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Recreational Effort, Catch and Biological Sampling in Florida During the 2018 South Atlantic Red Snapper Season

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Executive Summary

Landings in the recreational fishery for Red Snapper *Lutjanus campechanus* in the southeastern U.S. Atlantic have historically been monitored through a general survey of all saltwater fishing called the Marine Recreational Information Program, or MRIP. A majority of landings estimated through the MRIP survey were attributed to the Atlantic coast of Florida. However, the recreational fishery has been managed with an annual harvest season ranging from 0 to 9 days since 2010. In order to improve precision of fishing effort and harvest estimates over such short seasons, the state of Florida has developed specialized survey methods. Specialized surveys of the private boat fishery in Florida during Red Snapper harvest seasons in 2012, 2013 and 2014 resulted in estimated landings with coefficient of variations (c.v.s) that ranged between 0.11-0.23 (Sauls et al. 2017). The specialized survey also estimates the magnitude of discarding during the harvest season; however, because regulatory discarding occurs year-round the MRIP survey is the only complete estimate of the magnitude of Red Snapper discards during both open and closed seasons.

This report summarizes methods and final results for specialized surveys of the private boat and charter segments of the recreational fishery operating from the east coast of Florida during the 2018 recreational season for Red Snapper in the South Atlantic. Sampling activities were conducted over two weekends in August (Friday through Sunday, August 10-12 and 17-19) when recreational harvest of Red Snapper was open in the South Atlantic. Prior to the season opening, a paper log-sheet was also mailed to charter vessel operators based in Florida that possess a federal permit for South Atlantic Snapper-Grouper, which was followed up the week after the season closed with telephone contacts to collect information specifically on Red Snapper fishing effort and catch. Final estimates are provided for both the private boat and charter segments of the recreational fishery over the six days that the recreational season for Red Snapper was open on the east coast of Florida during 2018.

During the 2018 season, boat activity was monitored through nine inlets that provide access to the Atlantic Ocean along the east coast of Florida. Weather conditions during were favorable for offshore fishing, and hourly wave heights recorded at four NOAA weather buoys offshore of Fernandina Beach to Fort Pierce did not exceed 1 meter across all six days that the season was open. High levels of boating activity were observed throughout the study region, and an estimated 52,176 angler trips (SE ±9,928) targeted Red Snapper over the six days. A total of 1,225 private boat parties were interviewed upon returning from trips, and 75.3% of parties interviewed reported fishing for Red Snapper. An estimated 30,050 (SE ±6,256) Red Snapper were harvested over the six-day season, and the mean length and weight for fish sampled from private boat trips was 580.8 mm (±3.00) midline length and 3.972 kg (±0.056).

For the federally permitted charter fleet, a total of 490 charter vessels in the MRIP For-Hire Survey Frame that matched a South Atlantic Snapper-Grouper permit were included in the sample frame, and 390 were selected for this survey. Of those selected, 79.2% of vessel operators responded to the survey, and 25.2% of the total responses came from log sheets that were returned via mail. Overall, an estimated 3,184 (±212) Red Snapper were harvested during 2,969 (±182) angler trips from charter vessels over the six days. Most charter landings occurred in northeast Florida (3,059±208), and the mean CPUE in this region (1.02±0.03 fish per angler trip) was approximately two times higher than in the Florida Keys (0.57 ± 0.12). Red Snapper sampled from charter boats averaged 580.48 mm (±3.049) and 3.962 kg (±0.057). If charter vessels were observed during the Red Snapper season (either during inlet vessel counts or during intercept surveys) that were not also included in the sample frame for the mail and phone survey of charter vessels,

then data from those trips was included in the overall estimates of effort and catch for the private boat fishing fleet. Thus, no correction for under-coverage was necessary for the charter survey.

The Red Snapper harvest season also provided an opportunity to collect fishery dependent biological samples, including length, weight and age structures. During 2018, 2,749 Red Snapper harvested by private boat and charter anglers were sampled during intercept surveys, and as part of a three-year pilot study to test methods for collecting biological data that are representative of the recreational private boat and for-hire charter fisheries on the east coast of Florida. The pilot study began in 2017 and is funded through MARFIN (award number NA16NMF4330163). Otoliths from 728 Red Snapper that were sampled during the previous South Atlantic Red Snapper season in November/December 2017 were also processed and read during 2018, and the resulting age distributions are reported here.

Section 1. Private Boat Mode

Methods

The survey design and estimation methods for private boat mode described below were developed over three prior Red Snapper seasons during 2012, 2013, and 2014. Details for how methods were tested and validated, as well as results from the first three years, are described by Sauls et al. (2017).

Sample Design — Off the Atlantic coast of peninsular Florida, recreational boaters must pass through one of nine navigable inlets to access Red Snapper fishing grounds in the Exclusive Economic Zone (Figure 1.1). Recreational boat traffic through each of these egress points was monitored during the season. Each day that an inlet was sampled, boat traffic was observed during one of three time periods. The a.m. period began during local sunrise time and ended at 1059 hours Eastern Time (ET), the mid-day period was defined as 1100-1459 ET, and the p.m. period began at 1500 EDT and ended at local sunset time. Each inlet was observed at least once during each day of the season. Within each three-day weekend, an inlet was observed during one a.m., one mid-day, and one p.m. period on a different day, and the order that time periods were selected within a weekend was randomized for each inlet. This sample design ensured that recreational boat activity across the region was observed throughout each day, and that variable fishing effort in response to localized weather and offshore conditions across weekends was measured and accounted for. To observe boats egressing from the largest inlet (Mayport), observers were stationed on a small boat inside the mouth of the St. Johns River within sight of the Atlantic ship channel. The remaining eight inlets were monitored from land at locations where observers could clearly see boats passing through to the Atlantic Ocean. Matanzas Inlet is the smallest inlet and is not navigable during low tide. The channel has become more difficult to navigate following hurricanes Matthew in 2016 and Irma in 2017. Therefore, Matanzas Inlet was monitored at the same times selected for St. Augustine so that boat counts from the two nearby egress points may be pooled. On days when Matanzas Inlet was not navigable, only Saint Augustine was monitored.

Launch sites for private recreational boats were randomly selected for a complementary access point intercept survey over each weekend. The purpose of the intercept survey was to interview parties as they return from boating trips to determine whether they were fishing for Red Snapper, measure catch rates, and collect biological samples from harvested fish. The intercept survey also provided data that were necessary for accurately estimating fishing effort. During an assignment, each party that returned from a recreational boat trip was interviewed to determine the proportion that exited through inlets for the purpose of targeting Red Snapper and the proportion that departed before sunrise and were not accounted for in inlet boat count survey. Assignments were conducted between the hours of 1000 and sunset, or until no more vessels were expected to return to the site, whichever occurred first. Field procedures for conducting trip interviews with intercepted vessels are described in reports for previous years (Sauls et al. 2013, 2014).

Effort Estimation.— Prior to summing vessel activity in each inlet to estimate the numbers of boats that egressed into the Atlantic Ocean during the red snapper season, vessel names and/or registration numbers that were recorded by observers in the field were compared with the wave 4,

2018 registry of active charter boat vessels for the MRIP For-Hire Telephone Survey. Charter boats that were matched to an active charter boat in the For-Hire Survey frame were not retained in the vessel activity counts for each inlet, since a separate survey that was conducted to estimate effort and catch for this segment of the fishery (described in next section). The mean proportion of vessels with complete information that were not included in the For-Hire Survey was calculated as:

$$\bar{p}_{non-FHS} = \frac{\sum_{i=1}^{n} u}{\sum_{i=1}^{n} u+m} \quad (1.0)$$

Where u represents an observed vessel with complete name and/or registration information that is unmatched to the For-Hire Survey frame, and m represents any vessel that was matched to a known charter vessel in the For-Hire Survey. This proportion was applied to the remainder of vessels where complete information on the vessel name or registration number could not be recorded. Charter vessels that were not included in the For-Hire Survey vessel frame were retained in the inlet vessel counts, since they represent recreational fishing effort that is not accounted for in another survey.

Three main steps were used to estimate total fishing effort: 1) the numbers of recreational boats observed exiting through each inlet during daylight hours was expanded to generate an unadjusted seasonal estimate of trips in the Atlantic Ocean across all inlets; 2) the seasonal estimate of boat trips was multiplied by an estimated proportion that were targeting Red Snapper; and 3) estimated Red Snapper trips were adjusted to account for additional boats that exited through inlets before sunrise.

