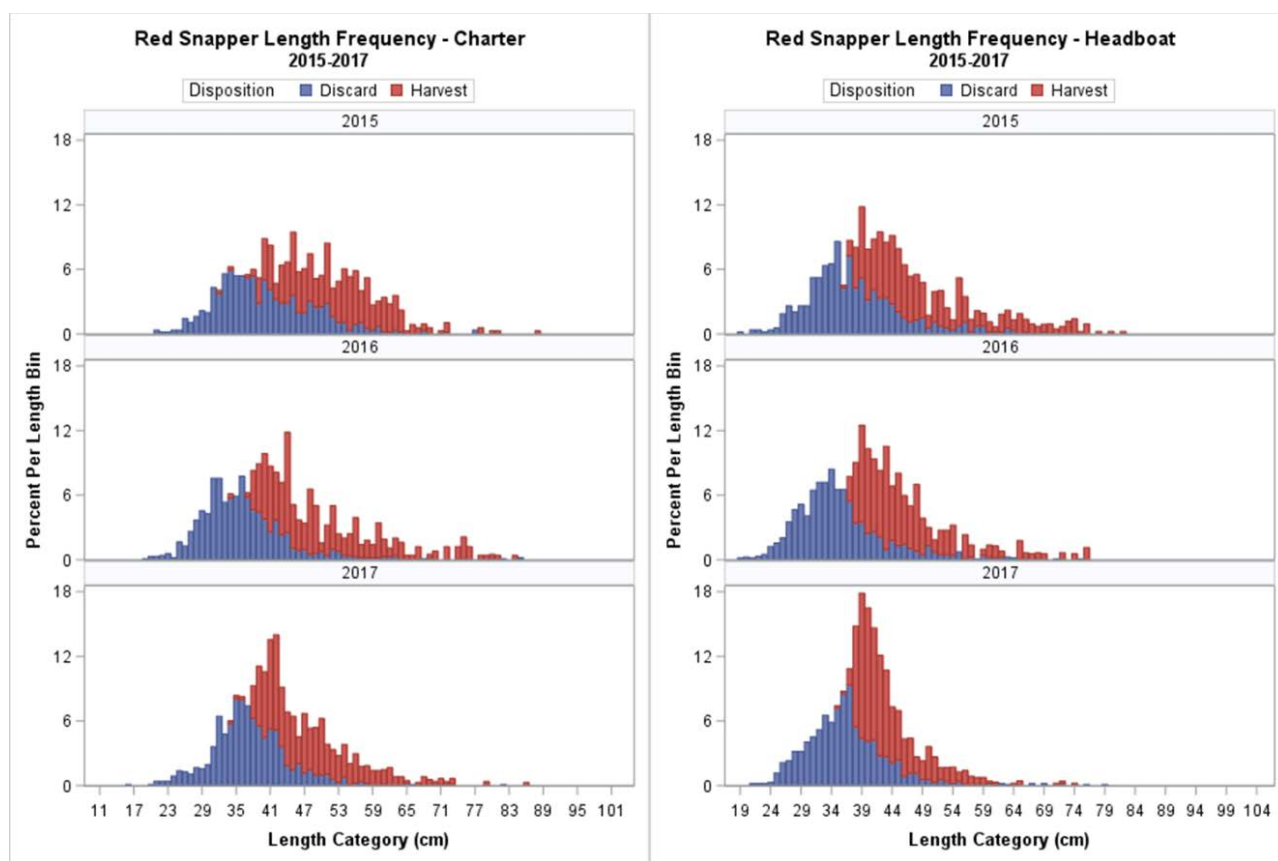


Figure 1.4.4. Length frequency data synthesized for SEDAR 52, Gulf of Mexico Red Snapper.

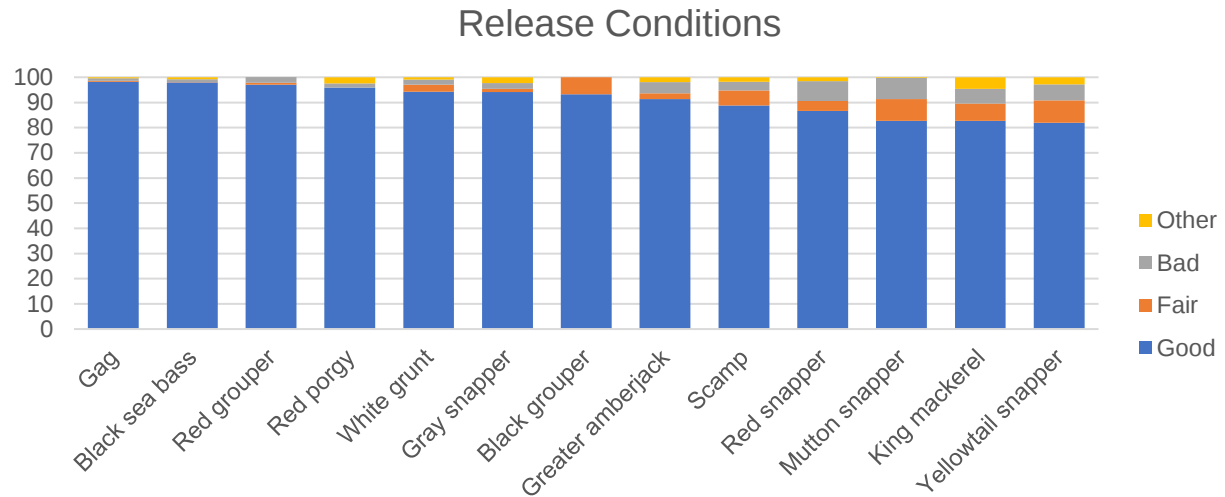


Figure 1.4.5. Percent fish released by condition, including: good (G), fair (F), bad (B), dead or preyed upon (O).

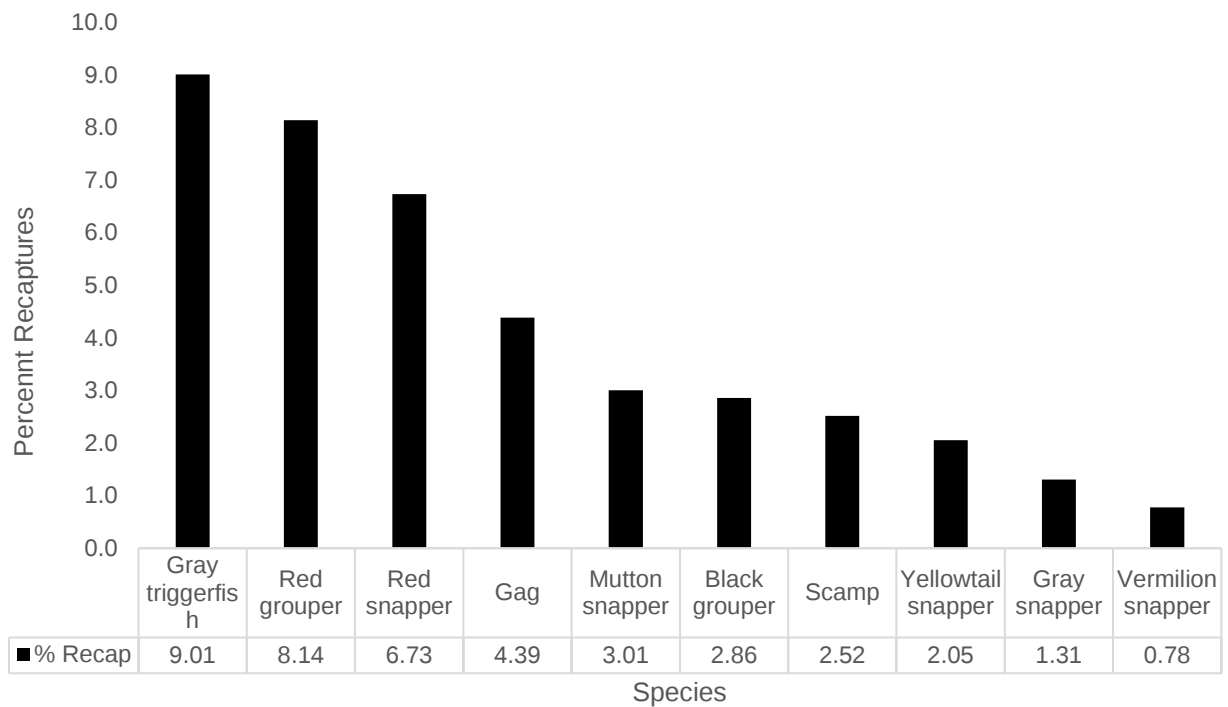


Figure 1.4.6. Recapture percentages.

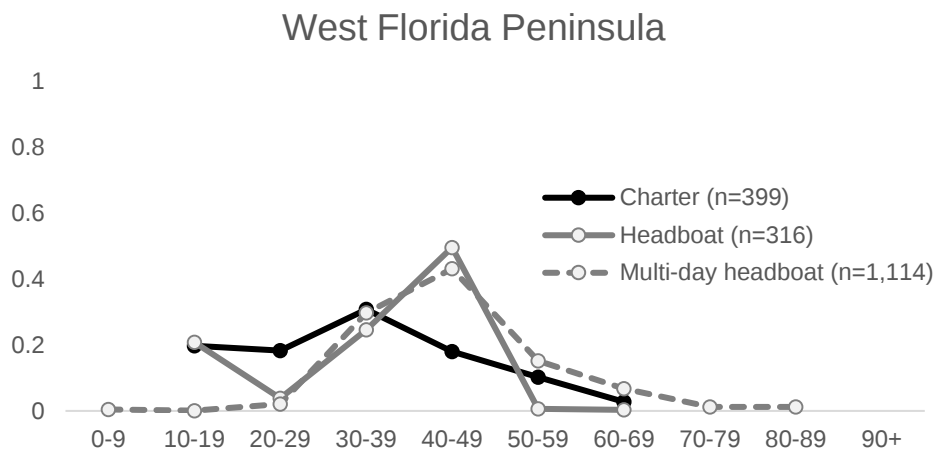
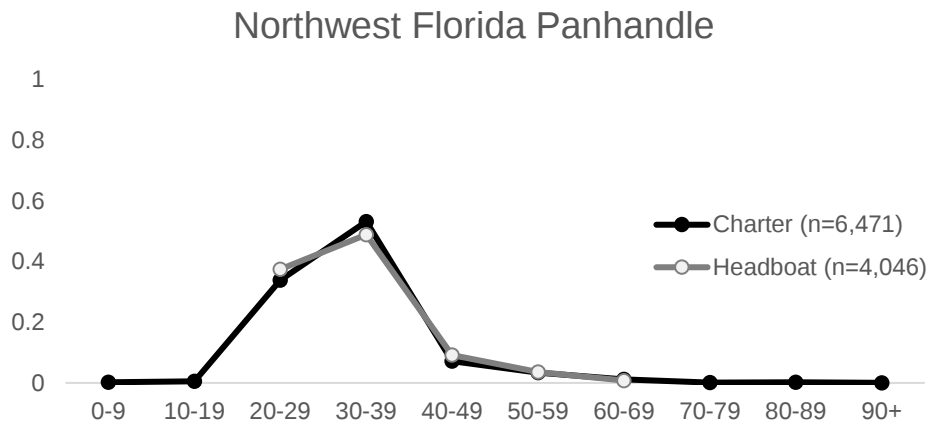


Figure 1.4.7. Distribution of capture depths (in meters) for Red Snapper discards observed during for-hire recreational fishing trips in northwest Florida (top) and the western Peninsula (bottom).

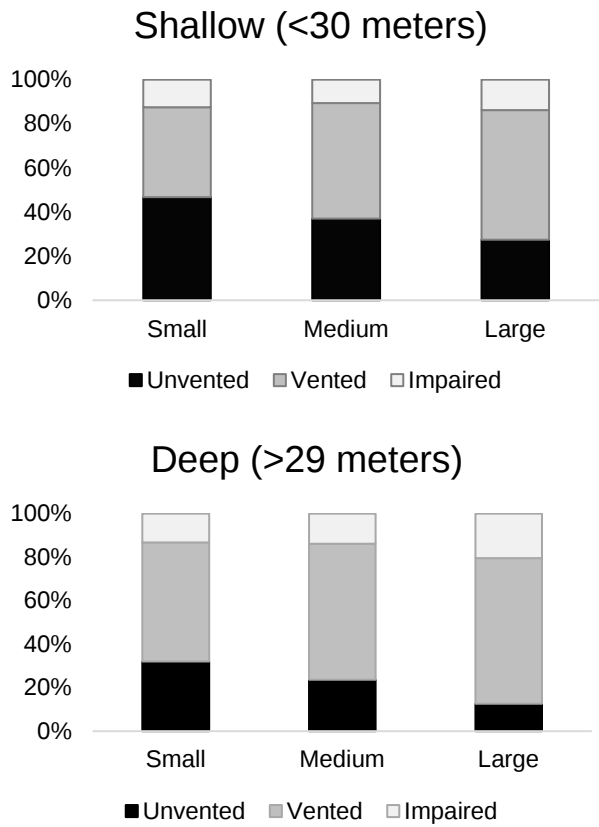


Figure 1.4.8. Percentages of small (<404), medium (404-507mm TL), and large (>507mm TL) Red Snapper discards, by release condition category, observed from shallow (top graph) and deep (bottom) fishing depths during recreational fishing trips on for-hire charter boats and headboats.

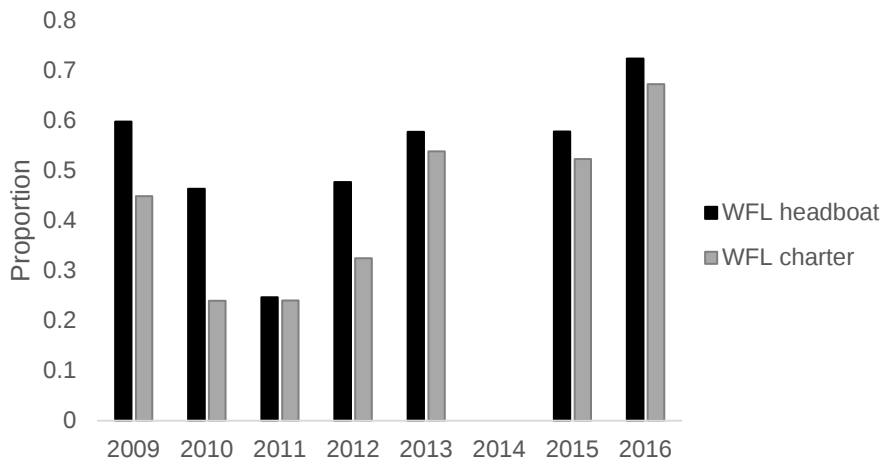


Figure 1.4.9. Annual proportions of Red Snapper discards observed in recreational fisheries Gulf of Mexico coast of Florida that were less than 406 mm total length by trip-type and year.

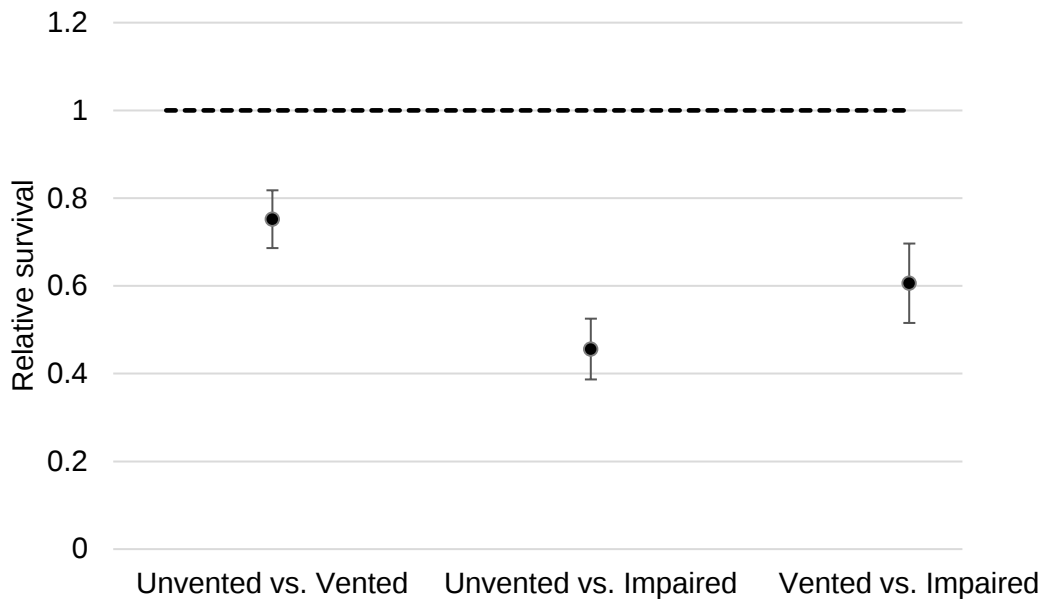


Figure 1.4.10. Relative survival of discarded red snapper released in different condition categories compared to a reference group (unvented). Point estimates below 1.0 indicate decreased survival for vented or impaired fish relative to a reference group. For example, the point estimate of 0.752 ± 0.043 from the Gulf model for good versus vented fish indicates that vented fish are 69–82% as likely to survive a catch and release event compared to fish released in good condition.