<u>Step 1</u>

A weighted mean of boat counts (y_i) within an inlet was used to calculate an expanded estimate for $\hat{Y}_h$. The primary sample weight (P) was calculated as the total number of days in the season (9) divided by the number of days period *p* was sampled. If an inlet could not be observed for the entire time period sampled (for example, observer arrived to site late), a secondary sample weight (S) was calculated as the total minutes in the sample period divided by the total minutes the period was observed. The mean weighted number of boats observed per sampled period in inlet *h* was calculated as:

$$\bar{y}_h = \sum_{p=1}^{t} \sum_{i=1}^{n} P_p S_i y_i \ / \sum_{p=1}^{t} \sum_{i=1}^{n} P_p S_i, \quad (1.1)$$

for periods 1 to t, where *i* is an individual sample from period p. Variance was calculated as:

$$v(\bar{y}_h) = \sum_{p=1}^{t} \sum_{i=1}^{n} P_p S_i (y_i - \bar{y}_h)^2 / \sum_{p=1}^{t} \sum_{i=1}^{n} P_p S_i \quad (1.2)$$

To estimate the total number of boats that exited through all inlets in a given season, the weighted mean for each sample inlet was multiplied times the total periods (N) in the season (in 2018, N = 6 days * 3 periods per day), and summed across inlets as:

$$\hat{Y} = \sum_{h=1}^{k} \bar{y}_h \mathrm{N} \quad (1.3)$$

Variance was calculated by:

$$v(\hat{Y}) = \sum_{h=1}^{k} v(\bar{y}_h)\mathrm{N} \quad (1.4)$$

Step 2

To estimate the proportion of trips targeting Red Snapper, the seasonal estimated number of boats that made a trip into the Atlantic Ocean was adjusted using additional information collected during the access point trip intercept survey. Following methods for estimating proportions and totals over subpopulations described by Cochran (1977), the proportion of intercepted trips that targeted Red Snapper was first calculated for each inlet as:

$$p_h = t_h / n_h \tag{1.5}$$

where t_h is the number of boats intercepted at access points adjacent to a given inlet with at least one angler in the group who reportedly caught or tried to catch Red Snapper in the Atlantic Ocean, and n_h is the total boats intercepted that reportedly entered into the Atlantic Ocean. Since $\hat{Y}_h$ does not account for trips that entered the Atlantic Ocean before sunrise (this occurs in step 3, below), boat intercepts that reported exiting through an inlet prior to 0630 hours are excluded from both the numerator and denominator in equation 10. Error for the proportion was calculated as:

$$\sigma(p_h) = \sqrt{1 - (n_h/\hat{Y}_h)} * \sqrt{\frac{p_h(1-p_h)}{n_h - 1}} \tag{1.6}$$

To estimate the total number of targeted trips in each inlet, the proportion was multiplied times the estimated number of boats that exited through the inlet as:

$$\hat{T}_h = N_h p_h \tag{1.7}$$

Where N_h is the total number of boats observed from a sampled inlet ($\hat{Y}_h$ from step 1 above) exiting into the Atlantic Ocean during daylight hours across all days in the season. Error was propagated by:

$$\sigma(\hat{T}_h) = \hat{T}_h \sqrt{(\sigma(\hat{Y}_h)/\hat{Y}_h)^2 + (\sigma(p_h)/p_h)^2} \tag{1.8}$$

Step 3

To adjust targeted trips for boats that departed before sunset, a second combined proportion was calculated using the number of targeted Red Snapper trips intercepted that reported exiting through an inlet after sunrise (0630 hours or later) as the numerator (t_h) in equation 1.5, and the total number of targeted trips intercepted as the denominator (n_h). Associated error around this proportion was calculated using equation 1.6, except $\hat{Y}_h$ is replaced with $\hat{T}_h$. The seasonal adjusted estimate of targeted Red Snapper trips within each inlet was calculated as:

$$\hat{T}_{h,adj} = \frac{\hat{T}_h}{p_h} \tag{1.9}$$

and error was propagated by:

$$\sigma(\hat{T}_{h,adj}) = \sqrt{\sigma(\hat{T}_h)/\hat{T}_h)^2 + (\sigma(p_h)/p_h)^2} \tag{1.10}$$

Catch Estimation — Red Snapper reported during targeted trips interviews in the access point trip intercept survey were used to estimate total harvest and discards. For each inlet, the mean number of Red Snapper caught per angler in targeted trip interviews was calculated as:

$$\bar{c}_h = \frac{\sum_{i=1}^{n} c_{h,i}}{\sum_{i=1}^{n} a_{h,i}} \tag{1.11}$$

Where c_i is either the number of Red Snapper retained (for harvest estimates) or released (for discard estimates) by all anglers on the boat during trip interview *i,* and a_i is the number of anglers in each interviewed party. Catch per unit effort was calculated at the angler level to account for variance in catch (partially due to the 1 fish per person bag limit) among boats with varied numbers of anglers. Variance was estimated by:

$$v(\bar{c}_h) = [\frac{1}{\sqrt{t_h a_h}} \sqrt{\frac{\sum_{i=1}^{n} c_{h,i}^2 - 2\bar{c}_h(\sum_{i=1}^{n} c_{h,i} a_{h,i}) + \bar{c}_h^2(\sum_{i=1}^{n} a_{h,i}^2)}{t_h - 1}}\ ]^2 \qquad (1.12)$$

where t_h is the total number of boat party intercepts that were targeting Red Snapper. The mean number of anglers in each boat party intercepted was calculated as:

$$\bar{e}_h = \frac{\sum_{i=1}^{n} a_{h,i}}{t_h} \qquad (1.13)$$

Variance is given by:

$$v(\bar{e}_h) = \frac{\sum_{i=1}^{n} a_{h,i}^2 - ((\sum_{i=1}^{n} a_{h,i})^2 / t_h)}{t_h(t_h - 1)} \qquad (1.14)$$

To estimate total catch, the estimated number of boat parties that targeted Red Snapper was converted to angler trips by:

$$\hat{E}_h = \hat{T}_h \hat{e}_h \qquad (1.15)$$

and variance is estimated following methods described by Goodman (1960) as:

$$v(\hat{E}_h) = \hat{T}_h^2 v(\bar{e}_h) + \bar{e}_h^2 v(\hat{T}_h) - v(\bar{e}_h) v(\hat{T}_h) \qquad (1.16)$$

Lastly, total catch was estimated by:

$$\hat{C} = \sum_{h=1}^{9} \hat{E}_h \bar{c}_h \qquad (1.17)$$

with variance:

$$v(\hat{C}) = \sum_{h=1}^{9} [\hat{E}_h^2 v(\bar{c}_h) + \bar{c}_h^2 v(\hat{E}_h) - v(\hat{E}_h) v(\bar{c}_h)] \qquad (1.18)$$

Methods used to calculate the overall mean size (mm midline length) and weight (kg) of landed fish are described in Section 3.

Results

Overall, fishing effort during the 2018 season was high and was likely due to a combination of the timing (late summer) and the calm conditions that enabled small recreational boats to access fishing grounds offshore. Over the duration of the season, hourly wave heights measured at weather buoys stationed offshore of Fernandina Beach, St. Augustine, Cape Canaveral and Fort Pierce, Florida, never exceeded 1 meter (Figure 1.2). Fishing effort for Red Snapper was highest between Mayport and Port Canaveral (Table 1.1), similar to previous seasons (Sauls et al. 2017).

Harvest rates varied across inlets, with an overall CPUE of 0.594 ($\pm$0.181) fish per angler trip (Table 1.2). Although there was no size limit (to discourage discarding), an average of 0.828 ($\pm$0.076) Red Snapper per angler trip were reported released (Table 1.3). Over the 6-day season,

a total estimated 30,050 (±6,256) Red Snapper were harvested by private boat anglers (Table 1.2), and 41,660 (±10,057) fish were discarded (Table 1.3) during the six day season. Landed fish had a mean weight of 3.975 kg (±0.056) (Table 1.2). Total estimated landings during 2018 are compared with previous years in Table 1.4.

References

Goodman, L.A. 1960. On the exact variance of products. Journal of the American Statistical Association 55:708-713.

Sauls, B. J., R.P. Cody, and A.J. Strelcheck. 2017. Survey methods for estimating Red Snapper landings in a high-effort recreational fishery managed with a small annual catch limit. North American Journal of Fisheries Management 37:302-313.

Table 1.1 Effort estimates for private boat mode ±SE.

Inlet	Number of boat parties intercepted	Mean anglers per party	Proportion of trips targeting Red Snapper	Proportion of trips departing after sunrise	Targeted boat trips	Targeted angler trips
Cumberland	90	3.34±0.174	0.762±0.047	0.958±0.024	615±254	2,142±891
Mayport	331	3.68±0.069	0.897±0.021	0.732±0.025	1,854±769	9,334±3,886
St Augustine	233	3.82±0.126	0.809±0.031	0.751±0.031	1,409±539	7,168±2,766
Ponce Inlet	209	3.47±0.092	0.827±0.042	0.523±0.036	2,074±909	13,771±6,116
Port Canaveral	203	3.91±0.118	0.870±0.032	0.600±0.036	1,995±863	13,013±5,696
Sebastian Inlet	43	3.48±0.279	0.576±0.086	0.793±0.075	1,061±434	4,658±1,985
Fort Pierce	73	2.91±0.184	0.216±0.058	0.696±0.096	392±158	1,641±705
St. Lucie	43	2.00±0.000	0.054±0.037	0.750±0.217	113±087	302±247
Overall	1,225	3.66±0.046	0.753±0.016	0.689±0.015	9,513±1,655	52,029±9,894

Table 1.2. Mean CPUE (landings per angler trip) and estimated total landings ±SE.

Inlet	CPUE	Landings (numbers of fish)	Mean weight (kg)	Landings (kg)
Cumberland	0.628 (±0.054)	1,346 (±570)		
Mayport	0.571 (±0.028)	5,348 (±2,239)		
St Augustine	0.489 (±0.037)	3,506 (±1,375)		
Ponce	0.459 (±0.036)	6,324 (±2,844)		
Port Canaveral	0.839 (±0.033)	10,919 (±4,795)		
Sebastian	0.376 (±0.088)	1,752 (±834)		
Fort Pierce/St. Lucie	0.440 (±0.098)	855 (±360)		
Overall	0.594 (±0.018)	30,050 (±6,256)	3.972 (±0.056)	119,345 (±24,900)
c.v.	0.030	0.208	0.014	0.209

Table 1.3. Mean CPUE (discards per angler trip) and estimated total discards ±SE.

Inlet	CPUE	Discards (numbers of fish)
Cumberland	0.833 (±0.439)	1,785 (±1,132)
Mayport	0.713 (±0.127)	6,659 (±2,9752)
St Augustine	0.359 (±0.085)	2,575 (±1,141)
Ponce	0.651 (±0.139)	8,959 (±4,333)
Port Canaveral	1.401 (±0.192)	18,235 (±8,291)
Sebastian	0.495 (±0.229)	2,306 (±1,376)
Fort Pierce/St. Lucie	0.587 (±0.218)	1,140 (±545)
Overall	0.828 (±0.076)	41,660 (±10,057)
c.v.	0.091	0.241

Table 1.4. Season length and total catch estimates for private boat mode expressed in numbers of Red Snapper during 2017, compared to three previous seasons (reported in Sauls et al. 2017).

Year	Month(s)	Number of days	Estimated harvest $\hat{C}_{harv}(\pm s.e.)$	c.v. harvest	Estimated discards $\hat{C}_{disc}(\pm s.e.)$	c.v. discards
2018	August	6	30,050 (±6,256)	0.208	41,660 (±10,057)	0.241
2017	Nov.-Dec.	9	5,390 (±475)	0.088	4,331 (±561)	0.129
2014	July	8	22,013 (±2,782)	0.126	9,755 (±1,741)	0.178
2013	August	3	6,999 (±1,321)	0.189	5,033 (±1,512)	0.300
2012	Sept.	6	11,136 (±1,734)	0.156	17,587 (±9,031)	0.513

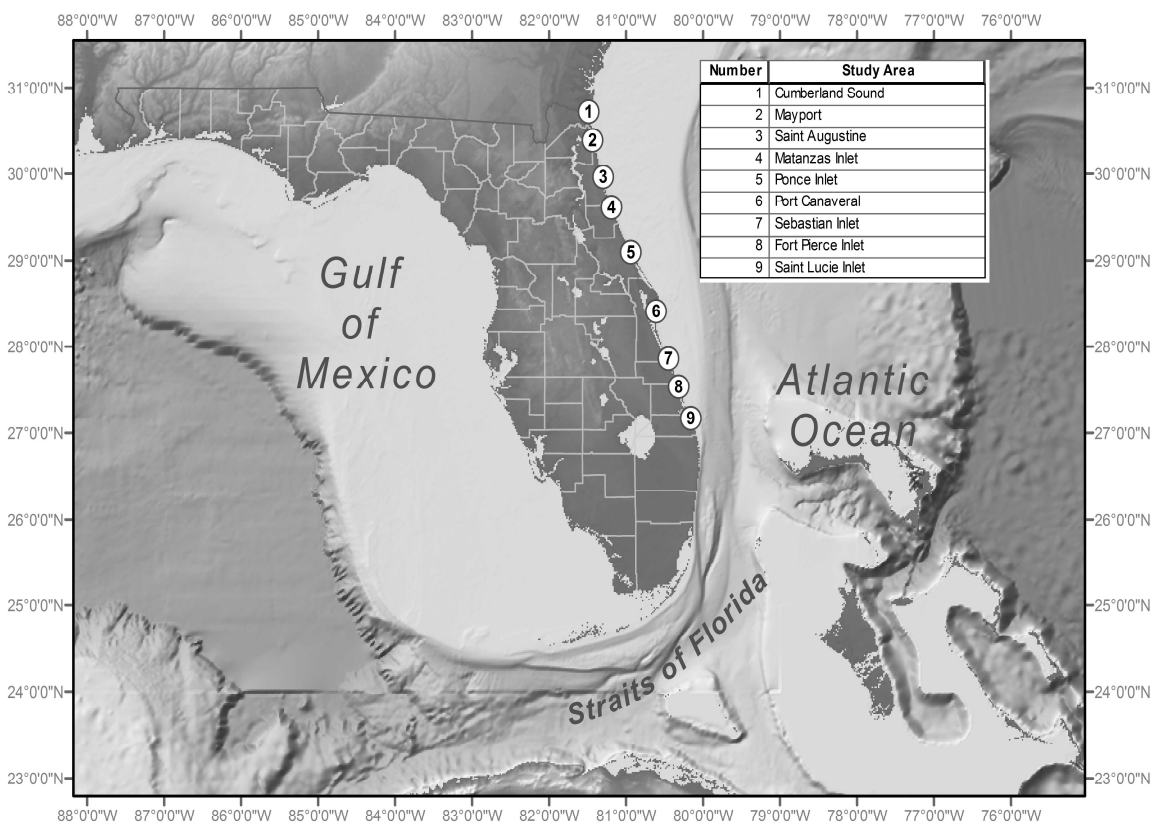


Figure 1.1. Inlets included in study area.