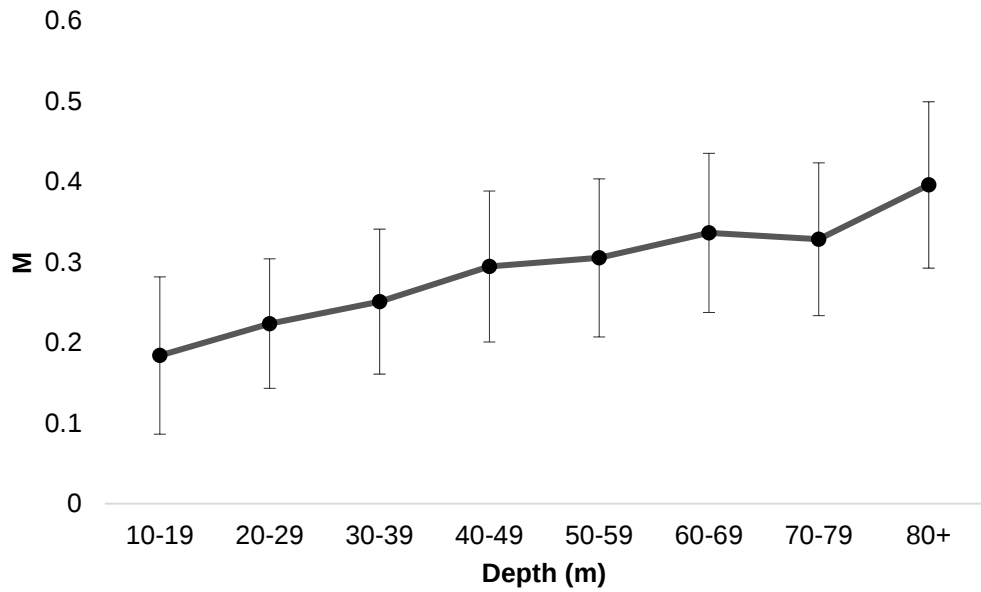


Figure 1.4.11. Estimated proportions of live discards from each depth interval that suffered mortality based on observed release conditions. Error bars represent 95% confidence intervals.

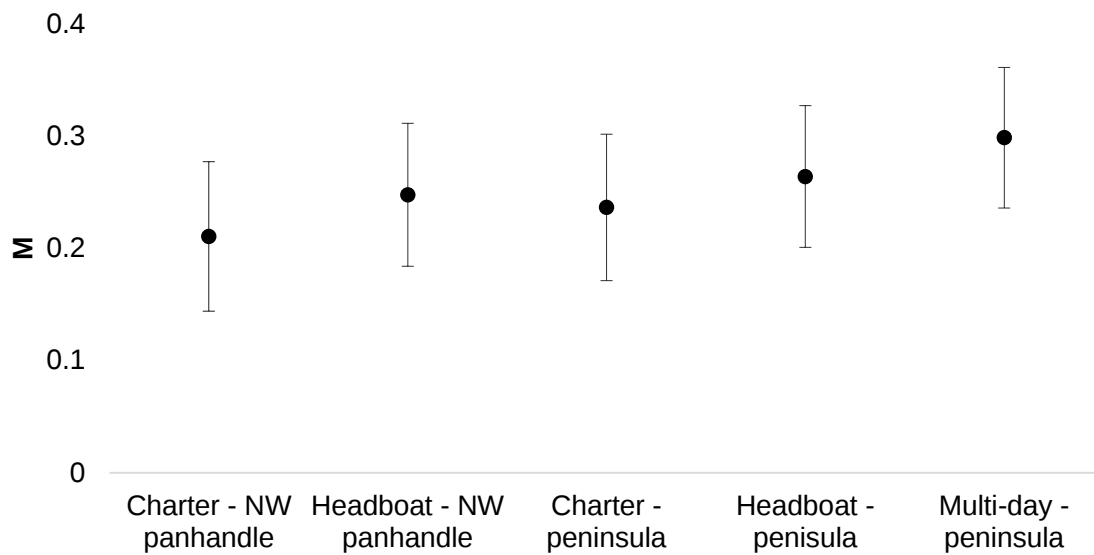


Figure 1.4.12. Overall estimated discard mortality by fishery.

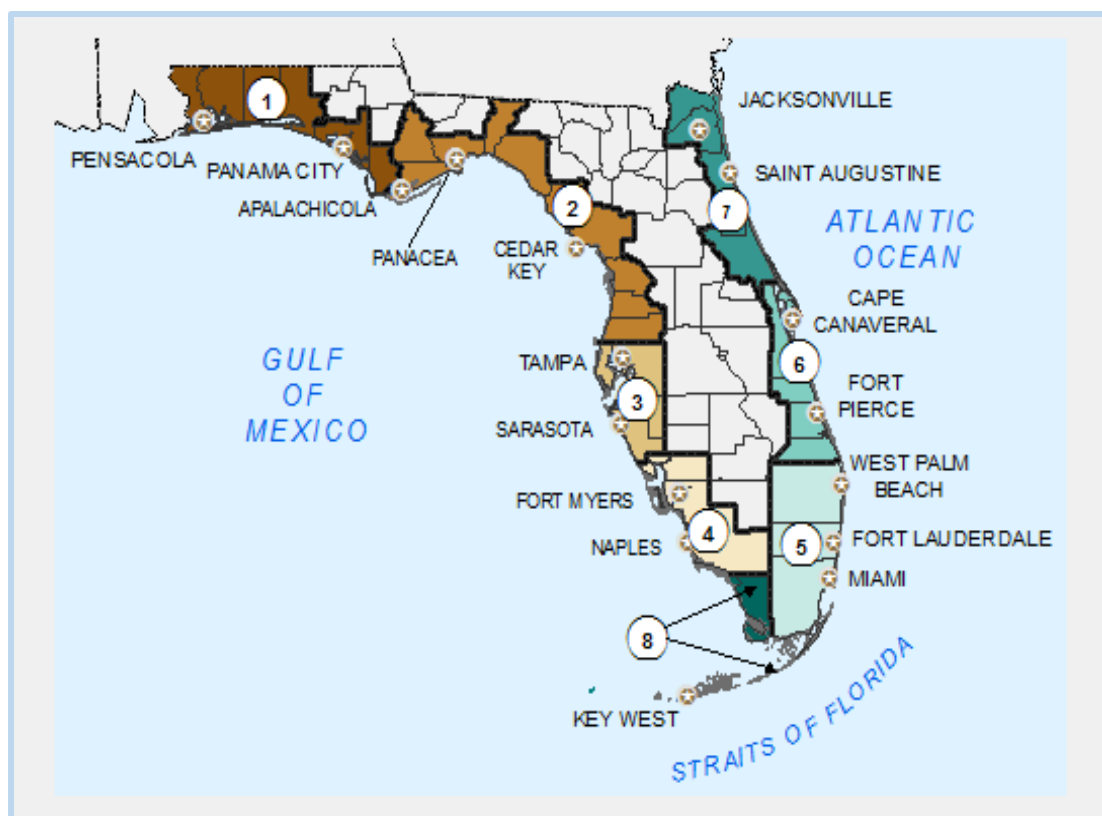


Figure 1.5.1. A map of the state of Florida that defines the regions used for the red snapper catch card.

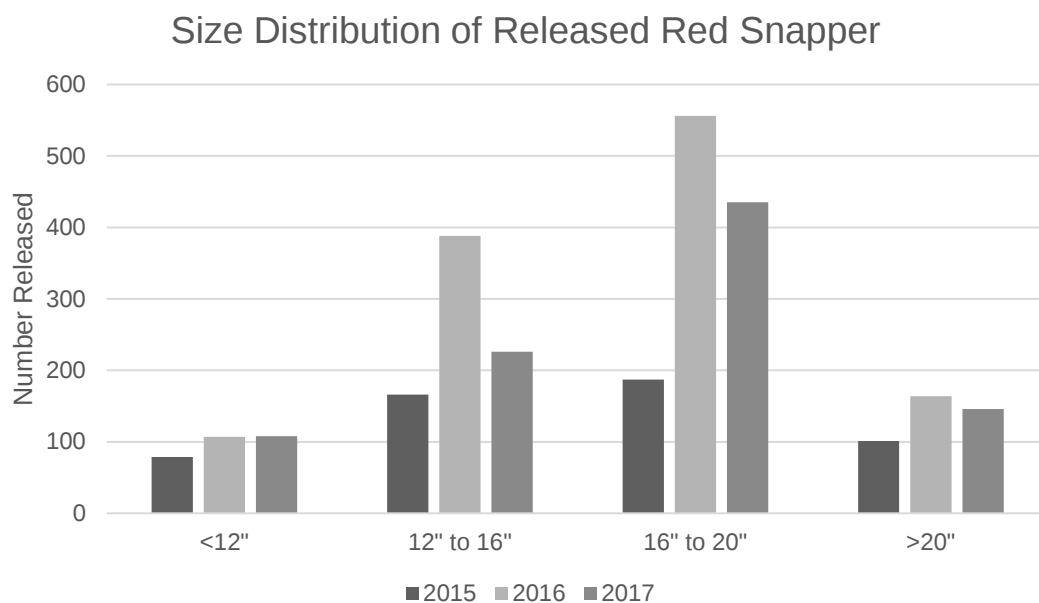


Figure 1.5.2. Reported numbers of red snapper released at sea, by size, in 2015-2017.

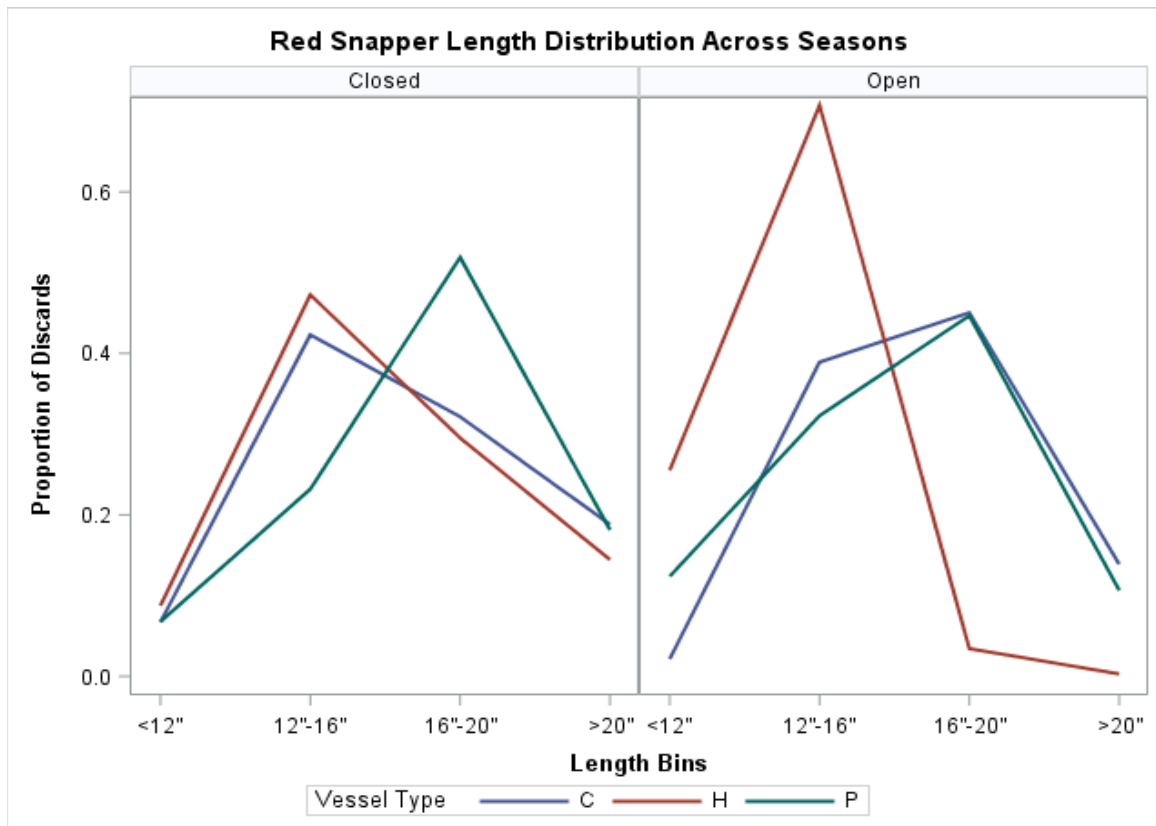


Figure 1.5.3. Proportion of Red Snapper discards by size category observed during charter boat (C) and headboat (H) at-sea surveys (Task 4), versus those reported on the online form by private boat anglers (P; Task 5), pooled across all years.

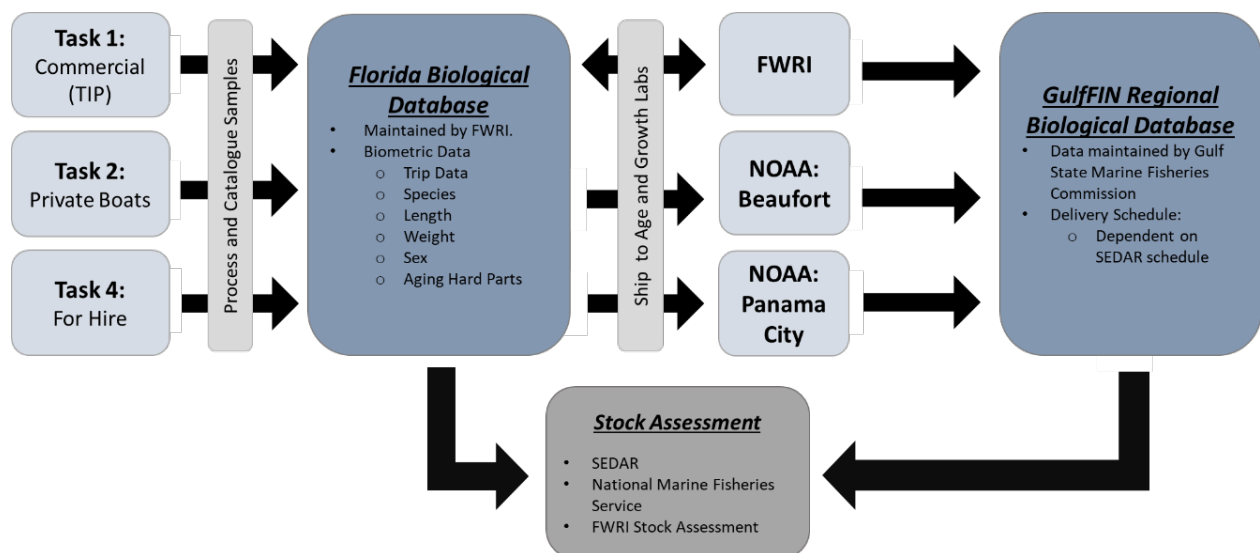


Figure 2.1. Diagrammatic representation of the flow of biological sample data from field collection to use in regional stock assessments.



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Commercial Fisheries Landings Summaries

Filters

Years: -

Species Set: ☒ Food and Bait ☐ Marine Life

Species *:

- ALL FOOD AND BAIT
- AMBERJACKS
- BAIT FISH
- BALLYHOO
- BLUE RUNNER
- BLUEFISH
- BUMPER, ATLANTIC
- CATFISH
- CHUB, BERMUDA
- CLAMS, HARD, BUTTON
- CLAMS, HARD, CHERRY
- CLAMS, HARD, CHOWDER
- CLAMS, HARD, LITTLENECK
- CLAMS, HARD, MIDDLENECK
- CLAMS, HARD, TOPNECK
- CLAMS, HARD, UNGRADED
- CLAMS, SUNRAY VENUS

Standard Output Columns

Year, Species, and Trips

Additional Output Columns

☒ Area, Area Description, Pounds, Average Price, and Estimated Value

☐ County, Pounds, Average Price, and Estimated Value

☐ Coast, Pounds, Average Price, and Estimated Value

☐ Month, Pounds, Average Price, and Estimated Value

☐ Statewide: Pounds, Average Price, and Estimated Value

Actions

[Export Report](#)

Figure 4.1. Screen capture of the commercial landings query form to generate landings reports. Reports are formatted as csv delimited files readily accessible with MS Excel and commonly available text editing programs.

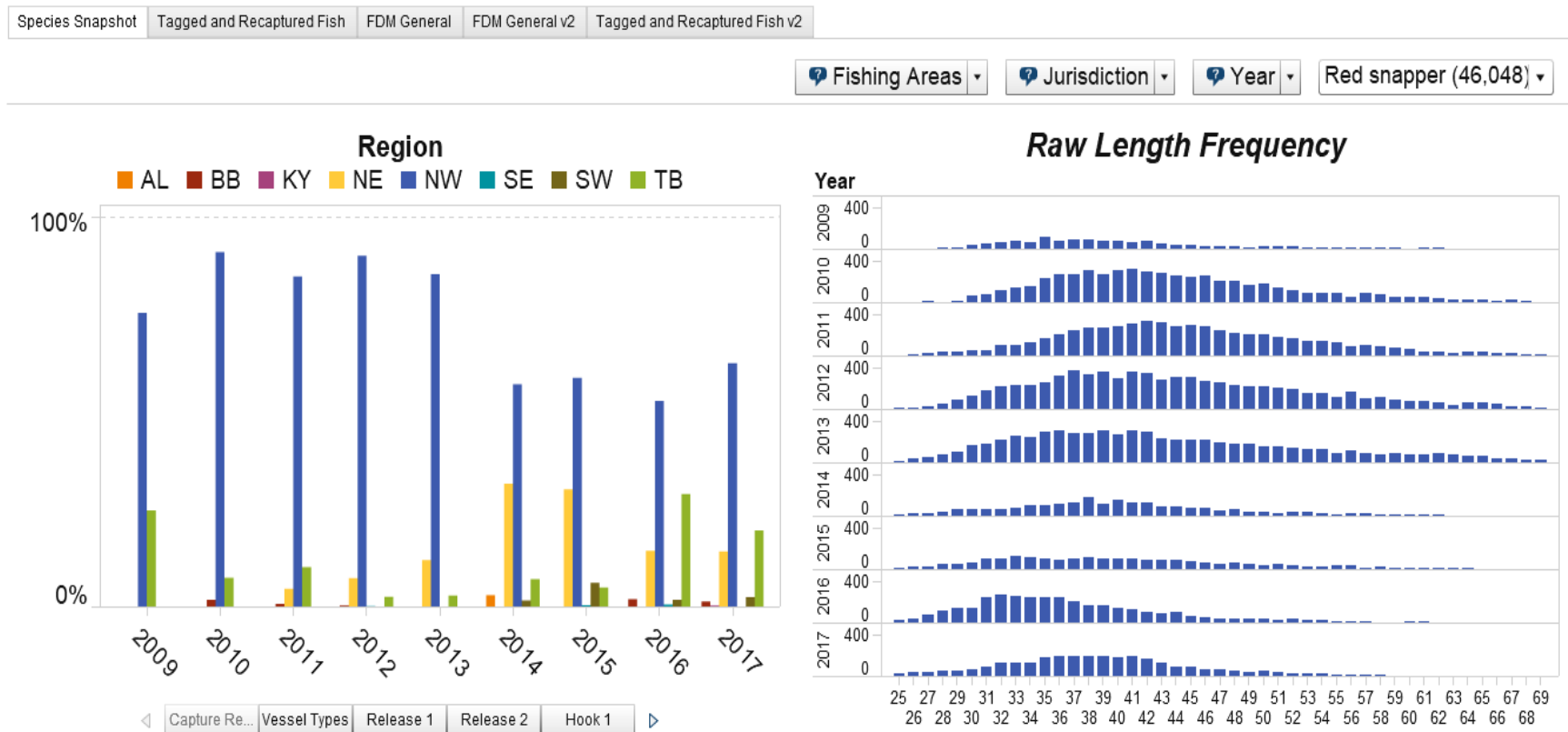


Figure 4.2. Screenshot from the SAS Visual Analytics report using the At-Sea Discard data. The top right represent the drop down menus used to filter the data by fishing area, jurisdiction, year and species. The left pane is used to toggle between graphs that aggregate trip level or fish level data by region, vessel type, release condition, hook injury, barotrauma, and depth. The right pane provides raw length frequency distributions for all fish captured, or for discarded versus harvested fish.

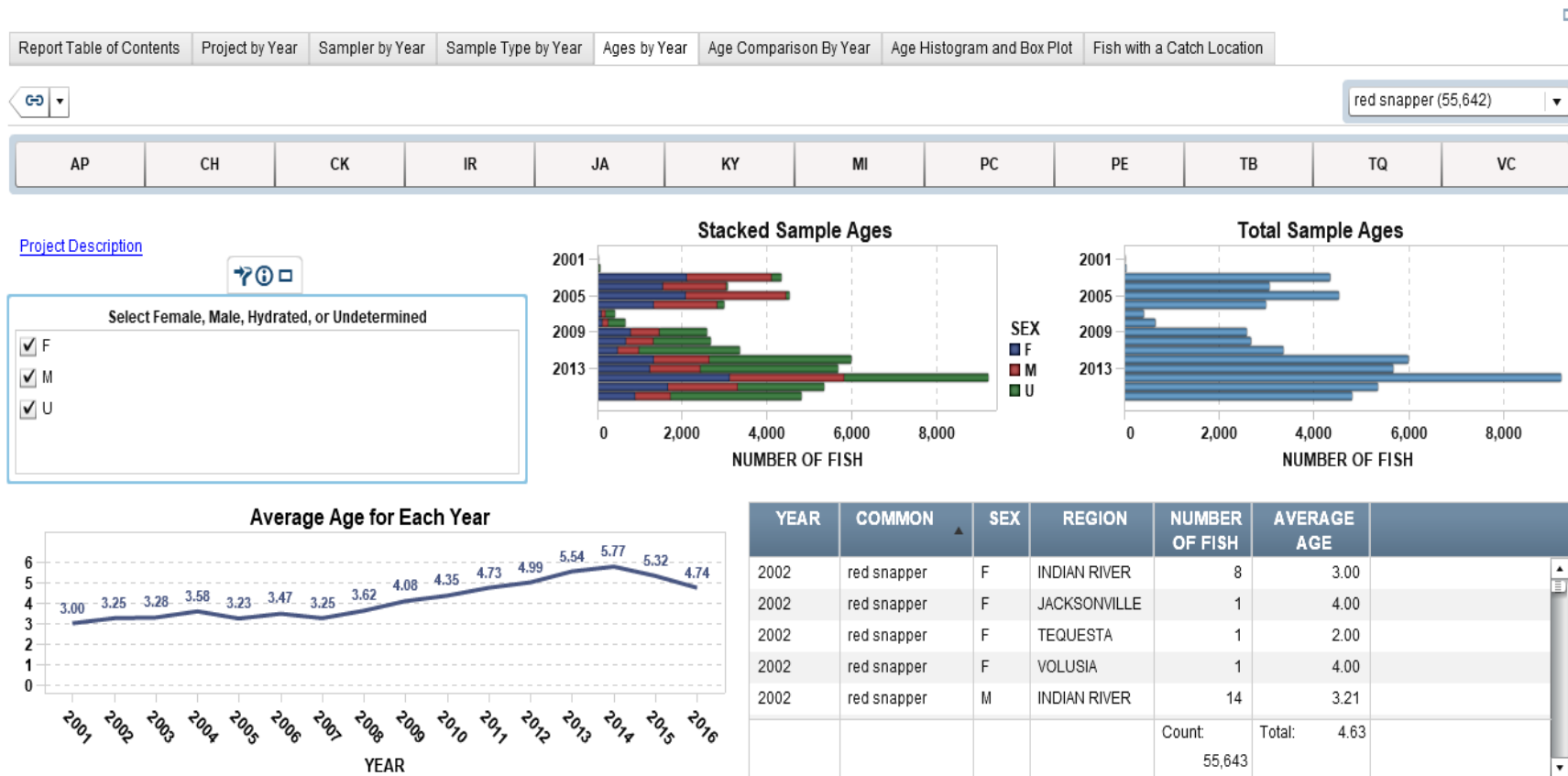


Figure 4.3. Screenshot from the SAS Visual Analytics report using data from the Florida Biological Database. The Top right filter allows the user to select a single species. The button bar along the top filters the data by coastal region of Florida. The check box on the left filters the data by sex of fish sampled, and the right graphs show the total number of aged samples by year and sex. The line graph on the left and associated table provide information on the average age of fish collected in each year, with aggregated sample sizes by year, region, and sex.

You asked for better data...

You asked for better data, and the Gulf Reef Fish Survey will provide just that! As of April 1, 2015, anglers are required to sign up for the Gulf Reef Fish Survey to recreationally fish for a variety of reef fish species in the Gulf of Mexico. As a Gulf reef fish angler, you may be asked periodically to participate in a voluntary survey and provide important information needed to monitor the fishery and provide optimum recreational fishing opportunities in Florida.

Signing up for the survey is free and is required for anyone 16 years of age and older (including those 65 and older) fishing from a private boat in the Gulf of Mexico (excluding Monroe County) who intend to harvest or possess any of the species pictured on this page. The Gulf Reef Fish Survey is only required if you are fishing for the 10 species described here. If you are fishing for other species, participation is not necessary.

With your help, this survey will improve recreational data collection and allow for more informed fisheries management decisions.

Species that **DO** Require Gulf Reef Fish Survey Participation

Black Grouper *Mycteroperca bonaci*

Box-like patches on body



Copper spots on face and body

Gray Triggerfish *Balistes capricus*

Upper rim of eye blue



Caudal fin lobes elongated in adults

Almaco Jack *Seriola rivoliana*

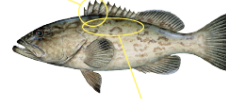
Front dorsal and anal fins elongated



A deep and flat-bodied amberjack

Gag Grouper *Mycteroperca microlepis*

Webbing between spines is notched



Brownish gray in color with dark, worm-like markings

Red Snapper *Lutjanus campechanus*

Does NOT have a yellow eye



Concave caudal fin

Sharply pointed anal fin

Amberjacks (Greater, Lesser)

Lesser Amberjack not pictured here. Lesser Amberjack grow up to 12 inches in length.

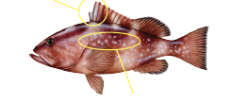
Dark band extends from nose to dorsal fin



Soft dorsal base and anal fin are closer in length than in banded rudderfish

Red Grouper *Epinephelus morio*

Webbing is even with the tip of the spine, creating a straight line



Irregular light blotches on body

Vermilion Snapper *Rhomboplites aurorubens*

Bullet shaped body



Forked caudal fin

Banded Rudderfish *Seriola zonata*

Tail-lobe often white tipped



Anal fin set back further compared to dorsal fin in greater amberjack

Anglers who sign up for the Gulf Reef Fish Survey must also abide by all state and federal recreational seasons, size limits and bag limits

Species that **DO NOT** Require Gulf Reef Fish Survey Participation

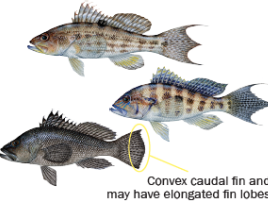
Gray Snapper *Lutjanus griseus* (Also called Mangrove Snapper or "Mangos")

Two conspicuous canine teeth



Offshore adults can be reddish in color (not as red as true Red Snapper)

Sea Bass (e.g., Rock, Bank and Black)



Convex caudal fin and may have elongated fin lobes

Porgies (e.g., Knobbed, Jolthead and Red)



Lane Snapper *Lutjanus synagris*

Diffuse black spot



Irregular pink and yellow lines

Grunts (e.g., White Grunt)



Mutton Snapper *Lutjanus analis*

Bright blue line below eye

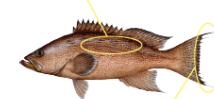
Small black spot



Offshore adults can be reddish in color (not as red as true Red Snapper)

Scamp *Mycteroperca phenax*

Reddish brown spots



Elongated caudal fin rays

May be mistaken for Red Snapper

May be mistaken for Red Grouper

Sign up for the Gulf Reef Fish Survey at License.MyFWC.com and click "Purchase a License." You can also sign up at licensing retailers (such as tackle shops) or by calling 888-FISH-FLORIDA (347-4356). For more information about regulations or the Gulf Reef Fish Survey, visit MyFWC.com/Fishing and click on "Saltwater" and "Recreational Regulations."



FLORIDA FISH AND WILDLIFE
CONSERVATION COMMISSION

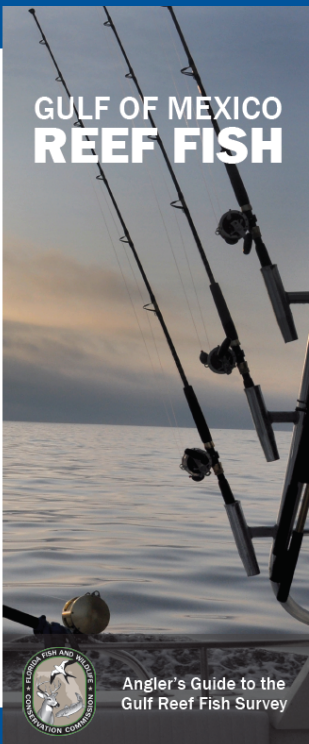
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GULF OF MEXICO REEF FISH



Angler's Guide to the
Gulf Reef Fish Survey

Figure 4.4. Brochure distributed to anglers to introduce the purpose of the Gulf Reef Fish Survey and describing which species require Gulf Reef Fish Survey participation for harvest (Top – Required, Bottom – Not Required).



Figure 4.5. Sticker distributed by FWC biologists to anglers in the Gulf of Mexico to raise awareness and visibility of the Gulf Reef Fish Survey.

Appendix 1.1. Overview of the NOAA Fisheries Trip Interview Program data entry.

Trip Interview Program System

HomeInterviewsReportsMaintenance

Interview Entry

Agency: NMFS-SERAgent: SARAH BEGGERLYInterview Date: 2017-01-25Copy DateBegin Time: (ex. 1345)End Time: (ex. 1400)

Fishing Mode: COMMERCIALInfo. Source: SALES AND INTERVIEWInterview Type: FISHERMAN SAMPLE

Landing State: FLORIDALanding County: = CHOOSE ONE =Landing Place: = CHOOSE ONE =

Sample State: FLORIDASample County: = CHOOSE ONE =Sample Place: = CHOOSE ONE =Sample Area Dealer: = CHOOSE ONE =

of Vessels: 1# of Trips: 1Dealer 1: = CHOOSE ONE =Dealer 2: = CHOOSE ONE =Trip Ticket #:Ticket Agency: NMFS-SERTrip Ticket #:Ticket Agency 2: = CHOOSE ONE =

Landing Type: COMPLETE LANDINGS

Crew Size:Termination Type: NORMALIs Effort Collected: Yes NoObserver Onboard: Yes No Unknown

Start Date:Landing Date:Unload Date:Days Out:Days Fished:VTR#

LICENSE INFORMATION FOR COMMERCIAL, SCIENTIFIC, RESEARCH TRIPS

License Agency: NMFS-SERIndividual License #:Vessel #:New Vessel Name:

COMMENTS / CHECKER

Comments:Checker:Checked Date:

Created By User: SARAH.BEGGERLY@NOAA.GOVCreated Date: 2017-01-25Modified By:Modified Date:

CancelDeleteSave New

Appendix 1.1. Effort Page

Trip Interview Program System

[Password](#) [Log Out](#)[Home](#) [Interviews](#) [Reports](#) [Maintenance](#)Interview
348605View
Date
2016-12-22Status
PENDINGChecked
-Effort
EFFORT: 0Landing
LANDINGS: 0Sample
SAMPLES: 0Observation
OBSER.: 0Tags
0Next Tag
20162760184Print

Effort Entry

GEAR INFORMATION

Gear: * ?Qty: ?Usage/Freq : ?Number Set: ?Avg Info: ?Size: ?Total Line Len: ?Avg Miles/Set: ?Soak days: ?Soak hours added to days: ?Soak Time : Hours ?

POSITIONING INFORMATION

Region: ?Area: ?Lat Deg: ?Lat Min: ?Lat Sec: ?Long Deg: ?Quadrant: ?10 Min: ?Long Min: ?Long Sec: ?Distance To Shore: mi ?Min or Avg Depth: ft ?Max Depth: ft ?Min or Avg Depth: fat ?Max Depth: fat ?Comments:

Created By User: SARAH.BEGGERLY@NOAA.GOV

Created Date: 2016-12-22

Appendix 1.1. Landings Page

Trip Interview Program System

HomeInterviewsReportsMaintenance

Interview348605ViewCalendarDate2016-12-22StatusPENDINGChecked- EffortEFFORT: 1LandingLANDINGS: 0SampleSAMPLES: 0ObservationOBSER.: 0Tags0Next Tag20162760184Print

Landing Entry

Gear: ⓘ
= Choose One = ⓘ

Species: ⓘ
= Choose One = ⓘ

Qty: ⓘ

Comment: ⓘ

Region: ⓘ
SOUTH ATLANTIC ⓘ

Size: ⓘ
= CHOOSE ONE = ⓘ

Weight: ⓘ

Area: ⓘ
Once a region has been selected, Enter at least 1 character of Area Id or ... ⓘ

Grade: ⓘ
NO GRADE ⓘ

Units: ⓘ
= CHOOSE ONE = ⓘ

Market Count Min: ⓘ

Market Count Max: ⓘ

Condition: ⓘ
= CHOOSE ONE = ⓘ

Created By User: SARAH.BEGGERLY@NOAA.GOV

Created Date: 2016-12-22

Cancel

Save New

Appendix 1.1. Sample Page

Trip Interview Program System

[Password](#) [Log Out](#)[Home](#) [Interviews](#) [Reports](#) [Maintenance](#)

Interview	View	Date	Status	Checked	Effort	Landing	Sample	Observation	Tags	Next Tag	Print
348605		2016-12-22	PENDING	-	EFFORT: 1	LANDINGS: 0	SAMPLES: 0	OBSER.: 0	0	20162760184	

Sample Entry:

Choose Landing (FIRST) : * ?

= CHOOSE ONE =

SAMPLE INFORMATION

Species: * ?

= CHOOSE ONE =

Size: * ?

= CHOOSE ONE =

Condition: * ?

= CHOOSE ONE =

Grade: * ?

= CHOOSE ONE =

Weight: ?

Weight Unit: ?

= CHOOSE ONE =

Sample Method: * ?

= CHOOSE ONE =

Cnt/Qty: ?

Random Sample? * ?

☐ NO ☒ YES

Full Catch? * ?