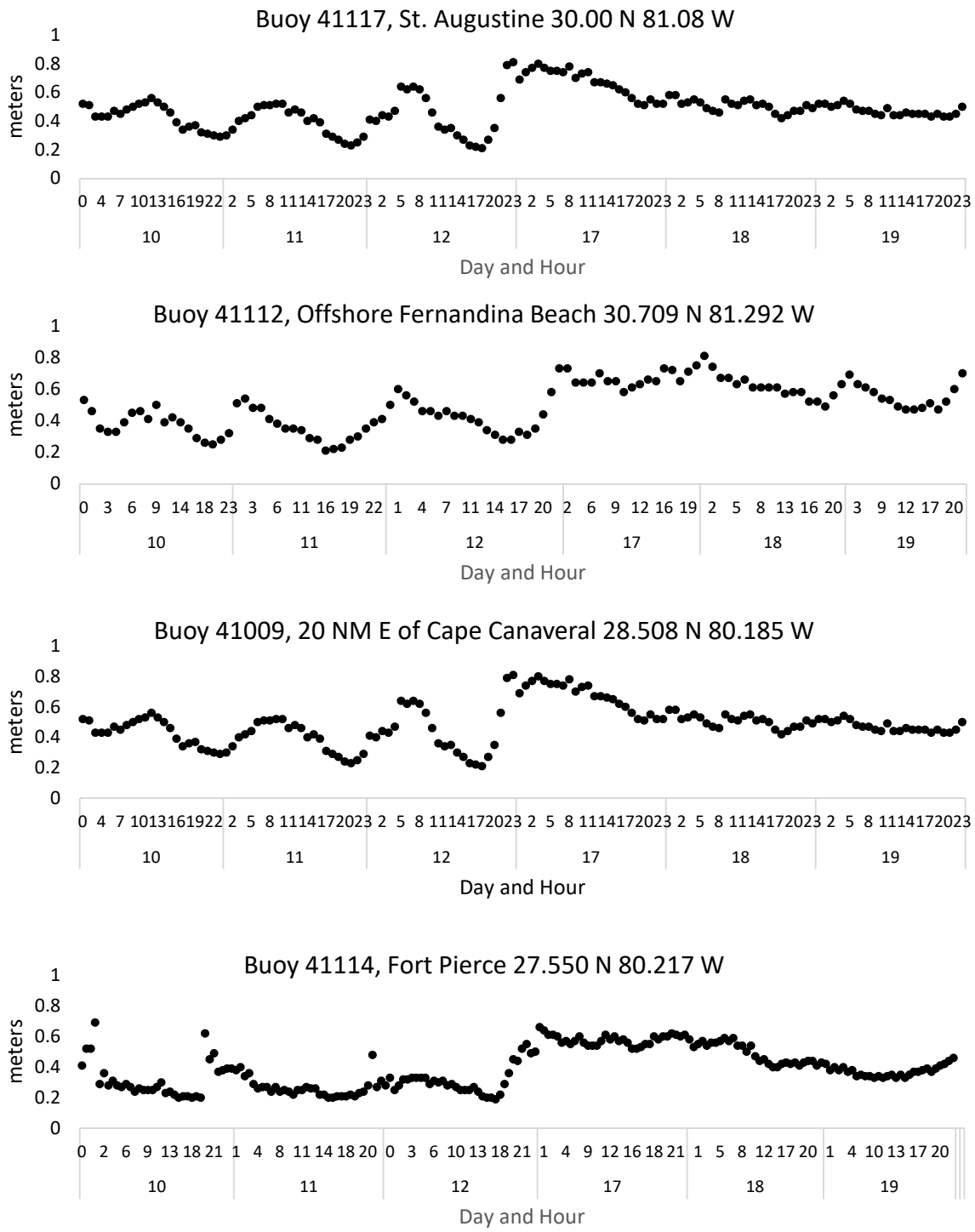


Figure 1.2. Hourly wave heights (in meters) from north (top) to south across the study region over the duration of the South Atlantic Red Snapper season. Buoy data obtained from https://www.ndbc.noaa.gov/

Section 2: Charter Mode

Methods

Mail / Telephone Survey —The FWC maintains a list of active charter vessels that serves as the sample frame from which the MRIP For-Hire Telephone Survey (FHTS) weekly draw is selected (10%). For this survey, charter vessels in the wave 4, 2018, FHTS sample frame were matched to a list of vessels with a valid federal permit to harvest Snapper-Grouper species in the South Atlantic. This permit is required for for-hire operators to harvest Red Snapper from the EEZ adjacent to the east coast of Florida. Charter vessels that do not possess a federal permit are more effectively monitored through the MRIP survey, since they may harvest legal sized Red Snapper year-round in state waters. However, a 20" size limit deters targeted fishing effort in this area due to the distribution of legal sized fish farther offshore, outside the state's jurisdiction (particularly in northeast Florida, where the species is most abundant). For this survey, all vessels in the FHTS sample frame with a South Atlantic Snapper-Grouper permit were selected, with the exception of vessels that were randomly selected to participate during weeks 32 or 33 in the FHTS.

During the week before the fishing season opened, each selected vessel was sent a letter describing the intent of FWC staff to collect catch and effort data for charter trips targeting or harvesting Red Snapper. The letter explained that captains could participate in the survey by completing and returning the enclosed log sheet or, if no log sheet was received, FWC staff would attempt to contact them by telephone at the end of the Red Snapper season. The log sheets were printed on waterproof paper to encourage captains to record data underway to improve the accuracy of responses. A pre-paid postage envelope was also provided to encourage prompt return of the log sheet. The log sheet provided space to record trip and catch level data for up to three trips that targeted Red Snapper on each day of the harvest season, including: number of anglers, number of passengers, trip origin (state and county), distance from shore and depth fished, dock to dock hours, hours fished, and numbers of Red Snapper harvested and released. Each vessel representative was called up to five times, or until a successful contact was made or their mailed log sheet was received. Vessels that did not return the log sheet or that could not be contacted by the fifth call attempt were marked as non-contacts.

Catch and Effort Estimation – Survey responses were used to estimate the total number of charter boat trips that targeted Red Snapper, angler trips, and numbers of fish harvested and discarded by all active federally permitted vessels during a given period (November or December). Total boat trips, angler trips, and numbers of fish harvested and released for each region and month were calculated by:

$$\hat{Y} = \sum_{i=1}^{n} w_h \, y_{h,i} \qquad (2.1)$$

where $y_{h,i}$ corresponds with the total number of boat trips, anglers, or fish reported by respondent i in region h during the one or two months weekends when Red Snapper harvest was open during a given month, and w_h is a sample weight. The sample weight was calculated as:

$$w_h = {}^{N_h}/_{n_h} \qquad (2.2)$$

Where N_h is the total number of federally permitted active charter vessels in region h, and n_h is the total number of vessels in region h that responded to the survey for a given month. The SAS procedure, PROC SURVEYMEANS, was used for this estimation (Appendix 3), and the variance is calculated using the Taylor Series method (SAS Institute Inc., 2008).

The northeast region included counties on the Atlantic coast of Florida north of Palm Beach County, where Red Snapper are most likely to be targeted, the southeast region included southern counties where the species is rarely encountered, and Monroe County was a separate region (Table 2.1). Charter vessels on the Gulf coast of Florida that carry the S. Atlantic Snapper – Grouper permit were also surveyed as a separate region during the November fishery opening to determine if any participated in the short seasonal opening (Table 2.1). The survey was not repeated for Gulf vessels during the extended weekend in December.

Estimated catch and effort were not adjusted for permitted vessels that are not included in the survey because they were not identified as active charter vessels in the FHTS frame. However, any such vessels also would not be known as active charter vessels by staff in the field, and thus would have been counted as private boats during inlet boat counts (described in Section 1 above). It would be inappropriate to adjust charter effort for under-coverage, because trips by unknown charter vessels would be accounted for twice.

Undercoverage Adjustment – Off-frame charter vessels were encountered during surveys described in section 1, and data collected from these vessels was included in expansions for total effort and catch in the private boat fishery. Thus, no adjustments for under-coverage were necessary in the mail and phone survey of federally permitted charter vessels in the NE region. In the Keys, where private anglers rarely target Red Snapper in the EEZ, no special field surveys are conducted and no information on off-frame charter vessels is available. However, the charter fishery in Keys is a minor portion of total recreational landings for Red Snapper on the east coast of Florida, and any under-coverage is expected to be small.

Results

The 2018 South Atlantic Red Snapper season was the second year of testing the dual mail / phone survey method to collect trip level data from the federal for-hire fleet during. The survey was distributed to 80% of the known, active charter vessels with a valid South Atlantic Snapper-Grouper permit. The response rates from charter representatives remained high, with an overall response rate of 79.2%, ranging from 70.3 – 90.2% by region (Table 2.2). Providing two modes for reporting likely contributed to high participation from charter representatives; 25.2% of responses were from mailed log sheets, and 74.8% were from and phone interviews. The response rates from northeast Florida declined by 15%, compared to the 2017 red snapper season, and there was an increase in the number of attempts and unavailable final statuses for representatives (Figure 2.1). This may be due to vessel operators being busier this year, when weather was more favorable for fishing. Nonetheless, this reporting rate is still high.

Before generating catch and effort estimates, the length frequency distribution of vessel lengths of the full charter vessel population was compared to the vessel lengths of the respondents and participants to determine if the latter groups are representative of the full charter population. The vessel length distributions of the full charter population and respondents appear to have similar shape, and are likely representative (Figure 2.2). Additionally, the length distribution from vessels in 2017 were compared to 2018, and the proportion of boats in smaller length classes has increased in 2018. This may be reflective of the difference in the timing of the opening of the South Atlantic Red Snapper season, with an August opening allowing for more small vessels to participate.

Similar to 2017, no respondents from Region 2 (SEFL – Palm Beach to Miami-Dade Counties) or Region 4 (WFL – Escambia to Collier Counties) participated in the South Atlantic Red Snapper Season; only charter vessels from Region 1 (NEFL – Nassau to Martin Counties) and Region 3 (Florida Keys – Monroe County) reported taking trips to harvest or target red snapper. Estimates of boat trips, angler trips, harvest, and discards were only generated for these regions. Participation was highest in northeast Florida, with an estimated 525 (± 22) boat trips taken by charter vessels. The catch per unit effort in Region 1 was 1.02 (±0.03) fish, with an estimate 3059 (± 208) red snapper harvested by these anglers. In the Florida Keys, 125 (± 43) red snapper were estimated to be harvested during 47 (±6) boat trips. The estimated number of fish harvested is 3.5 times greater than in 2017. The improved weather during August could account for the increase in fish caught. The number of red snapper discards, 3192 (±410), was higher than the total number of harvested fish estimated in both regions.

Each vessel was asked to provide trip level information about the depth and distance from shore where fishing occurred. Every vessel reported that their fishing occurred in federal waters, greater than 3 miles from shore, with the majority of trips occurring 18.7 miles from shore. The mean fishing depths reported by region varied, with Florida Keys fishing in depths three times greater than in Northeast Florida, 92.6 (±8.4) and 31.1 (±0.9) meters, respectively.

References

SAS Institute Inc. 2008. SAS/STAT ® 9.2 User's Guide. Cary, NC: SAS Institute Inc pp. 6457-6524

Table 2.1 Regional groupings of coastal counties used for generating catch and effort estimates.

Region	Coastal Counties
Northeast	Nassau, Duval, Clay, St. Johns, Flagler, Volusia, Brevard, St. Lucie, Martin
Southeast	Palm Beach, Broward, Miami-Dade
Keys	Monroe
West Florida	Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin, Wakulla, Taylor, Dixie, Levy, Citrus, Hernando, Pasco, Pinellas, Hillsborough, Manatee, Sarasota, Charlotte, Lee, Collier

Table 2.2 Survey frame, sample sizes, and response rates by region.

Region	Charter vessels	Total selected	Number responses via mail	Number responses via phone contact	Overall response rate
Northeast	121	101	23	48	0.703
Southeast	56	49	5	35	0.816
Keys	191	148	23	92	0.777
West Florida	122	92	27	56	0.902
Totals	490	390	78	231	0.792

Table 2.3 Summary effort and catch estimates for the federally permitted charter fleet from Region 1 (NEFL) and Region 3 (Keys), by region for the 2018 South Atlantic Red Snapper season.

Variable	Region	Estimate	S.E.	Var	95% CI		C.V.
Boat Trips	1	525	22	474	481	569	0.041
	3	47	6	37	33	60	0.131
	Overall	*571*	*23*	*511*	*526*	*617*	*0.040*
Angler Trips	1	2774	175	30494	2426	3123	0.063
	3	194	51	2569	94	295	0.261
	Overall	*2969*	*182*	*33063*	*2611*	*3327*	*0.612*
Harvest	1	3059	208	43220	2644	3474	0.068
	3	125	43	1829	40	209	0.343
	Overall	*3184*	*212*	*45049*	*2766*	*3601*	*0.067*
CPUE	1	1.02	0.03	0.001	0.96	1.08	0.030
	3	0.57	0.12	0.015	0.29	0.85	0.220
	Overall	*0.95*	*0.03*	*0.001*	*0.88*	*1.01*	*0.034*
Discards	1	3187	410	168380	2369	4005	0.129
	3	5	2	5	0	10	0.469
	Overall	*3192*	*410*	*168385*	*2384*	*3999*	*0.129*

Table 2.4 Descriptive statistics for boat trip level variables including the number of anglers, harvest, discards, fishing depths and distance from shore where fishing occurred, by region and season, for federally permitted charter vessels during the 2018 South Atlantic Red Snapper season.

Variable	Region	Mean	S.E	Var	95% CI		C.V
No. Anglers	1	5.2	0.12	0.014	5.0	5.4	0.023
	3	3.7	0.34	0.116	2.9	4.4	0.093
	Overall	*5.0*	*0.11*	*0.013*	*4.7*	*5.2*	*0.023*
Harvest	1	5.3	0.19	0.036	5.0	5.7	0.036
	3	2.1	0.45	0.205	1.1	3.1	0.214
	Overall	*4.8*	*0.18*	*0.031*	*4.5*	*5.2*	*0.036*
Release	1	6.6	0.74	0.547	5.1	8.0	0.113
	3	0.1	0.06	0.004	0.0	0.3	0.524
	Overall	*5.6*	*0.63*	*0.399*	*4.3*	*6.9*	*0.113*
Fishing Depth	1	102.2	2.80	7.852	96.5	107.8	0.027
	3	303.8	27.43	752.153	242.7	365.0	0.090
	Overall	*135.6*	*5.11*	*26.102*	*125.4*	*145.8*	*0.038*
Majority Distance	1	19.8	0.62	0.387	18.5	21.0	0.031
	3	13.2	2.40	5.780	7.9	18.6	0.182
	Overall	*18.7*	*0.65*	*0.416*	*17.5*	*20.0*	*0.034*
Maximum Distance	1	21.7	0.67	0.444	20.4	23.0	0.031
	3	16.2	3.46	11.973	8.5	23.9	0.213
	Overall	*20.9*	*0.78*	*0.608*	*19.3*	*22.4*	*0.037*
Minimum Distance	1	17.6	0.55	0.302	16.5	18.7	0.031
	3	10.7	1.13	1.273	8.2	13.2	0.105
	Overall	*16.5*	*0.50*	*0.246*	*15.5*	*17.5*	*0.030*