☒ NO ☐ YES ☐ UNKNOWN

SUB-SAMPLE INFORMATION

Sub Sample Count/Qty: ?

Sub Wt: ?

Sub Sample Weight Unit: ?

= CHOOSE ONE =

Sub Sample Condition: ?

= Choose One =

Random Sub-Sample? ?

☐ NO ☐ YES

Sample Comment

Created By User: SARAH.BEGGERLY@NOAA.GOV

Created Date: 2016-12-22

Modified By User:

Modified Date:

Cancel

Save New

Appendix 1.1. Observation Page

Trip Interview Program System

PasswordLog Out

HomeInterviewsReportsMaintenance

Interview349542

View

Date2017-01-26

StatusPENDING

Checked-

EffortEFFORT: 1

LandingLANDINGS: 3

SampleSAMPLES: 3

ObservationOBSER.: 0

Tags0

Next Tag20172760016

Print

▼ Observation Groups

Edit Group	Edit Obser	Copy	Grp#	Rows	Tags	Sample	Sample Species	Count	Weight	Observation Species	Size	Condition	Method	Sex	Mat. Stage
ADD/ROWS	LEN/TAGS	COPY	3078	0	0	831651	DOLPHINS,CORYPHAENA (1050)	16		DOLPHINS,CORYPHAENA (1050)	MIXED/UNSIZED	ROUND (WHOLE)	LANDED UNSORTED		
ADD/ROWS	LEN/TAGS	COPY	3079	0	0	831652	RED SNAPPER, LUTJANUS CAMPECHAN (3764)	45		RED SNAPPER, LUTJANUS CAMPECHAN (3764)	MIXED/UNSIZED	GUTTED - HEAD ON	LANDED UNSORTED		
ADD/ROWS	LEN/TAGS	COPY	3080	0	0	831653	GRAY TRIGGERFISH (4561)	12	26.0	GRAY TRIGGERFISH (4561)	MIXED/UNSIZED	ROUND (WHOLE)	LANDED UNSORTED		

1 - 3

Add Observations for a Sample

Appendix 1.1. Data Review

[Report List](#) /

Interview Overview

INTERVIEW		DEALER & VESSEL INFO		TRIP INFO	
INTERVIEW	348277	USERNAME	SARAH.BEGGERLY@NOAA.	DEALER	WD0007014 THE FISH PEDDLER EAST INC-FL
INT START	11/03/2016 at 11:30	INT END	11/03/2016 at 14:05	VESSEL_ID	
F MODE	COMMERCIAL	INT TYPE	FISHERMAN SAMPLE	CREW SIZE	3
LANDED	(FL) BROWARD: COCONUT CREEK	SAMPLED	(FL) BROWARD: COCONUT CREEK	LICENSE	LICENSE
#VESSELS	1	HAS EFFORT	Y	AGENCY	
BIAS TYPE		TERMINATION	NORMAL	TICKET AGENCY	18
SOURCE	SALES AND INTERVIEW			TICKET	123456
				CHECKED	
				TRIP TYPE	
				LANDING TYPE	COMPLETE LANDINGS
				START DATE	11/03/2016
				DAYS OUT	1
				COMMENTS	This is a test
				BSD STATUS	

Check

▼ EFFORT SECTION

Gear	Size	Tot Len	Num Set	Qty	Freq	Soak Time	Avg	Avg Set	Area	Latitude	Longitude	Quadrant	Min Max Depth	Area 10 Min	Distance To Shore Miles
REEL, ELECTRIC OR HYDRAULIC (REEL, ELECTRIC OR HYDRAULIC) (613)				2		10	3		SOUTH ATLANTIC: 744.1 MIAMI, FLORIDA BAY(MIAMI, FLORIDA BAY)				3.3333;8.3333		

▼ LANDING SECTION

Landing #	Species	Size	Gear	Region Area	Condition	Grade	Qty	Weight	Cnt Species
1295755	GRAY TRIGGERFISH (GRAY TRIGGERFISH) (173138:4561)	MIXED/UNSIZED	REEL, ELECTRIC OR HYDRAULIC (REEL, ELECTRIC OR HYDRAULIC) (613)	SOUTH ATLANTIC: MIAMI, FLORIDA BAY(MIAMI, FLORIDA BAY) (744.1)	(ROUND - WHOLE))	NO GRADE	12	21 LB	1
1295754	DOLPHINS,CORYPHAENA (DOLPHINS,CORYPHAENA) (168790:1050)	MIXED/UNSIZED	REEL, ELECTRIC OR HYDRAULIC (REEL, ELECTRIC OR HYDRAULIC) (613)	SOUTH ATLANTIC: MIAMI, FLORIDA BAY(MIAMI, FLORIDA BAY) (744.1)	(GUTTED - HEAD ON)	NO GRADE	29	350 LB	1
1295748	RED SNAPPER, LUTJANUS CAMPECHAN (RED SNAPPER,LUTJANUS CAMPECHAN) (168853:3764)	MIXED/UNSIZED	REEL, ELECTRIC OR HYDRAULIC (REEL, ELECTRIC OR HYDRAULIC) (613)	SOUTH ATLANTIC: MIAMI, FLORIDA BAY(MIAMI, FLORIDA BAY) (744.1)	(GUTTED - HEAD ON)	NO GRADE		1000 LB	1
Report Total:							41		

Appendix 1.1. Interview Validation

Trip Interview Program System

HomeInterviewsReportsMaintenance

Observation Groups

Edit Group	Edit Obser	Copy
ADD/ROWS	LEN/TAGS	COPY
ADD/ROWS	LEN/TAGS	COPY
ADD/ROWS	LEN/TAGS	COPY

Observation Values for Group: 2

Show Column Groups: ☐ All ☐ Spec

Rec	Line	Length1
11	1	300.0
12	2	350.0
13	3	324.0
14	4	332.0
15	5	380.0
16	6	400.0

20162760191SPINES

20162760192SPINES

Validation Report

SearchGoResetRun ValidationOverride Warnings

Interview 348277

1-1

Section	Name	Status	Message	I	Effort id	L	Sample id	O
OBSERVATION	Small length	Warning	LENGTH1 [101] is seldom less than [378 MM] for a DOLPHINS,CORYPHAENA FORK LENGTH	I	E	L	S	O

Download

Sex

Mat. Stage

*MANUAL	UNKNOWN
*MANUAL	UNKNOWN
DID NOT ATTEMPT	UNKNOWN

1 - 3

Add Observations for a Sample

Shuffle Tags: ☐ ON ☐

Appendix 1.2. NMFS Trip Interview Program interviews, fish measured, and hard parts (otoliths and spines) collected for the determination of age by FDM commercial samplers during the NFWF award period. Hard parts are collected from bony fish but not invertebrates sampled from both coasts.

	TIP Interviews	%	Product Measured*	%	Hard Parts	%
Atlantic Coast	2,379	48.96%	60,550	40.00%	7,104	11.48%
Gulf Coast	2,480	51.04%	90,818	60.00%	54,804	88.52%
Total	4,859		151,368		61,908	

Appendix 1.3. A comparison by taxa sampled in 2017 based on the relative contribution from NFWF funded sampling effort at Gulf locations. Taxa are ranked by percentage of measurements from the Gulf Coast (NFWF funded) from the entire State (Gulf and Atlantic coasts), this includes invertebrates as well as vertebrates. GEBF contribution is shown in terms of estimated numbers expressed as a percentage of State totals.

NODC Code	Common Name	Statewide Total		Gulf Coast			
		Number Measured	Hard Parts	Number Measured	% Measured	Hard Parts	% Hard Parts
2080	LIONFISH	90	7	90	100.0%	7	100.0%
8741120101	CONGER EEL	1	0	1	100.0%	0	-
8791031001	RED HAKE	1	1	1	100.0%	1	100.0%
8791031007	SOUTHERN HAKE	1	1	1	100.0%	1	100.0%
8792010401	BEARDED BROTLA	9	8	9	100.0%	8	100.0%
8809010101	BEARDFISH	1	1	1	100.0%	1	100.0%
8810050101	RED BREAM	1	1	1	100.0%	1	100.0%
8826010301	BLACKBELLY ROSEFISH	11	11	11	100.0%	11	100.0%
8826010402	SPINYCHEEK SCORPIONFISH	26	24	26	100.0%	24	100.0%
8826010503	LONGSPINE SCORPIONFISH	1	1	1	100.0%	1	100.0%
8835020402	ROCK HIND	30	29	30	100.0%	29	100.0%
8835020404	SPECKLED HIND	311	297	311	100.0%	297	100.0%
8835020406	RED HIND	1	1	1	100.0%	1	100.0%
8835020409	MISTY GROUPER	2	2	2	100.0%	2	100.0%
8835020410	WARSAW GROUPER	27	22	27	100.0%	22	100.0%
8835020440	MARBLED GROUPER	1	0	1	100.0%	0	-
8835020441	MUTTON HAMLET	5	5	5	100.0%	5	100.0%
8835020504	YELLOWMOUTH GROUPER	3	3	3	100.0%	3	100.0%
8835020506	YELLOWFIN GROUPER	1	1	1	100.0%	1	100.0%
8835021101	SPANISH FLAG	1	1	1	100.0%	1	100.0%
8835021701	CREOLE-FISH	6	5	6	100.0%	5	100.0%
8835170101	BIGEYE	2	0	2	100.0%	0	-
8835170201	SHORT BIGEYE	6	4	6	100.0%	4	100.0%
8835220102	BLACKLINE TILEFISH	1	1	1	100.0%	1	100.0%
8835280201	AFRICAN POMPAO	2	0	2	100.0%	0	-
8835280202	AFRICAN POMPAO	12	1	12	100.0%	1	100.0%
8835280902	PERMIT	1	0	1	100.0%	0	-
8835360106	BLACKFIN SNAPPER	65	50	65	100.0%	50	100.0%
8835360109	DOG SNAPPER	10	10	10	100.0%	10	100.0%
8835360110	MAHOGANY SNAPPER	2	2	2	100.0%	2	100.0%
8835360111	CARIBBEAN RED SNAPPER	1	1	1	100.0%	1	100.0%
8835360301	QUEEN SNAPPER	109	105	109	100.0%	105	100.0%
8835360701	WENCHMAN	1	1	1	100.0%	1	100.0%
8835360703	CARDINAL SNAPPER	5	5	5	100.0%	5	100.0%
8835400103	MARGATE	33	12	33	100.0%	12	100.0%
8835430508	LITTLEHEAD PORGY	19	1	19	100.0%	1	100.0%
8835430510	SHEEPSHEAD PORGY	2	0	2	100.0%	0	-
8850010401	OILFISH	3	1	3	100.0%	1	100.0%
8851010201	BARRELFISH	17	14	17	100.0%	14	100.0%
8851010202	BLACK DRIFTFISH	10	10	10	100.0%	10	100.0%
8860020101	ORANGE FILEFISH	1	0	1	100.0%	0	-
8861010101	SMOOTH PUFFER	1	0	1	100.0%	0	-
8835430502	JOLTHEAD PORGY	163	20	162	99.4%	20	100.0%
8835360113	SILK SNAPPER	147	85	146	99.3%	84	98.8%
8835020505	SCAMP	1,497	1,446	1,479	98.8%	1,439	99.5%
8835020408	RED GROUPER	3,639	3,463	3,582	98.4%	3,450	99.6%
8835020502	BLACK GROUPER	317	196	312	98.4%	191	97.4%
8835280301	YELLOW JACK	48	7	46	95.8%	7	100.0%
8835020439	GRAYSBY	21	20	20	95.2%	20	100.0%
8839010901	HOGFISH	81	7	75	92.6%	7	100.0%

8835020501	GAG	2,416	2,187	2,232	92.4%	2,179	99.6%
8835280304	HORSE-EYE JACK	11	0	10	90.9%	0	-
8835360112	LANE SNAPPER	615	609	559	90.9%	557	91.5%
8835020405	YELLOWEDGE GROUPER	722	716	655	90.7%	649	90.6%
8835360101	CUBERA SNAPPER	9	8	8	88.9%	7	87.5%
6189021301	FLORIDA STONE CRAB	6,161	0	5,445	88.4%	0	-
8835360107	RED SNAPPER	4,208	4,085	3,691	87.7%	3,642	89.2%
8835220301	SAND TILEFISH	8	2	7	87.5%	2	100.0%
8835020411	SNOWY GROUPER	577	556	503	87.2%	485	87.2%
8835220104	BLUELINE TILEFISH	354	240	305	86.2%	193	80.4%
8835021201	LONGTAIL BASS	7	7	6	85.7%	6	85.7%
8835430506	KNOBBED PORGY	66	0	56	84.8%	0	-
8835400102	WHITE GRUNT	199	169	163	81.9%	155	91.7%
8836010101	STRIPED MULLET	1,308	266	1,063	81.3%	266	100.0%
8860020502	OCEAN TRIGGERFISH	69	0	56	81.2%	0	-
8835280801	GREATER AMBERJACK	117	27	94	80.3%	27	100.0%
8835360401	YELLOWTAIL SNAPPER	1,846	695	1,470	79.6%	429	61.7%
8835360102	GRAY SNAPPER	841	618	646	76.8%	552	89.3%
8850030404	BLACKFIN TUNA	11	0	8	72.7%	0	-
8835440102	SPOTTED SEATROUT	17	16	11	64.7%	11	68.8%
8835360103	MUTTON SNAPPER	499	272	313	62.7%	254	93.4%
8810080101	SQUIRRELFISH	22	17	12	54.5%	7	41.2%
8835290101	DOLPHIN	158	0	86	54.4%	0	-
8835400304	BLACK MARGATE	2	2	1	50.0%	1	50.0%
8835430505	WHITEBONE PORGY	2	0	1	50.0%	0	-
8835400113	BLUESTRIPED GRUNT	22	20	10	45.5%	10	50.0%
8835020301	BLACK SEA BASS	100	77	45	45.0%	45	58.4%
8835360501	VERMILION SNAPPER	3,125	1,198	1,223	39.1%	1,102	92.0%
8835430601	RED PORGY	960	53	307	32.0%	53	100.0%
8835520101	ATLANTIC SPADEFISH	19	0	6	31.6%	0	-
8835280804	BANDED RUDDERFISH	26	0	8	30.8%	0	-
8835260101	COBIA	46	3	14	30.4%	0	0.0%
8837010104	GREAT BARRACUDA	23	6	7	30.4%	3	50.0%
8857030302	GULF FLOUNDER	220	26	65	29.5%	25	96.2%
8835280306	BLUE RUNNER	724	1	197	27.2%	1	100.0%
8835220201	TILEFISH	420	420	85	20.2%	85	20.2%
8835280803	ALMACO JACK	530	10	95	17.9%	10	100.0%
6182010101	CARIBBEAN SPINY LOBSTER	3,465	0	571	16.5%	0	-
8836010102	WHITE MULLET	295	7	48	16.3%	7	100.0%
8860020201	GRAY TRIGGERFISH	2,059	226	309	15.0%	172	76.1%
8835250101	BLUEFISH	369	101	45	12.2%	29	28.7%
8835280901	FLORIDA POMPAÑO	419	0	50	11.9%	0	-
8835400117	SAILORS CHOICE	26	13	2	7.7%	0	0.0%
8835430602	RED PORGY (SEDECIM)	215	14	14	6.5%	13	92.9%
8850030102	LITTLE TUNNY	175	0	11	6.3%	0	-
8835400101	TOMTATE	75	45	4	5.3%	4	8.9%
8850030502	ATLANTIC SPANISH MACKEREL	1,295	0	68	5.3%	0	-
8835390203	STRIPED MOJARRA	136	17	6	4.4%	0	0.0%
8835430301	SHEEPSHEAD	409	17	18	4.4%	0	0.0%
8835380101	TRIPLETAIL	30	27	1	3.3%	1	3.7%
8835280303	CREVALLE JACK	399	0	12	3.0%	0	-
8850030503	CERO	149	2	4	2.7%	2	100.0%
8850030501	KING MACKEREL	928	43	10	1.1%	3	7.0%
8857030304	SOUTHERN FLOUNDER	961	75	2	0.2%	2	2.7%
8738010101	LADYFISH	34	4	0	0.0%	0	0.0%
8747010404	YELLOWFIN MENHADEN	34	0	0	0.0%	0	-
8777180202	HARDHEAD CATFISH	3	0	0	0.0%	0	-
8835280401	ATLANTIC BUMPER	37	0	0	0.0%	0	-
8835280601	BIGEYE SCAD	69	0	0	0.0%	0	-
8835280701	LOOKDOWN	271	0	0	0.0%	0	-

8835280705	ATLANTIC MOONFISH	10	0	0	0.0%	0	-
8835281202	ROUND SCAD	4	0	0	0.0%	0	-
8835281301	RAINBOW RUNNER	4	0	0	0.0%	0	-
8835360104	SCHOOLMASTER	1	1	0	0.0%	0	0.0%
8835390105	FLAGFIN MOJARRA	2	0	0	0.0%	0	-
8835390204	IRISH POMPAÑO	310	83	0	0.0%	0	0.0%
8835390301	YELLOWFIN MOJARRA	7	4	0	0.0%	0	0.0%
8835400106	CAESAR GRUNT	2	2	0	0.0%	0	0.0%
8835400108	FRENCH GRUNT	3	3	0	0.0%	0	0.0%
8835400111	COTTONWICK	1	1	0	0.0%	0	0.0%
8835400116	STRIPED GRUNT	5	5	0	0.0%	0	0.0%
8835430201	PINFISH	10	0	0	0.0%	0	-
8835430302	SEA BREAM	43	28	0	0.0%	0	0.0%
8835430401	SPOTTAIL PINFISH	5	2	0	0.0%	0	0.0%
8835440104	WEAKFISH	21	1	0	0.0%	0	0.0%
8835440401	SPOT	23	2	0	0.0%	0	0.0%
8835440601	SOUTHERN KINGFISH	20	0	0	0.0%	0	-
8835440602	GULF KINGFISH	27	7	0	0.0%	0	0.0%
8835440701	ATLANTIC CROAKER	26	23	0	0.0%	0	0.0%
8835440801	BLACK DRUM	7	6	0	0.0%	0	0.0%
8835510102	BERMUDA CHUB	8	0	0	0.0%	0	-
8837010103	GUAGUANCHE	5	1	0	0.0%	0	0.0%
8850030101	SKIPJACK TUNA	2	0	0	0.0%	0	-
8850030202	ATLANTIC BONITO	45	0	0	0.0%	0	-
8850030601	WAHOO	7	1	0	0.0%	0	0.0%
8851030103	BUTTERFISH	2	0	0	0.0%	0	-
8851030106	HARVESTFISH	1	0	0	0.0%	0	-
8860020103	UNICORN FILEFISH	1	0	0	0.0%	0	-
8860020104	SCRAWLED FILEFISH	8	0	0	0.0%	0	-
8860020202	QUEEN TRIGGERFISH	2	0	0	0.0%	0	-
Total		45,671	18,950	27,293	59.8%	16,846	88.9%

Appendix 1.4. A summary of Trip Interview Program sampling for the Gulf Coast of Florida by FWC field lab locations (AP = Apalachicola, CK = Cedar Key, SP = Saint Petersburg, PN = Pensacola, KY = Florida Keys). Taxa are shown in order of decreasing abundance and are representative of the entire state with some species exclusive to either coast. AP, CK, CH, and SP are all completely or partially funded by NFWF.