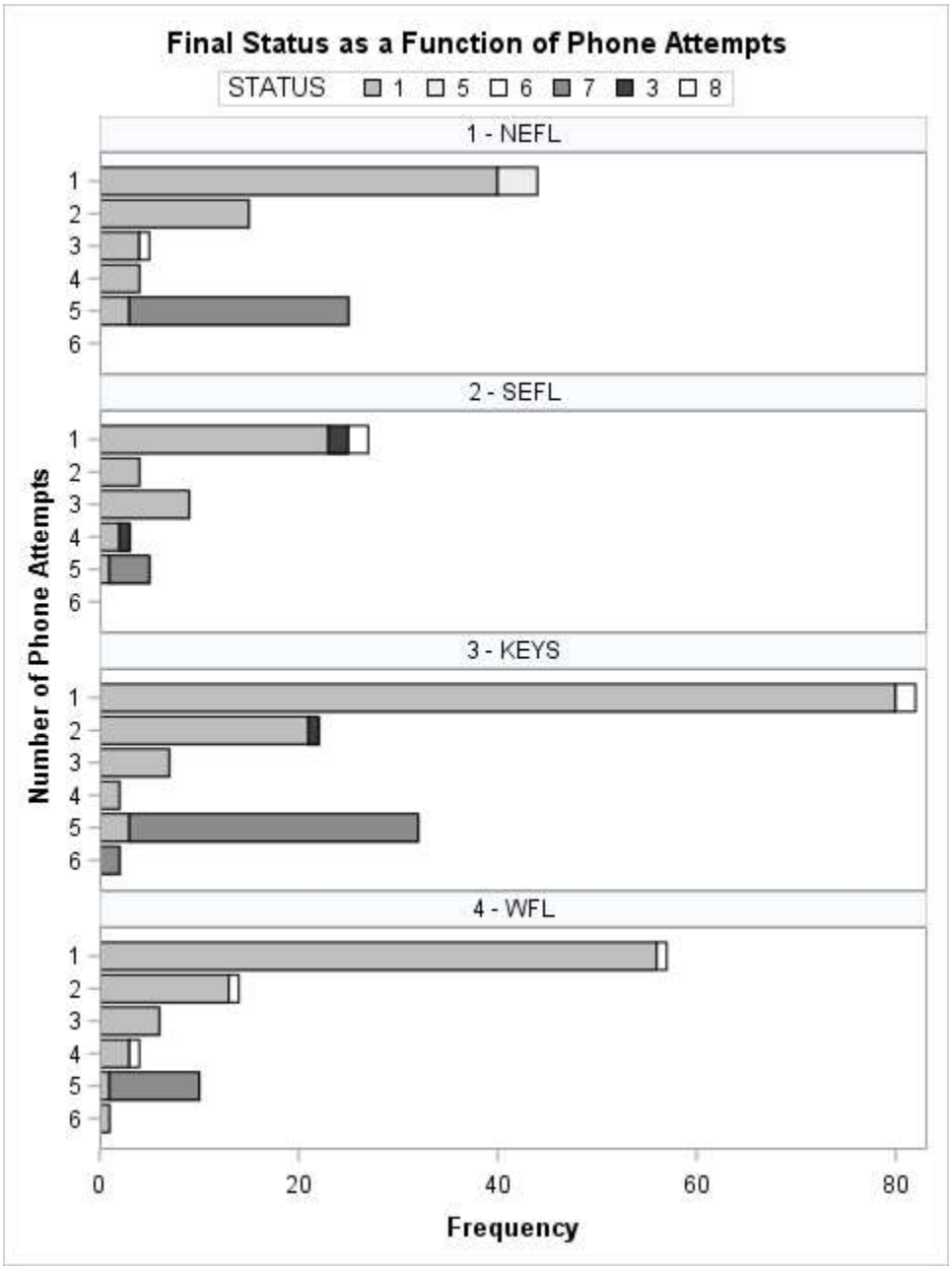
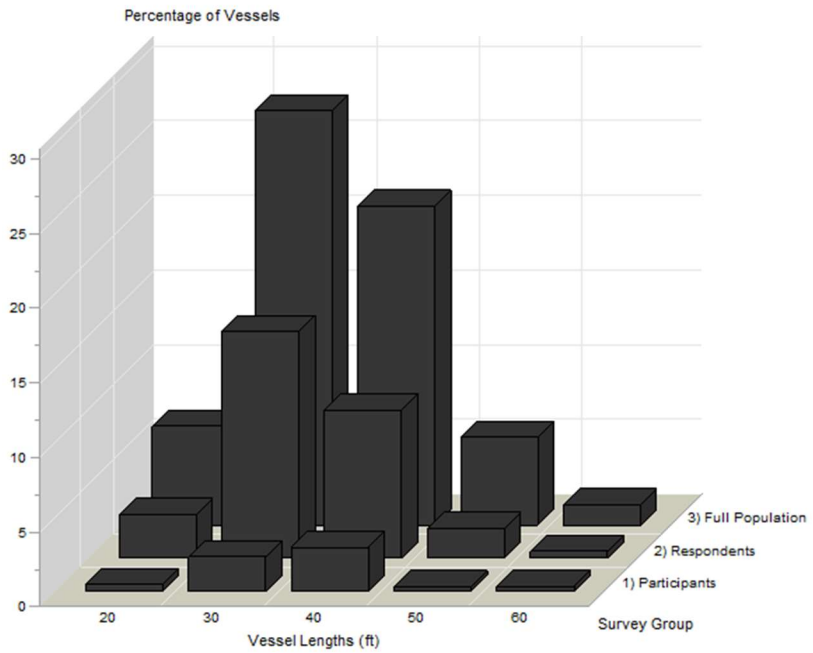


Figure 2.1 Frequency of attempted telephone calls to federally permitted charter representatives, as a function of the status after the final call. Status codes: 1=Complete interview, 2=Incomplete, but all key questions answered, 3=Refusal, 4=Language barrier, 5=Mid-Interview refusal, 6=Ineligible, 7=Unable to contact, 8=Inactive.

A.



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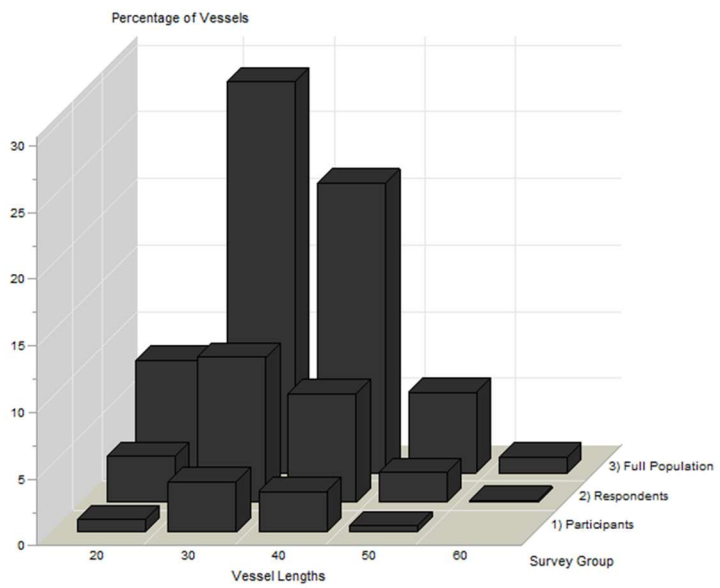


Figure 2.2 Percentage of vessels in 10 ft. length bins for three charter vessel groups: Full Population – all charter vessels, Respondents – vessels that responded to the survey, and Participants – vessels that responded to and conducted Red Snapper trips during the South Atlantic Red Snapper fishing season. Panel A and B represent the 2017 and 2018 South Atlantic Red Snapper fishing seasons, respectively.

Section 3. Biological Sampling

Methods

The Red Snapper harvest season provides an opportunity to collect fishery dependent biological samples. During the 2018 season, age structures were collected from fish sampled during intercept surveys with private boat parties (described above in Section 1). During interviews with private boat fishing parties, all available Red Snapper were measured (at midline in mm), weighed (kg), and one otolith was extracted. Priority was given to collecting the left otolith, and this was done to quickly process fish so they could be returned to anglers.

In addition, fish were sampled from private boat and charter fishing parties as part of a three-year pilot study to test methods for collecting biological data that are representative of the recreational fishery on the east coast of Florida. The study began in 2017 and is funded through MARFIN (award number NA16NMF4330163). The survey design includes year-round, stratified random sampling of offshore landing sites clustered around egress points along the east coast of the Florida peninsula. Snappers, groupers, and other managed species are targeted for collection of biological data. Additional MARFIN assignments were issued at charter sites to increase samples collected from this segment of the recreational fishery, and assignments were also conducted at sites with private boat mode pressure as originally scheduled to supplement data collected during the Red Snapper intercept survey.

To account for varied sampling rates across inlets in the study area, sample weights were calculated. For private boat catch, sample weights were calculated for each inlet as:

$$W_h = {\hat{C}_h}/{n_h} \qquad (3.1)$$

where $\hat{C}_h$ is the estimated landings for inlet h (reported in Table 1.3), and n_h is the number of fish sampled in inlet h (reported in results section below). Sample weights for each inlet were used to calculate an overall weighted mean for fork length (in mm) and kilograms for landed fish (using the survey means procedure in SAS). The sample weights for fish in each 1 cm length bin were also summed and divided by the sum of all sample weights (equal to total estimated landings) to calculate the weighted proportion of fish in each size category.

Red Snapper otoliths were assigned a unique sample number and associated data entered into the central database for fishery dependent biological samples housed at FWRI. Data are stored on a secure network that is routinely backed up. Otoliths collected during the 2018 season will be sectioned and aged in house at FWRI's Age and Growth Lab. Otoliths from fish sampled by the state of Georgia were also shipped to FWRI for processing. All resulting biological data will be shared with analysts from the NMFS Southeast Fisheries Science Center for the next SEDAR stock assessment update. Resulting ages for fish sampled during the 2017 season are also presented.

Results

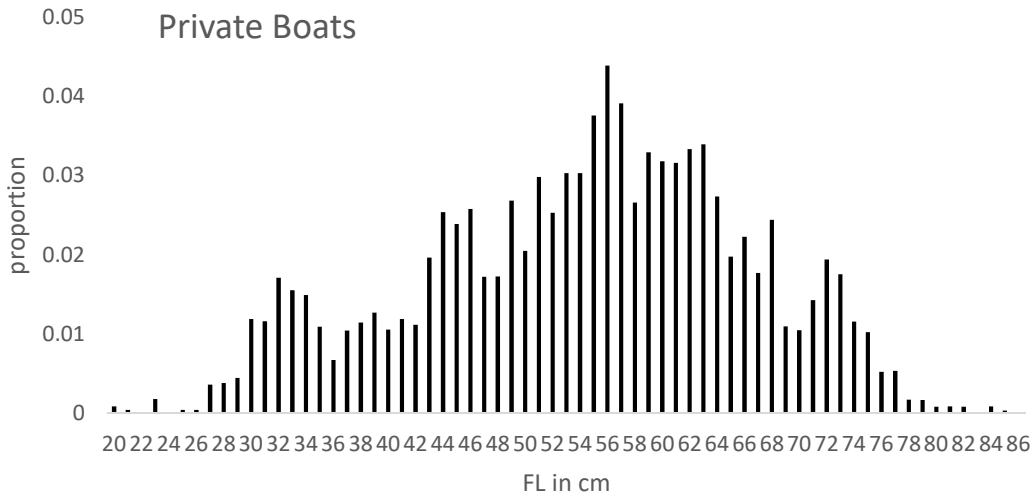
Biological Samples collected during 2018

Sample sizes for numbers of Red Snapper measured, weighed, and sampled for age and growth during 2018 are provided in Table 3.1. The mean length and weight for Red Snapper sampled from private boat trips and charter trips that were not included in the charter survey was 580.81 ±2.998 mm fork length and 3.97 ±0.056 kg. Excluding fish sampled from charter trips that were not included in the charter survey had a negligible effect on the overall mean size (580.48 ±3.049 mm fork length) and weight (3.96 ±0.057 kg). The weighted length frequency of fish harvested by private boat anglers is shown in Figure 3.1. Red Snapper sampled from charter boats that were included in the charter survey averaged 580.48 mm (±3.049) and 3.962 kg (±0.057). The length frequency of fish harvested by charter boat anglers is also shown in Figure 3.1.

The 2017 South Atlantic season occurred late in the year during November and December, and the age distribution of Red Snapper sampled during this season is presented in Figure 3.2. The majority of fish harvested by private boat and charter anglers were younger than 5 years of age. Factors that may have influenced the selectivity of the recreational fishery during this season include colder temperatures, poor offshore conditions for small craft (including high wind and wave heights), and shorter days (early sunset times) that resulted in private boat parties fishing closer to shore (Figure 3.3). Lower discard rates (CPUE 0.488 ±0.060) during this season also indicate anglers may have also been less likely to release fish in hopes of catching a larger sized fish. Thus, time of year when the season is open may influence the selectivity of the fishery.

Table 3.1. Numbers of fish sampled for length, weight and otoliths from private boat trips (intercept surveys and MARFIN combined) and charter boat trips (intercept surveys and MARFIN combined). Numbers in parenthesis indicate additional fish sampled during intercept surveys from vessels that were not included in charter survey, and were thus included in the catch estimate for private boats.

Inlet	Mode	Number length samples	Number weight sampled	Number otolith samples
Cumberland	Private boat	105 (10)	102 (10)	102 (10)
Mayport		377 (31)	361 (31)	361 (31)
St. Augustine		317 (4)	257 (4)	293 (4)
Ponce Inlet		242	241	239
Port Canaveral		815	790	811
Sebastian Inlet		36 (46)	32 (46)	30 (45)
Fort Pierce and St. Lucie		30 (4)	30 (4)	17 (4)
Total		1,922 (95)	1,813 (95)	1,853 (94)
Cumberland	Charter boat	111	87	111
Mayport		31	25	31
St. Augustine		262	229	259
Ponce Inlet		21	21	21
Port Canaveral		252	246	239
Sebastian Inlet		55	42	55
Fort Pierce and St. Lucie		0	0	0
Total		732	650	716



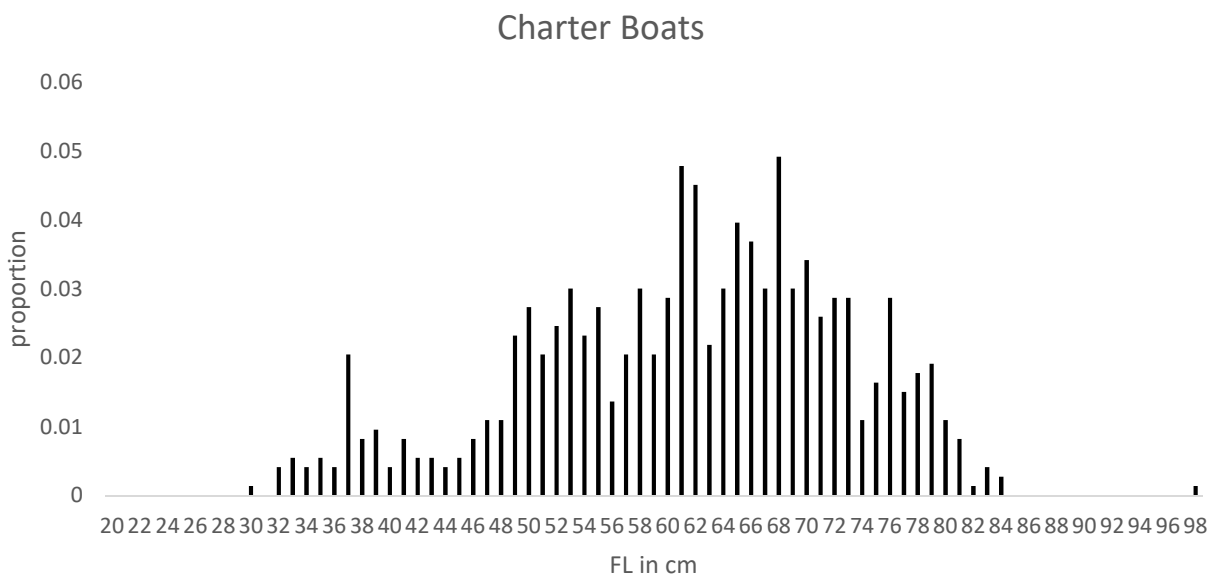


Figure 3.1. Size distribution of harvested Red Snapper sampled from private boat (top) and charter trips (bottom) during 2018. Samples for private boats are weighted proportional to total estimated landings for each inlet.

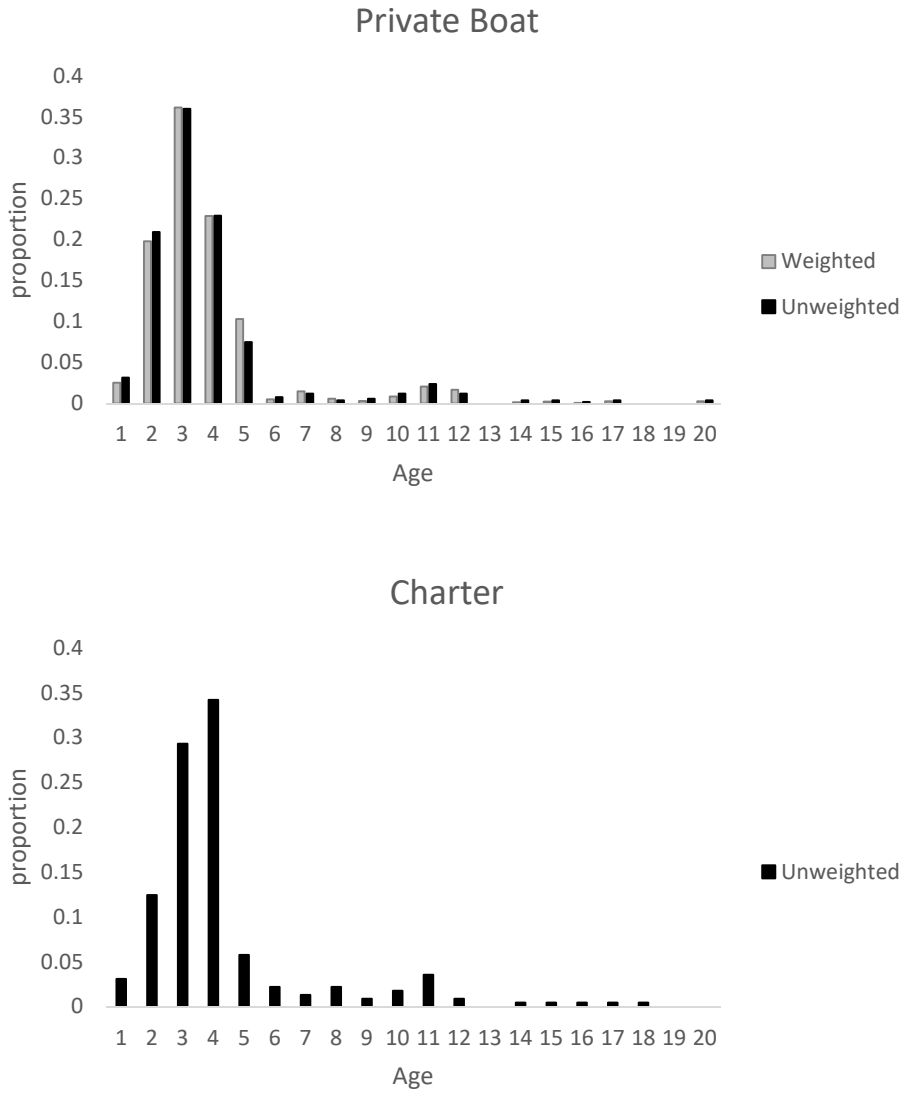


Figure 3.2 Age distributions of harvested Red Snapper sampled during the 2017 South Atlantic season.