NODC Code	Common Name	AP		CK		SP		CH		PN		KY	
		Number Measured	Hard Parts	Number Measured	Hard Parts	Number Measured	Hard Parts	Number Measured	Hard Parts	Number Measured	Hard Parts	Number Measured	Hard Parts
2080	LIONFISH	.	.	.	.	.	.	.	.	6	0	84	7
6182010101	CARIBBEAN SPINY LOBSTER	.	.	.	.	.	.	.	.	.	.	571	0
6189021301	FLORIDA STONE CRAB	.	.	.	.	.	.	.	.	.	.	5,445	0
8741120101	CONGER EEL	.	.	.	.	1	0	.	.	.	.	.	.
8791031001	RED HAKE	.	.	.	.	.	.	1	1	.	.	.	.
8791031007	SOUTHERN HAKE	.	.	.	.	1	1	.	.	.	.	.	.
8792010401	BEARDED BROTLA	.	.	.	.	4	4	.	.	5	4	.	.
8809010101	BEARDFISH	.	.	.	.	.	.	.	.	.	.	1	1
8810050101	RED BREEM	.	.	.	.	1	1	.	.	.	.	.	.
8810080101	SQUIRRELFISH	2	2	1	1	2	2	2	2	5	0	.	.
8826010301	BLACKBELLY ROSEFISH	.	.	.	.	10	10	1	1	.	.	.	.
8826010402	SPINYCHEEK SCORPIONFISH	.	.	.	.	23	23	1	1	2	0	.	.
8826010503	LONGSPINE SCORPIONFISH	1	1	.	.	.	.	.	.	.	.	.	.
8835020301	BLACK SEA BASS	.	.	27	27	5	5	.	.	13	13	.	.
8835020402	ROCK HIND	4	4	4	3	16	16	1	1	5	5	.	.
8835020404	SPECKLED HIND	23	18	1	1	273	265	3	3	1	1	10	9
8835020405	YELLOWEDGE GROUPER	74	74	.	.	510	508	46	44	3	3	22	20
8835020406	RED HIND	.	.	.	.	.	.	1	1	.	.	.	.
8835020408	RED GROUPER	468	453	520	507	1,909	1,859	426	402	176	169	83	60
8835020409	MISTY GROUPER	.	.	.	.	1	1	.	.	.	.	1	1
8835020410	WARSAW GROUPER	1	1	.	.	25	21	.	.	1	0	.	.
8835020411	SNOWY GROUPER	35	35	.	.	391	390	14	13	6	6	57	41
8835020439	GRAYSBY	.	.	10	10	9	9	.	.	1	1	.	.
8835020440	MARbled GROUPER	.	.	.	.	1	0	.	.	.	.	.	.
8835020441	MUTTON HAMLET	.	.	.	.	5	5	.	.	.	.	.	.
8835020501	GAG	214	206	324	312	1,627	1,601	4	4	62	56	1	0
8835020502	BLACK GROUPER	.	.	.	.	125	112	.	.	.	.	187	79
8835020504	YELLOWMOUTH GROUPER	.	.	.	.	3	3	.	.	.	.	.	.
8835020505	SCAMP	31	29	103	103	1,236	1,219	19	17	81	63	9	8
8835020506	YELLOWFIN GROUPER	.	.	.	.	1	1	.	.	.	.	.	.
8835021101	SPANISH FLAG	.	.	.	.	.	.	.	.	.	.	1	1
8835021201	LONGTAIL BASS	.	.	.	.	4	4	1	1	1	1	.	.
8835021701	CREOLE-FISH	.	.	4	4	1	1	.	.	1	0	.	.
8835170101	BIGEYE	.	.	.	.	.	.	.	.	1	0	1	0
8835170201	SHORT BIGEYE	2	2	2	2	.	.	.	.	2	0	.	.
8835220102	BLACKLINE TILEFISH	.	.	.	.	1	1	.	.	.	.	.	.
8835220104	BLUELINE TILEFISH	.	.	.	.	142	132	11	8	.	.	152	53
8835220201	TILEFISH	13	13	.	.	66	66	2	2	.	.	4	4
8835220301	SAND TILEFISH	.	.	3	2	4	0	.	.	.	.	.	.
8835250101	BLUEFISH	.	.	.	.	.	.	45	29	.	.	.	.
8835260101	COBIA	.	.	.	.	4	0	.	.	3	0	7	0
8835280201	AFRICAN POMPAÑO	.	.	.	.	2	0	.	.	.	.	.	.
8835280202	AFRICAN POMPAÑO	.	.	.	.	5	0	6	0	.	.	1	1
8835280301	YELLOW JACK	.	.	.	.	.	.	.	.	.	.	46	7
8835280303	CREVALLE JACK	.	.	.	.	.	.	12	0	.	.	.	.
8835280304	HORSE-EYE JACK	.	.	.	.	.	.	.	.	.	.	10	0
8835280306	BLUE RUNNER	.	.	.	.	.	.	.	.	.	.	197	1
8835280801	GREATER AMBERJACK	.	.	.	.	1	1	.	.	2	0	91	26
8835280803	ALMACO JACK	.	.	.	.	1	1	.	.	75	0	19	9
8835280804	BANDED RUDDERFISH	.	.	.	.	.	.	.	.	8	0	.	.
8835280901	FLORIDA POMPAÑO	.	.	.	.	.	.	.	.	50	0	.	.
8835280902	PERMIT	.	.	1	0	.	.	.	.	.	.	.	.
8835290101	DOLPHIN	.	.	.	.	2	0	.	.	.	.	84	0
8835360101	CUBERA SNAPPER	.	.	.	.	3	3	.	.	.	.	5	4
8835360102	GRAY SNAPPER	40	40	131	127	182	173	65	62	101	90	127	60
8835360103	MUTTON SNAPPER	4	4	.	.	185	179	6	6	1	1	117	64
8835360106	BLACKFIN SNAPPER	.	.	.	.	42	42	.	.	2	2	21	6
8835360107	RED SNAPPER	588	587	1,248	1,236	862	850	94	92	819	807	80	70
8835360109	DOG SNAPPER	.	.	.	.	6	6	.	.	.	.	4	4
8835360110	MAHOGANY SNAPPER	.	.	.	.	.	.	.	.	.	.	2	2
8835360111	CARIBBEAN RED SNAPPER	.	.	.	.	1	1	.	.	.	.	.	.
8835360112	LANE SNAPPER	25	25	92	92	257	256	166	165	19	19	.	.
8835360113	SILK SNAPPER	.	.	.	.	28	27	.	.	.	.	118	57
8835360301	QUEEN SNAPPER	.	.	.	.	106	102	3	3	.	.	.	.
8835360401	YELLOWTAIL SNAPPER	.	.	1	1	28	28	74	73	1	1	1,366	326
8835360501	VERMILION SNAPPER	253	253	228	228	63	62	85	82	478	437	116	40
8835360701	WENCHMAN	.	.	.	.	1	1	.	.	.	.	.	.
8835360703	CARDINAL SNAPPER	.	.	.	.	5	5	.	.	.	.	.	.
8835380101	TRIPLETAIL	.	.	.	.	1	1	.	.	.	.	.	.
8835390203	STRIPED MOJARRA	.	.	.	.	.	.	6	0	.	.	.	.
8835400101	TOMTATE	.	.	.	.	.	.	4	4	.	.	.	.
8835400102	WHITE GRUNT	.	.	4	4	3	3	101	100	.	.	55	48
8835400103	MARGATE	.	.	.	.	11	11	.	.	.	.	22	1
8835400113	BLUESTRIPE GRUNT	.	.	.	.	.	.	.	.	.	.	10	10
8835400117	SAILORS CHOICE	.	.	.	.	.	.	.	.	.	.	2	0
8835400304	BLACK MARGATE	.	.	.	.	.	.	.	.	.	.	1	1
8835430301	SHEEPSHEAD	.	.	.	.	.	.	10	0	8	0	.	.
8835430502	JOLTHEAD PORGY	.	.	.	.	136	20	1	0	.	.	25	0

8835430505	WHITEBONE PORGY	.	.	.	.	.	.	.	.	1	0	.	.
8835430506	KNOBBED PORGY	.	.	1	0	1	0	2	0	5	0	47	0
8835430508	LITTLEHEAD PORGY	.	.	.	.	2	0	1	0	3	0	13	1
8835430510	SHEEPSHEAD PORGY	.	.	1	0	1	0	.	.	.	.	.	.
8835430601	RED PORGY	.	.	29	21	31	23	9	8	237	0	1	1
8835430602	RED PORGY (SEDECIM)	.	.	14	13	.	.	.	.	.	.	.	.
8835440102	SPOTTED SEATROUT	.	.	.	.	.	.	11	11	.	.	.	.
8835520101	ATLANTIC SPADEFISH	.	.	.	.	.	.	6	0	.	.	.	.
8836010101	STRIPED MULLET	.	.	.	.	.	.	292	266	771	0	.	.
8836010102	WHITE MULLET	.	.	.	.	.	.	7	7	41	0	.	.
8837010104	GREAT BARRACUDA	.	.	.	.	3	3	.	.	.	.	4	0
8839010901	HOGFISH	.	.	7	7	6	0	12	0	5	0	45	0
8850010401	OILFISH	.	.	.	.	3	1	.	.	.	.	.	.
8850030102	LITTLE TUNNY	.	.	.	.	.	.	.	.	8	0	3	0
8850030404	BLACKFIN TUNA	.	.	.	.	5	0	.	.	2	0	1	0
8850030501	KING MACKEREL	.	.	2	0	.	.	.	.	2	0	6	3
8850030502	ATLANTIC SPANISH MACKEREL	.	.	1	0	.	.	5	0	61	0	1	0
8850030503	CERO	.	.	.	.	.	.	.	.	.	.	4	2
8851010201	BARRELFISH	.	.	.	.	3	2	.	.	.	.	14	12
8851010202	BLACK DRIFTFISH	.	.	.	.	10	10	.	.	.	.	.	.
8857030302	GULF FLOUNDER	.	.	.	.	.	.	1	1	64	24	.	.
8857030304	SOUTHERN FLOUNDER	.	.	.	.	.	.	.	.	2	2	.	.
8860020101	ORANGE FILEFISH	.	.	.	.	1	0	.	.	.	.	.	.
8860020201	GRAY TRIGGERFISH	.	.	22	21	152	149	2	2	133	0	.	.
8860020502	OCEAN TRIGGERFISH	.	.	.	.	.	.	.	.	.	.	56	0
8861010101	SMOOTH PUFFER	.	.	.	.	1	0	.	.	.	.	.	.
Total		1,778	1,747	2,781	2,722	8,551	8,220	1,559	1,412	3,274	1,705	9,350	1,040

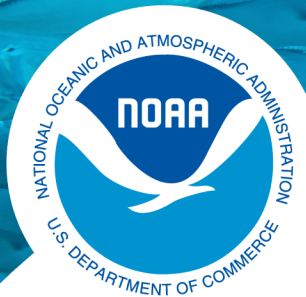
Appendix 1.5. A comparison by taxa sampled based on the relative contribution from NFWF funded sampling effort at Gulf locations. Taxa are ranked by percentage of measurements from the Gulf Coast (NFWF funded) from the entire State (Gulf and Atlantic coasts), this includes invertebrates as well as vertebrates. GEBF contribution is shown in terms of estimated numbers expressed as a percentage of State totals.

NODC Code	Common Name	Statewide Total		Gulf Coast			
		Number Measured	Hard Parts	Number Measured	% Measured	Hard Parts	% Measured
8791031001	RED HAKE	1	1	1	100.0%	1	100.0%
8791031007	SOUTHERN HAKE	4	4	4	100.0%	4	100.0%
8792010401	BEARDED BROTLA	16	15	16	100.0%	15	100.0%
8809010101	BEARDFISH	2	2	2	100.0%	2	100.0%
8810050101	RED BREAM	18	18	18	100.0%	18	100.0%
8826010301	BLACKBELLY ROSEFISH	55	53	55	100.0%	53	100.0%
8826010402	SPINYCHEEK SCORPIONFISH	57	54	57	100.0%	54	100.0%
8826010503	LONGSPINE SCORPIONFISH	11	11	11	100.0%	11	100.0%
8826011101	ATLANTIC THORNYHEAD	1	1	1	100.0%	1	100.0%
8835020402	ROCK HIND	92	89	92	100.0%	89	100.0%
8835020404	SPECKLED HIND	786	751	786	100.0%	751	100.0%
8835020406	RED HIND	13	12	13	100.0%	12	100.0%
8835020438	CONEY	2	2	2	100.0%	2	100.0%
8835020440	MARBLED GROUPE	3	2	3	100.0%	2	100.0%
8835020441	MUTTON HAMLET	5	5	5	100.0%	5	100.0%
8835020504	YELLOWMOUTH GROUPE	9	9	9	100.0%	9	100.0%
8835020506	YELLOWFIN GROUPE	3	3	3	100.0%	3	100.0%
8835021002	SAND PERCH	5	5	5	100.0%	5	100.0%
8835021101	SPANISH FLAG	1	1	1	100.0%	1	100.0%
8835021701	CREOLE-FISH	14	12	14	100.0%	12	100.0%
8835022801	WRECKFISH	8	3	8	100.0%	3	100.0%
8835170101	BIGEYE	6	3	5	83.3%	3	100.0%
8835170201	SHORT BIGEYE	8	5	8	100.0%	5	100.0%
8835220301	SAND TILEFISH	26	4	23	88.5%	4	100.0%
8835280202	AFRICAN POMPAO	23	4	22	95.7%	4	100.0%
8835280301	YELLOW JACK	151	10	63	41.7%	10	100.0%
8835280306	BLUE RUNNER	2,691	1	335	12.4%	1	100.0%
8835280803	ALMACO JACK	1,158	22	215	18.6%	22	100.0%
8835360106	BLACKFIN SNAPPER	189	172	189	100.0%	172	100.0%
8835360110	MAHOGANY SNAPPER	2	2	2	100.0%	2	100.0%
8835360111	CARIBBEAN RED SNAPPER	3	3	3	100.0%	3	100.0%
8835360703	CARDINAL SNAPPER	18	18	18	100.0%	18	100.0%
8835440603	NORTHERN KINGFISH	3	2	3	100.0%	2	100.0%
8835441208	BLACKBAR DRUM	1	1	1	100.0%	1	100.0%
8836010102	WHITE MULLET	1,171	71	166	14.2%	71	100.0%
8850010401	OILFISH	9	4	9	100.0%	4	100.0%
8851010201	BARRELFISH	181	101	181	100.0%	101	100.0%
8851010202	BLACK DRIFTFISH	10	10	10	100.0%	10	100.0%
8835020408	RED GROUPE	14,895	13,734	14,826	99.5%	13,713	99.8%
8835020505	SCAMP	4,731	4,477	4,660	98.5%	4,468	99.8%
8835020501	GAG	7,067	6,531	6,698	94.8%	6,512	99.7%
8835360301	QUEEN SNAPPER	275	258	273	99.3%	256	99.2%
8835360113	SILK SNAPPER	252	172	250	99.2%	170	98.8%
8835020439	GRAYSBY	54	51	52	96.3%	50	98.0%
8835020502	BLACK GROUPE	738	531	727	98.5%	520	97.9%
8835360112	LANE SNAPPER	1,856	1,846	1,799	96.9%	1,793	97.1%
8835020405	YELLOWEDGE GROUPE	2,193	2,183	2,123	96.8%	2,113	96.8%
8850030502	ATLANTIC SPANISH MACKEREL	5,456	26	277	5.1%	25	96.2%
2080	LIONFISH	283	48	276	97.5%	46	95.8%