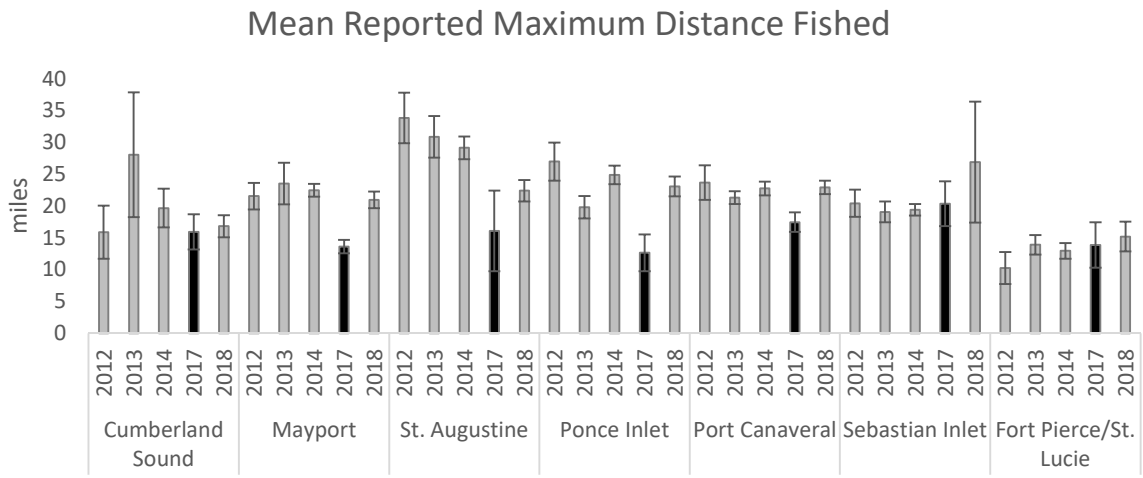


Figure 3.3. Mean values for maximum distance from shore (in miles) where private boat fishing parties intercepted from each inlet reported fishing for Red Snapper during 2012 to 2018 harvest seasons. Dark bars highlight the 2017 season, when private boat anglers reported fishing closer to shore. The 2017 season fell late in the year (Nov./Dec.) during a period of low temperatures and rough offshore conditions, and short daylight hours.

Appendix 1. Letter sent to federally permitted charter representatives the week prior to the South Atlantic Red Snapper season opening in August.

FWC RED SNAPPER SURVEY

Florida Fish and Wildlife Conservation Commission

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Panama City

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Fish and Wildlife Research Institute
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727-896-8626
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Managing fish and wildlife resources for their long-term well-being and the benefit of people.

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800-955-8770 (V)
MyFWC.com/Research

July 31, 2018

Dear Florida Charter Vessel Operator,

The red snapper recreational season on the Atlantic coast of Florida will be open for six days, over two weekends, August 10, 11, 12 and August 17, 18, 19. The state of Florida is requesting your assistance so that we can collect more precise information on the numbers of charter trips and numbers of red snapper harvested during this short season. Enclosed is a log sheet printed on waterproof paper that may be used to keep track of your charter fishing activity during the 2018 red snapper season. You may respond to this survey in one of two ways:

1. At the close of the red snapper season, return the completed log sheet using the self-addressed postage-paid envelope. If your charter business is not offering charter fishing trips in the Atlantic Ocean during the 2018 season, simply record this information at the top of the log sheet and mail it to us at your earliest convenience.

2. After August 19, an FWC biologist will contact you by telephone to conduct a short interview and collect information about your charter fishing activity during the red snapper season. If you have already mailed your log sheet to FWC when you receive our call, please let the caller know and we will not contact you again.

We are collecting this additional information because the regular dockside intercept survey (when FWC biologists interview charter customers at the dock) was not designed to precisely estimate landings over very short fishing seasons. The precise landings and fishing effort estimates generated from this survey last year were provided to National Marine Fisheries Service, and were used to support the decision to re-open the fishery this year. Therefore, your assistance during this special season is requested to ensure that we collect the best data possible to accurately assess the 2018 red snapper fishing season.

FWC is also working in cooperation with the National Marine Fisheries Service to conduct additional dockside surveys with charter boat and private recreational anglers as they return from red snapper fishing trips. Biologists will ask for permission to weigh and measure fish and collect samples to determine the age of each fish. The recreational harvest season offers our only opportunity to collect this vital information for use in future stock assessments. To learn more about these efforts, please visit our website. A copy of the report produced last year is available at http://myfwc.com/research/saltwater/fishstats/recreational-fisheries/atlantic-results/. Please feel free to contact myself or Beverly Sauls at (727) 896-8626 or FishStats@MyFWC.com if you have any questions or concerns. Thank you for your cooperation.

Sincerely,

Dominique Lazarre

Dominique Lazarre
Associate Research Scientist

Appendix 2. Log sheet sent to federally permitted charter representatives the week prior to the South Atlantic Red Snapper season opening in August.

Florida – Red Snapper Survey Log Vessel Name: Vessel Number:

Did you participate in the 2018 Federal South Atlantic Red Snapper Season (Trips where you kept, released, or tried to catch Atlantic Red Snapper)? YES NO
If you circled yes above, please complete the log sheet below. Only report trips where Atlantic Red snapper were harvested, released at sea, or targeted.

Please return all completed log sheets with the self-addressed postage-paid envelope provided. Thank you for your participation.

Date	Day of Week	Trip No.	Trip Type (Charter, Headboat, or Other)	No. of Anglers	No. in Party	Origin of Trip		Miles from Shore (range)	Miles from Shore (majority of trip)	Depth Fished (majority of trip)	Time Trip Started (24hr)	Time Trip Ended (24hr)	Time Spent Fishing (nearest half-hr)	No. of Atlantic Red Snapper Kept	No. of Atlantic Red Snapper Released
						State	County								
8/10/2018	FRI	1													
8/10/2018	FRI	2													
8/10/2018	FRI	3													
8/11/2018	SAT	1													
8/11/2018	SAT	2													
8/11/2018	SAT	3													
8/12/2018	SUN	1													
8/12/2018	SUN	2													
8/12/2018	SUN	3													
8/17/2018	FRI	1													
8/17/2018	FRI	2													
8/17/2018	FRI	3													
8/18/2018	SAT	1													
8/18/2018	SAT	2													
8/18/2018	SAT	3													
8/19/2018	SUN	1													
8/19/2018	SUN	2													
8/19/2018	SUN	3													

Please write any additional comments about the season or your trips on the back of this sheet.

Appendix 3. The PROC SURVEYMEANS code used in SAS to generate the total number of charter boat trips that targeted Red Snapper, charter angler trips that targeted Red Snapper, and numbers of fish harvested and discarded by all active federally permitted charter vessels during the 2018 South Atlantic Red Snapper season.

```
*COMPLETE ESTIMATE USING PROC SURVEYMEANS;
proc surveymeans data=charter total=pop sum sumwgt cvsum std varsum clsum missing ;
    strata     region season;
    weight      w;
    domain      region season region*season;
    var         rf_trips Anglers Harv Rel;
    ods output statistics=charter_estimate domain=charter_strat;
run;
```