8835360107	RED SNAPPER	10,708	10,501	10,191	95.2%	10,058	95.8%
8835020410	WARSAW GROUPER	57	46	55	96.5%	44	95.7%
8835360101	CUBERA SNAPPER	24	21	23	95.8%	20	95.2%
8835360109	DOG SNAPPER	21	21	20	95.2%	20	95.2%
8835400102	WHITE GRUNT	879	840	808	91.9%	792	94.3%
8836010101	STRIPED MULLET	7,239	3,071	5,730	79.2%	2,861	93.2%
8835430602	RED PORGY (SEDECIM)	215	14	14	6.5%	13	92.9%
8835400103	MARGATE	65	27	63	96.9%	25	92.6%
8835021201	LONGTAIL BASS	12	12	11	91.7%	11	91.7%
8860020201	GRAY TRIGGERFISH	5,278	601	876	16.6%	547	91.0%
8835020411	SNOWY GROUPER	1,231	1,179	1,110	90.2%	1,071	90.8%
8835360103	MUTTON SNAPPER	1,470	671	752	51.2%	608	90.6%
8835220104	BLUELINE TILEFISH	773	517	719	93.0%	466	90.1%
8835360102	GRAY SNAPPER	3,215	2,195	2,357	73.3%	1,957	89.2%
8835280801	GREATER AMBERJACK	262	84	200	76.3%	74	88.1%
8835440102	SPOTTED SEATROUT	161	40	36	22.4%	35	87.5%
8835430601	RED PORGY	3,393	351	780	23.0%	303	86.3%
8835360501	VERMILION SNAPPER	8,627	3,440	3,128	36.3%	2,939	85.4%
8835220102	BLACKLINE TILEFISH	7	6	6	85.7%	5	83.3%
8835360701	WENCHMAN	13	11	9	69.2%	9	81.8%
8835020301	BLACK SEA BASS	450	201	160	35.6%	160	79.6%
8835430502	JOLTHEAD PORGY	502	151	465	92.6%	116	76.8%
8810080101	SQUIRRELFISH	50	40	35	70.0%	30	75.0%
8835020409	MISTY GROUPER	5	4	3	60.0%	3	75.0%
8860020502	OCEAN TRIGGERFISH	138	19	114	82.6%	13	68.4%
8857030302	GULF FLOUNDER	679	135	255	37.6%	89	65.9%
8835430508	LITTLEHEAD PORGY	77	10	73	94.8%	6	60.0%
8835360104	SCHOOLMASTER	2	2	1	50.0%	1	50.0%
8835400113	BLUESTRIPED GRUNT	28	26	13	46.4%	13	50.0%
8835400304	BLACK MARGATE	8	8	4	50.0%	4	50.0%
8850030503	CERO	368	6	15	4.1%	3	50.0%
8835430510	SHEEPSHEAD PORGY	8	5	4	50.0%	2	40.0%
8835440801	BLACK DRUM	80	15	30	37.5%	6	40.0%
8835360401	YELLOWTAIL SNAPPER	4,967	2,493	3,203	64.5%	850	34.1%
8835220201	TILEFISH	892	869	275	30.8%	272	31.3%
8839010901	HOGFISH	300	40	242	80.7%	12	30.0%
8837010104	GREAT BARRACUDA	114	21	12	10.5%	6	28.6%
8835250101	BLUEFISH	1,110	471	167	15.0%	107	22.7%
8835400117	SAILORS CHOICE	63	46	14	22.2%	10	21.7%
8835260101	COBIA	155	5	46	29.7%	1	20.0%
8835430506	KNOBBED PORGY	138	5	122	88.4%	1	20.0%
8850030501	KING MACKEREL	3,171	222	134	4.2%	40	18.0%
8835380101	TRIPLETAIL	92	85	11	12.0%	11	12.9%
8857030304	SOUTHERN FLOUNDER	2,757	316	40	1.5%	32	10.1%
8835400101	TOMTATE	141	100	9	6.4%	4	4.0%
8835430301	SHEEPSHEAD	1,337	88	190	14.2%	2	2.3%
8738010101	LADYFISH	185	93	0	0.0%	0	0.0%
8835280804	BANDED RUDDERFISH	90	2	61	67.8%	0	0.0%
8835390105	FLAGFIN MOJARRA	11	7	0	0.0%	0	0.0%
8835390203	STRIPED MOJARRA	419	193	6	1.4%	0	0.0%
8835390204	IRISH POMPAÑO	1,574	908	0	0.0%	0	0.0%
8835390301	YELLOWFIN MOJARRA	35	20	0	0.0%	0	0.0%
8835400106	CAESAR GRUNT	7	2	5	71.4%	0	0.0%
8835400108	FRENCH GRUNT	7	7	0	0.0%	0	0.0%
8835400111	COTTONWICK	1	1	0	0.0%	0	0.0%
8835400116	STRIPED GRUNT	5	5	0	0.0%	0	0.0%
8835400201	PIGFISH	1	1	0	0.0%	0	0.0%
8835400306	PORKFISH	4	4	0	0.0%	0	0.0%
8835430201	PINFISH	73	11	0	0.0%	0	0.0%

8835430302	SEA BREAM	65	43	0	0.0%	0	0.0%
8835430401	SPOTTAIL PINFISH	15	9	0	0.0%	0	0.0%
8835440104	WEAKFISH	36	3	0	0.0%	0	0.0%
8835440401	SPOT	330	101	20	6.1%	0	0.0%
8835440601	SOUTHERN KINGFISH	24	2	0	0.0%	0	0.0%
8835440602	GULF KINGFISH	66	13	0	0.0%	0	0.0%
8835440701	ATLANTIC CROAKER	84	46	0	0.0%	0	0.0%
8835441101	SAND DRUM	48	47	0	0.0%	0	0.0%
8835510102	BERMUDA CHUB	13	4	0	0.0%	0	0.0%
8837010102	NORTHERN SENNET	7	7	0	0.0%	0	0.0%
8837010103	GUAGUANCHE	16	3	0	0.0%	0	0.0%
8850030601	WAHOO	36	2	13	36.1%	0	0.0%
6182010101	CARIBBEAN SPINY LOBSTER	12,852	0	4,391	34.2%	0	-
6182020203	SPANISH SLIPPER LOBSTER	3	0	3	100.0%	0	-
6189021301	FLORIDA STONE CRAB	21,555	0	18,861	87.5%	0	-
8708020301	ATLANTIC SHARPNOSE SHARK	1	0	0	0.0%	0	-
8741120101	CONGER EEL	3	0	3	100.0%	0	-
8747010404	YELLOWFIN MENHADEN	136	0	0	0.0%	0	-
8747010701	ATLANTIC THREAD HERRING	1	0	0	0.0%	0	-
8777180101	GAFFTOPSAIL CATFISH	5	0	5	100.0%	0	-
8777180202	HARDHEAD CATFISH	80	0	0	0.0%	0	-
8835170102	GLASSEYE SNAPPER	21	0	21	100.0%	0	-
8835220105	GOLDFACE TILEFISH	1	0	1	100.0%	0	-
8835280201	AFRICAN POMPAÑO	2	0	2	100.0%	0	-
8835280303	CREVALLE JACK	2,322	0	67	2.9%	0	-
8835280304	HORSE-EYE JACK	68	0	10	14.7%	0	-
8835280308	BAR JACK	1	0	0	0.0%	0	-
8835280401	ATLANTIC BUMPER	66	0	0	0.0%	0	-
8835280501	LEATHERJACKET	4	0	0	0.0%	0	-
8835280601	BIGEYE SCAD	79	0	0	0.0%	0	-
8835280701	LOOKDOWN	2,348	0	0	0.0%	0	-
8835280705	ATLANTIC MOONFISH	69	0	0	0.0%	0	-
8835280901	FLORIDA POMPAÑO	1,176	0	71	6.0%	0	-
8835280902	PERMIT	17	0	2	11.8%	0	-
8835281202	ROUND SCAD	4	0	0	0.0%	0	-
8835281301	RAINBOW RUNNER	11	0	2	18.2%	0	-
8835290101	DOLPHIN	690	0	303	43.9%	0	-
8835430501	GRASS PORGY	2	0	2	100.0%	0	-
8835430505	WHITEBONE PORGY	4	0	1	25.0%	0	-
8835440106	SAND SEATROUT	1	0	0	0.0%	0	-
8835441206	CUBBYU	1	0	1	100.0%	0	-
8835520101	ATLANTIC SPADEFISH	108	0	48	44.4%	0	-
8839010301	SPOTFIN HOGFISH	1	0	1	100.0%	0	-
8839010709	PUDDINGWIFE	1	0	0	0.0%	0	-
8839030101	BLUE PARROTFISH	3	0	3	100.0%	0	-
8839030104	RAINBOW PARROTFISH	4	0	4	100.0%	0	-
8839030403	REDTAIL PARROTFISH	10	0	10	100.0%	0	-
8839030406	STOPLIGHT PARROTFISH	2	0	2	100.0%	0	-
8849010102	DOCTORFISH	4	0	4	100.0%	0	-
8849010103	BLUE TANG	2	0	2	100.0%	0	-
8850020201	ATLANTIC CUTLASSFISH	13	0	0	0.0%	0	-
8850030101	SKIPJACK TUNA	2	0	0	0.0%	0	-
8850030102	LITTLE TUNNY	581	0	20	3.4%	0	-
8850030202	ATLANTIC BONITO	45	0	0	0.0%	0	-
8850030404	BLACKFIN TUNA	34	0	25	73.5%	0	-
8851030103	BUTTERFISH	2	0	0	0.0%	0	-
8851030106	HARVESTFISH	2	0	0	0.0%	0	-
8860020101	ORANGE FILEFISH	1	0	1	100.0%	0	-
8860020103	UNICORN FILEFISH	8	0	0	0.0%	0	-

8860020104	SCRAWLED FILEFISH	9	0	0	0.0%	0	-
8860020202	QUEEN TRIGGERFISH	21	0	0	0.0%	0	-
8861010101	SMOOTH PUFFER	1	0	1	100.0%	0	-
8861010102	OCEANIC PUFFER	1	0	1	100.0%	0	-
Total		151,368	61,908	90,818	60.0%	54,804	88.5%



NOAA
FISHERIES

Integration of GRFS Intercept and APAIS

John Foster
Florida Gulf Reef Fish Survey
Review Workshop

February 6, 2018

Integration

- Basic approach
- Sample design
- Data considerations
- Estimation

Basic approach

- GRFS intercept sample drawn as add-on sample in select APAIS strata
- APAIS data screened for GRFS eligibility
- GRFS and eligible APAIS data used in standard design-based weighted estimation

Sample Design - APAIS

- Complex
- Frame
 - PSU: site-cluster, date, 6-hour time interval
- Stratification
 - Temporal: month, kind-of-day, time period
 - Spatial: sub-region, state, sub-state region
 - Fishing attribute: site group

Sample Design – APAIS Site Group Strata

- Defined using fishing pressures (activity levels) in different modes of fishing
 - Shore
 - Private boat
 - Charter boat
 - **Offshore**

Sample Design – Offshore Site Group

- Sites designated as offshore
 - General offshore fishing activity
 - Fishing activity for key regionally specific offshore species
- All offshore site group PSU's are single-site clusters
- GRFS sample units drawn from offshore site group strata

Sample Design – APAIS Sample Selection

- PSU's drawn using a form of rejective sampling
 - Basic selection: stratified probability proportional to size without replacement for PSU's
 - PSU sizes derived from expected fishing pressures estimated by State partners
 - Rejection criteria based on per-day sampler availability constraints
 - Nominal PPS inclusion probabilities adjusted to account for effects of rejective sampling

Sample Design – GRFS Samples

- Total sample sizes for offshore strata are sums of APAIS base and GRFS add-on sample sizes
- Total samples from offshore strata drawn using APAIS draw process
- GRFS samples identified at random (srswor) from all offshore strata
- Remaining samples become APAIS base samples for the offshore strata

Sample Design – GRFS Sample Weighting

- Generally follows APAIS sample weighting
- Primary stage weights calculated as inverse of inclusion probabilities for selected PSU's
- Secondary stage
 - GRFS eligible trips returning to selected PSU
 - Secondary stage weights calculated as inverse of within PSU sampling fraction of GRFS trips
- Final weights calculated as product of primary and secondary stage weights

Data Considerations

- Applying GRFS eligibility to APAIS data
- Data for GRFS effort survey coverage adjustment
- Potential for using GRFS intercept data in APAIS estimation

GRFS Eligibility in APAIS Data

- APAIS covers all marine recreational fishing trips
- Two ways to be GRFS eligible
 - GRFS species targeted on trip
 - GRFS species caught on trip
- APAIS questionnaire has primary and secondary target species questions
- APAIS catch data

GRFS Eligibility in APAIS Data

- APAIS intercepts individual angler-trips
- Angler-trips from same boat/fishing party linked in APAIS data
- GRFS eligibility for APAIS data determined at boat level
 - All angler-trips marked eligible if any angler-trips within the boat are eligible

GRFS Eligibility in APAIS Data

- APAIS data limited to GRFS eligible trips
- No adjustment made to APAIS secondary stage weights
 - Do not have separate counts of total angler-trips by eligibility status

$$\bullet \frac{N_{psu_e}}{n_{psu_e}} = \frac{N_{psu}}{n_{psu}} * \frac{n_{psu_e}/n_{psu}}{n_{psu_e}/n_{psu}} = \frac{N_{psu}}{n_{psu}}$$

GRFS effort survey coverage adjustment

- GRFS effort survey frame covers anglers with “GRFS license”
- GRFS base effort estimates adjusted to account for off-frame effort
- Data for adjustment calculation only collected on GRFS intercept assignments, would need to add question(s) to APAIS questionnaire

GRFS intercept data in APAIS estimation

- Integration works one way: APAIS data used in GRFS estimation
- Would like to incorporate GRFS intercept data into APAIS estimation
 - Ineligible trips counted on GRFS assignments
 - No full interviews for ineligible trips
- Seeking recommendations
 - Nonresponse approach?
 - Subsampling?

GRFS Total Effort and Total Catch Estimation

- Similar approach to MRIP estimation
- Estimation components from intercept survey data
 - Catch rates (GRFS intercept and APAIS data)
 - Coverage adjustment for GRFS effort survey (GRFS intercept data only)
- Total effort estimation
- Total catch estimation

GRFS Estimation – Estimation Components

- Estimation coded in SAS using proc surveymeans
- Design aspects specified (strata identifiers, PSU identifiers)
- Final stage sample weights specified
- Estimation domains, D , specified
 - Year, Month
 - GRFS area: Federal waters, State waters (territorial seas + inland)
- Linearization used for variances of estimation components

GRFS Estimation – Catch Rates

- Calculated as weighted means within domains:

$$\hat{\bar{y}}_D = \frac{\sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) y_{hij}}{\sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j)}$$

- $\hat{\bar{y}}_D$ = estimated mean catch per angler-trip (element) in domain D
- H = total count of strata
- n_h = total count of PSU in stratum h
- m_{hi} = total count of sampled elements in PSU n_h
- w_{hij} = sample weight for element hij
- $I_D(h, i, j)$ = indicator variable for element hij being in D
- y_{hij} = catch for element hij
- Catch rates estimated by species and catch type (e.g., landings, releases)
- Notation adapted from SAS Documentation

GRFS Estimation – Catch Rates

- Calculations for estimated variances of weighted means within domains:

$$\text{var}(\hat{y}_D) = \sum_{h=1}^H \text{var}_h(\hat{y}_D)$$

$$\begin{aligned} &\text{var}_h(\hat{y}_D) \\ &= \frac{n_h(1 - f_h)}{n_h - 1} \sum_{i=1}^{n_h} \left(\frac{\sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) (y_{hij} - \hat{y}_D)}{\sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j)} \right. \\ &\quad \left. - \frac{\sum_{i=1}^{n_h} \left(\sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) (y_{hij} - \hat{y}_D) \right) / \sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j)}{n_h} \right)^2 \end{aligned}$$

- $\text{var}(\hat{y}_D)$ = estimated variance for $\hat{y}_D$
- $\text{var}_h(\hat{y}_D)$ = contribution of estimated variance for $\hat{y}_D$ from stratum h
- Notation adapted from SAS Documentation

GRFS Estimation – Effort Svy Coverage Adj

- Calculated as weighted ratios within domains:

$$\hat{r}_D = \frac{\sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) t_{hij}}{\sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) o_{hij}}$$

- $\hat{r}_D$ = estimated ratio of total GRFS trips to GRFS effort survey on-frame trips in domain D
- t_{hij} = angler-trip indicator, always equal to 1
- o_{hij} = on-frame angler-trip indicator, equal to 1 for on-frame or 0 for off-frame
- Notation adapted from SAS Documentation

GRFS Estimation – Effort Svy Coverage Adj

- Calculations for estimated variances of weighted ratios within domains :

$$\text{var}(\hat{r}_D) = \sum_{h=1}^H \text{var}_h(\hat{r}_D)$$

$$\begin{aligned} & \text{var}_h(\hat{y}_D) \\ &= \frac{n_h(1 - f_h)}{n_h - 1} \sum_{i=1}^{n_h} \left(\frac{\sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) (t_{hij} - o_{hij} \hat{r}_D)}{\sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) o_{hij}} \right. \\ & \quad \left. - \frac{\sum_{i=1}^{n_h} \left(\sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) (t_{hij} - o_{hij} \hat{r}_D) \right) / \sum_{h=1}^H \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} I_D(h, i, j) o_{hij}}{n_h} \right)^2 \end{aligned}$$

- $\text{var}(\hat{r}_D)$ = estimated variance for $\hat{r}_D$
- $\text{var}_h(\hat{r}_D)$ = contribution of estimated variance for $\hat{r}_D$ from stratum h
- Notation adapted from SAS Documentation

GRFS Estimation – Total Effort

- Basic calculation:

$$\hat{E}_D = \hat{G}_D * \hat{r}_D$$

- $\hat{E}_D$ = total GRFS effort in domain D
- $\hat{G}_D$ = base GRFS effort in D
 - Estimation details covered in separate presentation
- $\hat{r}_D$ = coverage adjustment in D

GRFS Estimation – Total Effort

- Variance approximation uses Goodman's formula for product:

$$\text{var}(\hat{E}_D) = \text{var}(\hat{G}_D) * \hat{r}_D^2 + \hat{G}_D^2 * \text{var}(\hat{r}_D) - \text{var}(\hat{G}_D) * \text{var}(\hat{r}_D)$$

- $\text{var}(\hat{E}_D)$ = variance of total GRFS effort estimate in domain D
- $\text{var}(\hat{G}_D)$ = variance of base GRFS effort estimate in D
- $\text{var}(\hat{r}_D)$ = variance of coverage adjustment in D
- Consistent with MRIP estimation approach

GRFS Estimation – Total Catch

- Basic calculation:

$$\hat{Y}_D = \hat{y}_D * \hat{E}_D$$

- $\hat{Y}_D$ = total GRFS catch in domain D
 - $\hat{y}_D$ = mean catch per GRFS angler-trip in D
 - $\hat{E}_D$ = total GRFS effort in D
- Estimation domains (D):
 - Month
 - GRFS area: Federal waters, State waters (territorial seas + inland)
 - Separate calculations by GRFS species and catch type (e.g., landings, releases)

GRFS Estimation – Total Catch

- Variance calculation uses Goodman's formula for product:

$$\text{var}(\hat{Y}_D) = \text{var}(\hat{y}_D) * \hat{E}_D^2 + \hat{y}_D^2 * \text{var}(\hat{E}_D) - \text{var}(\hat{y}_D) * \text{var}(\hat{E}_D)$$

- $\text{var}(\hat{Y}_D)$ = variance of total GRFS catch in domain D
- $\text{var}(\hat{y}_D)$ = variance of mean catch per GRFS angler-trip in D
- $\text{var}(\hat{E}_D)$ = variance of total GRFS effort in D
- Consistent with MRIP estimation approach



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5
CONT'D

Please continue reporting each trip in a separate column below.

TRIP 7

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

Northwest panhandle (excluding Alabama)

Big Bend, Nature coast

Southwest peninsula

Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

0-10 miles from the shoreline

More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore			
More than 10 miles from shore			

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure

Did anyone on the boat keep, release, or try to catch any of the following species?

Red snapper

Banded rudderfish

Vermilion snapper

Almaco jack

Other snappers

Amberjack

Gag, black, or red grouper

Other jacks

Other groupers

None of these

Gray triggerfish

TRIP 8

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

Northwest panhandle (excluding Alabama)

Big Bend, Nature coast

Southwest peninsula

Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

0-10 miles from the shoreline

More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore			
More than 10 miles from shore			

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure

Did anyone on the boat keep, release, or try to catch any of the following species?

Red snapper

Banded rudderfish

Vermilion snapper

Almaco jack

Other snappers

Amberjack

Gag, black, or red grouper

Other jacks

Other groupers

None of these

Gray triggerfish

TRIP 9

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

Northwest panhandle (excluding Alabama)

Big Bend, Nature coast

Southwest peninsula

Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

0-10 miles from the shoreline

More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore			
More than 10 miles from shore			

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure

Did anyone on the boat keep, release, or try to catch any of the following species?

Red snapper

Banded rudderfish

Vermilion snapper

Almaco jack

Other snappers

Amberjack

Gag, black, or red grouper

Other jacks

Other groupers

None of these

Gray triggerfish

If you are reporting more than 9 trips and/or have comments for us, please use the additional sheet provided.

THANK YOU FOR YOUR COOPERATION!

Please return your survey in the postage-paid envelope provided.

Gulf Reef Fish Survey Questionnaire

This survey should be completed by FIRST NAME LASTNAME only.

Return this form even if you don’t participate in recreational saltwater fishing.

▼START HERE

Please carefully follow these steps when completing this survey.

Use only a blue or black ink pen that does not blot the paper

Make solid marks inside the response boxes

Do not make other marks on the survey

EXAMPLE

RIGHT WAY

WRONG WAY

For the purpose of this questionnaire:

A **private boat** is defined as any boat that did not have a paid professional captain and/or crew used for recreational fishing. *Do not* report any trips taken from a paid charter or large party boat.

Please report only those trips where the boat launched from the west coast of Florida and recreational fishing occurred in saltwater *regardless if fish were caught*.

1

In general, when you go recreational fishing, how often does the boat (or boats) that you fish on launch from the following locations: *(Check the box that corresponds to your answer)*

		NEVER	SOMETIMES	VERY OFTEN
1	a residential boat slip, such as a dock at a waterfront home, vacation rental, condominium or apartment complex?			
2	a facility for launching boats from trailers (boat ramp)?			
3	a wet slip at a commercially operated or municipal marina?			
4	a dry storage facility (boat is hoisted in/out of the water)?			

2

The following questions pertain to recreational fishing on artificial reefs off the Gulf coast of Florida:

		YES	NO	NOT SURE
1	Do you ever fish recreationally on artificial reefs?			
2	During the month of APRIL, did you fish recreationally on an artificial reef?			

3

During the month of APRIL, did you personally participate in a recreational fishing trip on a private boat that launched from the west coast of Florida? *(Check the box that corresponds to your answer)*

1

NO, I DID NOT FISH

2

YES, I FISHED

3

NOT SURE, DO NOT RECALL

THANK YOU - THAT IS ALL THE INFORMATION WE NEED. PLEASE RETURN THE QUESTIONNAIRE IN THE ENCLOSED ENVELOPE.

4

On the APRIL calendar below, please “X” the box that corresponds to each day when you personally participated in a recreational fishing trip on a private boat that launched from the west coast of Florida.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30						

5

For each trip marked on the APRIL calendar on the previous page, please provide information about the trip in a separate column below, regardless if fish were caught.

Each trip should be a recreational fishing trip you personally participated in on a private boat that launched from the west coast of Florida.

If you took more than 12 trips, please report the 12 most recent trips. A map and a species identification guide are included in this survey packet to help with this section.

TRIP 1

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

☐ Northwest panhandle (excluding Alabama)

☐ Big Bend, Nature coast

☐ Southwest peninsula

☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

☐ 0-10 miles from the shoreline

☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure
	☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

☐ Red snapper	☐ Banded rudderfish
☐ Vermilion snapper	☐ Almaco jack
☐ Other snappers	☐ Amberjack
☐ Gag, black, or red grouper	☐ Other jacks
☐ Other groupers	☐ None of these
☐ Gray triggerfish	

TRIP 2

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

☐ Northwest panhandle (excluding Alabama)

☐ Big Bend, Nature coast

☐ Southwest peninsula

☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

☐ 0-10 miles from the shoreline

☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure
	☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

☐ Red snapper	☐ Banded rudderfish
☐ Vermilion snapper	☐ Almaco jack
☐ Other snappers	☐ Amberjack
☐ Gag, black, or red grouper	☐ Other jacks
☐ Other groupers	☐ None of these
☐ Gray triggerfish	

TRIP 3

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

☐ Northwest panhandle (excluding Alabama)

☐ Big Bend, Nature coast

☐ Southwest peninsula

☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

☐ 0-10 miles from the shoreline

☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure
	☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

☐ Red snapper	☐ Banded rudderfish
☐ Vermilion snapper	☐ Almaco jack
☐ Other snappers	☐ Amberjack
☐ Gag, black, or red grouper	☐ Other jacks
☐ Other groupers	☐ None of these
☐ Gray triggerfish	

TRIP 4

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

☐ Northwest panhandle (excluding Alabama)

☐ Big Bend, Nature coast

☐ Southwest peninsula

☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

☐ 0-10 miles from the shoreline

☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure
	☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

☐ Red snapper	☐ Banded rudderfish
☐ Vermilion snapper	☐ Almaco jack
☐ Other snappers	☐ Amberjack
☐ Gag, black, or red grouper	☐ Other jacks
☐ Other groupers	☐ None of these
☐ Gray triggerfish	

TRIP 5

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

☐ Northwest panhandle (excluding Alabama)

☐ Big Bend, Nature coast

☐ Southwest peninsula

☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

☐ 0-10 miles from the shoreline

☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure
	☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

☐ Red snapper	☐ Banded rudderfish
☐ Vermilion snapper	☐ Almaco jack
☐ Other snappers	☐ Amberjack
☐ Gag, black, or red grouper	☐ Other jacks
☐ Other groupers	☐ None of these
☐ Gray triggerfish	

TRIP 6

Please “X” ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

☐ Northwest panhandle (excluding Alabama)

☐ Big Bend, Nature coast

☐ Southwest peninsula

☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

☐ 0-10 miles from the shoreline

☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

	Yes	No	Not Sure
	☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

☐ Red snapper	☐ Banded rudderfish
☐ Vermilion snapper	☐ Almaco jack
☐ Other snappers	☐ Amberjack
☐ Gag, black, or red grouper	☐ Other jacks
☐ Other groupers	☐ None of these
☐ Gray triggerfish	

Please continue on the back page

TRIP 10

Please "X" ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

- ☐ Northwest panhandle (excluding Alabama)
- ☐ Big Bend, Nature coast
- ☐ Southwest peninsula
- ☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

- ☐ 0-10 miles from the shoreline
- ☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

Yes	No	Not Sure
☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

- ☐ Red snapper
- ☐ Vermilion snapper
- ☐ Other snappers
- ☐ Gag, black, or red grouper
- ☐ Other groupers
- ☐ Gray triggerfish
- ☐ Banded rudderfish
- ☐ Almaco jack
- ☐ Amberjack
- ☐ Other jacks
- ☐ None of these

TRIP 11

Please "X" ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

- ☐ Northwest panhandle (excluding Alabama)
- ☐ Big Bend, Nature coast
- ☐ Southwest peninsula
- ☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

- ☐ 0-10 miles from the shoreline
- ☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

Yes	No	Not Sure
☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

- ☐ Red snapper
- ☐ Vermilion snapper
- ☐ Other snappers
- ☐ Gag, black, or red grouper
- ☐ Other groupers
- ☐ Gray triggerfish
- ☐ Banded rudderfish
- ☐ Almaco jack
- ☐ Amberjack
- ☐ Other jacks
- ☐ None of these

TRIP 12

Please "X" ONE date the boat departed:

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Refer to the enclosed map. Select the region the boat departed from:

- ☐ Northwest panhandle (excluding Alabama)
- ☐ Big Bend, Nature coast
- ☐ Southwest peninsula
- ☐ Keys, Monroe County

In which of the following areas did you fish? (select all that apply)

- ☐ 0-10 miles from the shoreline
- ☐ More than 10 miles from shore

If you selected more than one area above, what percentage of time did you spend fishing in each of the areas?

	Less than 50%	About 50%	More than 50%
0-10 miles from shore	☐	☐	☐
More than 10 miles from shore	☐	☐	☐

Did you fish on an artificial reef during this trip?

Yes	No	Not Sure
☐	☐	☐

Did anyone on the boat keep, release, or try to catch any of the following species?

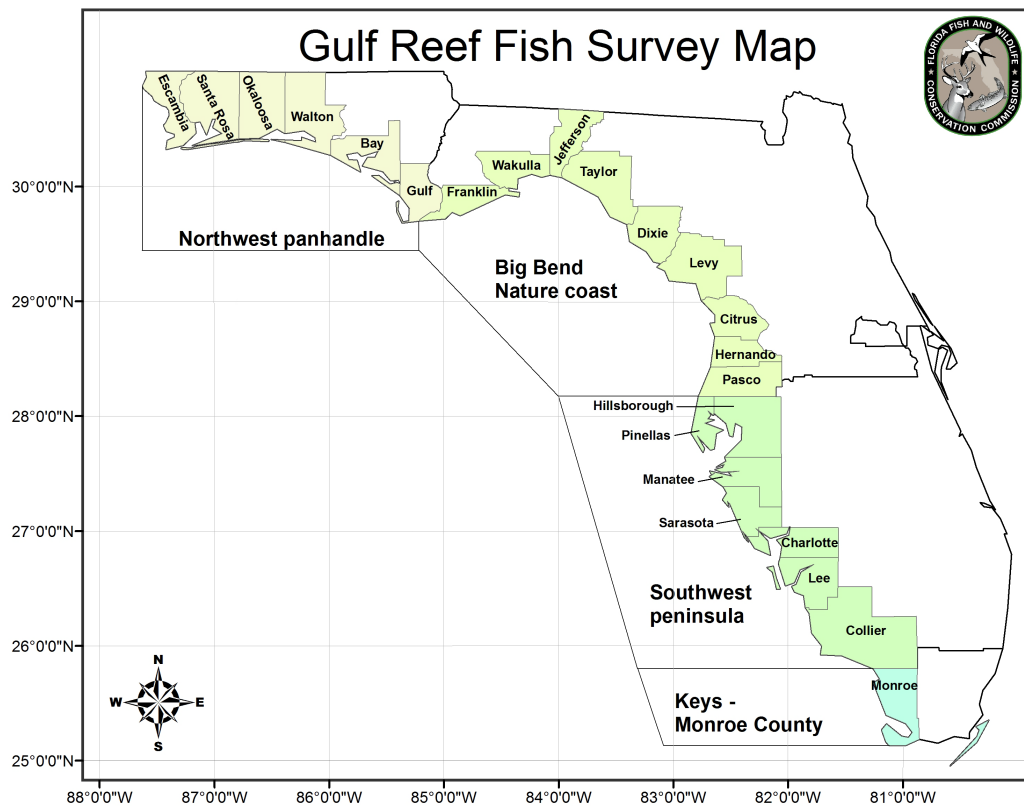
- ☐ Red snapper
- ☐ Vermilion snapper
- ☐ Other snappers
- ☐ Gag, black, or red grouper
- ☐ Other groupers
- ☐ Gray triggerfish
- ☐ Banded rudderfish
- ☐ Almaco jack
- ☐ Amberjack
- ☐ Other jacks
- ☐ None of these

If you have comments for us, please use the back of this form.

THANK YOU FOR YOUR COOPERATION!

Please return your completed questionnaire in the postage-paid envelope provided.

Please use the map below to help you complete Question 5.



Is there anything else you would like to tell us about saltwater recreational fishing in Florida?

THANK YOU FOR YOUR COOPERATION!

Please return your completed questionnaire in the postage-paid envelope provided.

Appendix 1.8. Numbers (N) of harvested and discarded fish observed during at-sea sampling from 2015 to 2017; and the mean, standard deviation (SD), minimum, and maximum fork length (in mm) by species.

Scientific name	Common name	N	Mean	SD	Min	Max
<i>Rhomboplites aurorubens</i>	Vermilion snapper	16,507	276	43.03	33	490
<i>Haemulon plumierii</i>	White grunt	15,820	240	33.77	83	400
<i>Epinephelus morio</i>	Red grouper	9,036	362	97.93	148	890
<i>Lutjanus campechanus</i>	Red snapper	7,508	400	96.01	159	880
<i>Balistes capriscus</i>	Gray triggerfish	6,676	331	49.75	136	608
<i>Pagrus pagrus</i>	Red porgy	6,064	264	31.58	165	444
<i>Ocyurus chrysurus</i>	Yellowtail snapper	4,937	267	58.65	125	530
<i>Lutjanus synagris</i>	Lane snapper	4,721	243	44.23	100	593
<i>Lutjanus griseus</i>	Gray snapper	2,968	342	82.36	143	672
<i>Haemulon aurolineatum</i>	Tomtate	2,456	200	18.96	100	408
<i>Mycteroperca microlepis</i>	Gag	1,853	485	137.25	109	1,042
<i>Centropristis striata</i>	Black sea bass	1,641	245	45.70	102	562
<i>Diplectrum formosum</i>	Sand perch	1,626	221	28.82	124	345
<i>Seriola dumerili</i>	Greater amberjack	1,309	703	197.82	204	1,410
<i>Scomberomorus maculatus</i>	Spanish mackerel	1,134	420	80.16	204	672
<i>Calamus proridens</i>	Littlehead porgy	1,035	264	43.74	138	445
<i>Scomberomorus cavalla</i>	King mackerel	910	734	147.59	326	1,498
<i>Calamus leucosteus</i>	Whitebone porgy	712	268	27.47	196	437
<i>Centropristis ocyurus</i>	Bank sea bass	678	223	29.32	124	340
<i>Seriola zonata</i>	Banded rudderfish	466	476	71.65	270	598
<i>Lutjanus analis</i>	Mutton snapper	458	384	123.27	164	785
<i>Caranx crysos</i>	Blue runner	446	279	78.37	120	590
<i>Mycteroperca phenax</i>	Scamp	418	367	96.62	135	790
<i>Euthynnus alletteratus</i>	Little tunny	381	519	103.85	216	878
<i>Cephalopholis cruentata</i>	Graysby	337	225	45.28	122	380
<i>Seriola rivoliana</i>	Almaco jack	321	417	95.75	192	862
<i>Coryphaena spp.</i>	Dolphinfishes	292	565	119.50	318	1,221
<i>Lachnolaimus maximus</i>	Hogfish	279	340	58.28	193	495
<i>Orthopristis chrysoptera</i>	Pigfish	271	207	20.87	139	270
<i>Calamus nodosus</i>	Knobbed porgy	265	285	44.78	166	420
<i>Calamus arctifrons</i>	Grass porgy	226	214	34.33	130	340
<i>Sphoeroides nephelus</i>	Southern puffer	204	225	32.13	148	355
<i>Synodus foetens</i>	Inshore lizardfish	188	294	65.96	51	472
<i>Calamus bajonado</i>	Jolthead porgy	123	365	107.20	201	615
<i>Coryphaena hippurus</i>	Dolphin	122	527	118.54	301	1,111
<i>Lagodon rhomboides</i>	Pinfish	112	189	35.43	110	308
<i>Thunnus atlanticus</i>	Blackfin tuna	98	540	169.74	289	891
<i>Rachycentron canadum</i>	Cobia	92	851	238.87	320	1,290
<i>Syacium papillosum</i>	Dusky flounder	71	256	34.04	184	340

<i>Scientific name</i>	Common name	N	Mean	SD	Min	Max
<i>Alectis ciliaris</i>	African Pompano	71	630	179.58	242	985
<i>Diplodus holbrookii</i>	Spottail pinfish	69	179	23.36	93	233
<i>Priacanthus arenatus</i>	Bigeye	65	315	33.17	196	397
<i>Caranx hippos</i>	Crevalle jack	63	441	164.15	140	880
<i>Paralichthys albigutta</i>	Gulf flounder	55	363	79.90	210	518
<i>Mycteroperca bonaci</i>	Black grouper	51	558	242.94	318	1,290
<i>Haemulon sciurus</i>	Bluestriped grunt	50	224	26.53	170	308
<i>Scomberomorus regalis</i>	Cero	48	523	96.59	371	709
<i>Canthidermis sufflamen</i>	Ocean triggerfish	41	388	37.41	234	475
<i>Lutjanus apodus</i>	Schoolmaster	38	235	36.95	184	410
<i>Echeneis neucratoides</i>	Whitefin sharksucker	37	485	135.54	178	740
<i>Sphyaena barracuda</i>	Great barracuda	35	894	180.62	495	1,300
<i>Archosargus probatocephalus</i>	Sheepshead	34	351	47.64	245	461
<i>Lutjanus vivanus</i>	Silk snapper	34	307	105.50	150	458
<i>Pomatomus saltatrix</i>	Bluefish	34	344	76.04	209	520
<i>Malacanthus plumieri</i>	Sand tilefish	33	424	85.48	190	570
<i>Pristigenys alta</i>	Short bigeye	29	257	27.83	207	310
<i>Epinephelus adscensionis</i>	Rock hind	29	311	57.94	201	422
<i>Anisotremus virginicus</i>	Porkfish	26	224	23.37	167	271
<i>Haemulon album</i>	Margate	25	457	121.00	240	653
<i>Caulolatilus microps</i>	Blueline tilefish	23	469	92.47	311	634
<i>Elops saurus</i>	Ladyfish	20	399	30.03	354	460
<i>Serranus phoebe</i>	Tattler	17	167	34.19	125	254
<i>Sciaenops ocellatus</i>	Red drum	17	581	190.40	220	950
<i>Katsuwonus pelamis</i>	Skipjack tuna	15	541	56.49	447	628
<i>Halichoeres radiatus</i>	Puddingwife	15	296	64.77	190	395
<i>Elagatis bipinnulata</i>	Rainbow runner	15	398	113.67	267	665
<i>Aluterus scriptus</i>	Scrawled filefish	14	432	71.68	210	495
<i>Pareques umbrosus</i>	Cubby	13	205	22.12	170	250
<i>Opsanus pardus</i>	Leopard toadfish	12	253	55.14	178	360
<i>Aluterus monoceros</i>	Unicorn filefish	12	454	55.20	380	570
<i>Caranx bartholomaei</i>	Yellow jack	12	360	66.77	279	527
<i>Ariopsis felis</i>	Hardhead catfish	11	252	39.16	185	302
<i>Lagocephalus laevigatus</i>	Smooth puffer	10	409	121.14	183	570
<i>Seriola spp.</i>	Amberjacks	10	796	281.44	390	1,117
<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	10	769	153.33	530	1,000
<i>Haemulon parra</i>	Sailors choice	10	252	16.01	217	273
<i>Sphyaenidae spp.</i>	Barracudas	10	848	150.56	640	1,080
<i>Lutjanus buccanella</i>	Blackfin snapper	10	188	33.24	145	247
<i>Haemulon flavolineatum</i>	French grunt	10	155	14.99	120	176
<i>Rypticus maculatus</i>	Whitespotted soapfish	9	178	31.84	139	224
<i>Haemulon melanurum</i>	Cottonwick	9	207	25.36	161	252

<i>Scientific name</i>	<i>Common name</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
<i>Holocentridae spp.</i>	Squirrelfishes	9	281	55.40	161	335
<i>Lutjanus jocu</i>	Dog snapper	8	325	163.22	170	622
<i>Paranthias furcifer</i>	Creole-fish	8	280	32.42	225	312
<i>Halichoeres bivittatus</i>	Slippery dick	7	151	65.79	85	271
<i>Pterois volitans</i>	Lionfish	7	337	56.48	300	460
<i>Rypticus spp.</i>	Soapfishes	7	175	18.90	150	200
<i>Lactophrys trigonus</i>	Trunkfish	7	315	22.24	285	349
<i>Calamus penna</i>	Sheepshead porgy	7	341	101.70	222	520
<i>Synodus intermedius</i>	Sand diver	7	268	26.92	221	300
<i>Decapterus spp.</i>	Mackerel scads	7	177	15.14	152	200
<i>Sphyrna tiburo</i>	Bonnethead	7	669	88.41	540	780
<i>Carcharhinus acronotus</i>	Blacknose shark	6	699	138.97	541	880
<i>Trachinotus falcatus</i>	Permit	6	651	32.80	610	685
<i>Bellator spp.</i>	Searobin	6	254	38.79	210	309
<i>Caranx ruber</i>	Bar jack	6	261	40.35	187	302
<i>Carcharhinus limbatus</i>	Blacktip shark	6	799	463.85	350	1,372
<i>Opsanus tau</i>	Oyster toadfish	5	306	51.28	250	390
<i>Chaetodipterus faber</i>	Atlantic spadefish	5	353	37.48	322	417
<i>Seriola fasciata</i>	Lesser amberjack	5	374	13.73	355	386
<i>Paralichthys lethostigma</i>	Southern flounder	5	295	109.86	200	485
<i>Carangidae spp.</i>	Jacks and pompanos	5	639	16.04	620	660
<i>Cephalopholis fulva</i>	Coney	5	250	49.59	186	305
<i>Lobotes surinamensis</i>	Tripletail	5	356	106.12	223	495
<i>Stephanolepis spp.</i>	Filefish	4	204	9.78	195	215
<i>Gymnothorax saxicola</i>	Ocellated moray	4	718	143.60	571	910
<i>Lagocephalus lagocephalus</i>	Oceanic puffer	4	454	71.12	381	551
<i>Synodontidae spp.</i>	Lizardfishes	4	282	47.50	234	333
<i>Bodianus pulchellus</i>	Spotfin hogfish	4	273	25.47	254	309
<i>Decapterus tabl</i>	Redtail scad	4	327	20.40	311	354
<i>Epinephelus itajara</i>	Goliath grouper	4	1269	505.93	800	1,820
<i>Epinephelus flavolimbatus</i>	Yellowedge grouper	3	632	212.89	502	878
<i>Acanthocybium solandri</i>	Wahoo	3	1201	69.09	1130	1,268
<i>Scomber scombrus</i>	Atlantic mackerel	3	273	62.39	224	343
<i>Echeneis naucrates</i>	Sharksucker	3	480	123.77	395	622
<i>Balistes vetula</i>	Queen triggerfish	3	355	17.32	335	365
<i>Stephanolepis hispidus</i>	Planehead filefish	2	234	18.38	221	247
<i>Xyrichtys novacula</i>	Pearly razorfish	2	166	21.92	150	181
<i>Acanthurus chirurgus</i>	Doctorfish	2	238	42.43	208	268
<i>Equetus iwamotoi</i>	Blackbar drum	2	207	9.90	200	214
<i>Holocentrus rufus</i>	Longspine squirrelfish	2	280	10.61	272	287
<i>Haemulon macrostomum</i>	Spanish grunt	2	247	60.10	204	289
<i>Epinephelus drummondhayi</i>	Speckled hind	2	443	137.89	345	540

<i>Scientific name</i>	<i>Common name</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
<i>Epinephelus niveatus</i>	Snowy grouper	2	505	84.85	445	565
<i>Mustelus canis</i>	Smooth dogfish	2	593	9.19	586	599
<i>Caranx latus</i>	Horse-eye jack	2	453	116.67	370	535
<i>Cynoscion arenarius</i>	Sand seatrout	2	223	67.18	175	270
<i>Istiophorus platypterus</i>	Sailfish	2	1611	3.54	1608	1,613
<i>Decapterus punctatus</i>	Round scad	2	217	9.90	210	224
<i>Epinephelus guttatus</i>	Red hind	2	286	34.65	261	310
<i>Prionotus rubio</i>	Blackwing searobin	2	265	14.85	254	275
<i>Bagre marinus</i>	Gafftopsail catfish	2	375	106.07	300	450
<i>Caulolatilus cyanops</i>	Blackline tilefish	1	292	.	292	292
<i>Labrodei</i>	Parrotfishes	1	431	.	431	431
<i>Aluterus schoepfii</i>	Orange filefish	1	445	.	445	445
<i>Stegastes adustus</i>	Dusky damselfish	1	70	.	70	70
<i>Sphoeroides maculatus</i>	Northern puffer	1	140	.	140	140
<i>Lutjanus cyanopterus</i>	Cubera snapper	1	570	.	570	570
<i>Halichoeres cyanocephalus</i>	Yellowcheek wrasse	1	220	.	220	220
<i>Tetrapturus albidus</i>	White marlin	1	617	.	617	617
<i>Helicolenus dactylopterus</i>	Blackbelly rosefish	1	248	.	248	248
<i>Epinephelus nigritus</i>	Warsaw grouper	1	710	.	710	710
<i>Chilomycterus schoepfii</i>	Striped burrfish	1	247	.	247	247
<i>Leiostomus xanthurus</i>	Spot	1	185	.	185	185
<i>Carcharhinus brevipinna</i>	Spinner shark	1	730	.	730	730
<i>Oligoplites saurus</i>	Leatherjacket	1	250	.	250	250
<i>Anisotremus surinamensis</i>	Black margate	1	340	.	340	340
<i>Bodianus rufus</i>	Spanish hogfish	1	248	.	248	248
<i>Gonioplectrus hispanus</i>	Spanish flag	1	237	.	237	237
<i>Tylosurus crocodilus</i>	Houndfish	1	260	.	260	260
<i>Remora spp.</i>	Sharksuckers	1	782	.	782	782
<i>Lutjanus mahogoni</i>	Mahogany snapper	1	359	.	359	359
<i>Serranidae spp.</i>	Groupers	1	103	.	103	103
<i>Kyphosus sectatrix</i>	Bermuda chub	1	360	.	360	360
<i>Ogcocephalidae spp.</i>	Batfishes	1	320	.	320	320
<i>Centropristis philadelphica</i>	Rock sea bass	1	310	.	310	310
<i>Scomber colias</i>	Chub mackerel	1	280	.	280	280
<i>Chloroscombrus chrysurus</i>	Atlantic bumper	1	190	.	190	190
<i>Tetraodontidae spp.</i>	Blowfishes	1	260	.	260	260
<i>Sparisoma aurofrenatum</i>	Redband parrotfish	1	160	.	160	160
<i>Pleuronectiformes spp.</i>	Flounders	1	310	.	310	310

Appendix 1.9. Numbers of discards by species and year observed during at-sea surveys.

Common name	2015	2016	2017	Total
Red grouper	1,904	2,903	3,365	8,172
Gray triggerfish	1,714	2,573	1,927	6,214
Red snapper	1,110	2,257	2,090	5,457
White grunt	246	1,076	1,241	2,563
Yellowtail snapper	67	1,181	942	2,190
Vermilion snapper	452	759	446	1,657
Gag	259	662	627	1,548
Tomtate	318	402	667	1,387
Greater amberjack	357	439	291	1,087
Lane snapper	196	383	496	1,075
Black sea bass	251	488	281	1,020
Sand perch	100	288	195	583
Gray snapper	63	157	329	549
Blue runner	72	64	158	294
Scamp	82	114	93	289
Mutton snapper	18	88	174	280
Graysby	6	83	128	217
Littlehead porgy	21	68	106	195
Bank sea bass	72	62	48	182
Southern puffer	20	74	76	170
Pigfish	7	74	70	151
Inshore lizardfish	22	73	47	142
King mackerel	4	44	71	119
Grass porgy	8	48	41	97
Hogfish	19	33	30	82
Red porgy	20	44	9	73
Dusky flounder	10	33	18	61
Spanish mackerel	4	31	26	61
Spottail pinfish	16	25	12	53
Dolphinfishes			52	52
Dolphin			41	41
Pinfish	14	12	13	39
Banded rudderfish	6	20	11	37
Whitefin sharksucker	6	14	17	37
Cobia	8	7	21	36
Crevalle jack	2	13	21	36
Black grouper		8	27	35

Common name	2015	2016	2017	Total
African Pompano	12	14	6	32
Knobbed porgy		25	5	30
Almaco jack	13	7	9	29
Schoolmaster		12	13	25
Porkfish		12	12	24
Sand tilefish	3	12	3	18
Little tunny	3	5	9	17
Silk snapper		6	10	16
Bluefish		4	11	15
Bluestriped grunt		9	6	15
Great barracuda	1	3	10	14
Tattler	10	1	3	14
Ladyfish	1	3	8	12
Puddingwife	2	5	5	12
Red drum		2	10	12
Cubbyu		6	5	11
Gulf flounder	1	4	6	11
Jolthead porgy	1	9	1	11
Leopard toadfish	1	8	2	11
Blackfin snapper		3	7	10
French grunt		3	7	10
Hardhead catfish	3	3	4	10
Sheepshead	2	1	7	10
Whitespotted soapfish	1	4	4	9
Cottonwick		7	1	8
Scrawled filefish		5	3	8
Amberjacks		1	6	7
Sand diver		1	6	7
Slippery dick		7		7
Soapfishes	2	2	3	7
Trunkfish		1	6	7
Bar jack			6	6
Blacknose shark		2	4	6
Bonnethead		3	3	6
Dog snapper			6	6
Searobin	1	3	2	6
Short bigeye	2	2	2	6
Squirrelfishes		5	1	6
Whitebone porgy		5	1	6

Common name	2015	2016	2017	Total
Atlantic sharpnose shark		3	2	5
Atlantic spadefish		1	4	5
Oyster toadfish		2	3	5
Rock hind		5		5
Blacktip shark		1	3	4
Filefish	1	2	1	4
Goliath grouper	1		3	4
Lizardfishes	3	1		4
Ocean triggerfish	1	1	2	4
Ocellated moray		4		4
Permit		4		4
Southern flounder		3	1	4
Baitfish	3			3
Bigeye		2	1	3
Jacks and pompanos			3	3
Sharksucker	1	1	1	3
Tripletail			3	3
Blackwing searobin		1	1	2
Blueline tilefish	1		1	2
Doctorfish		1	1	2
Gafftopsail catfish			2	2
Longspine squirrelfish		2		2
Oceanic puffer	2			2
Pearly razorfish		1	1	2
Planehead filefish			2	2
Queen triggerfish		1	1	2
Redtail scad			2	2
Sailors choice		1	1	2
Sand seatrout	2			2
Smooth dogfish			2	2
Smooth puffer	1		1	2
Spotfin hogfish		1	1	2
Unicorn filefish			2	2
Barracudas		1		1
Batfishes			1	1
Blackbar drum			1	1
Blackbelly rosefish	1			1
Blackline tilefish		1		1
Blowfishes	1			1

Common name	2015	2016	2017	Total
Cero			1	1
Chub mackerel	1			1
Coney			1	1
Dusky damselfish		1		1
Flounders	1			1
Groupers			1	1
Northern puffer	1			1
Orange filefish			1	1
Parrotfishes		1		1
Rainbow runner			1	1
Redband parrotfish		1		1
Rock sea bass		1		1
Sailfish			1	1
Sharksuckers			1	1
Spanish grunt		1		1
Spanish hogfish			1	1
Striped burrfish		1		1
Yellowcheek wrasse	1			1
Totals	7,555	14,851	14,475	36,881