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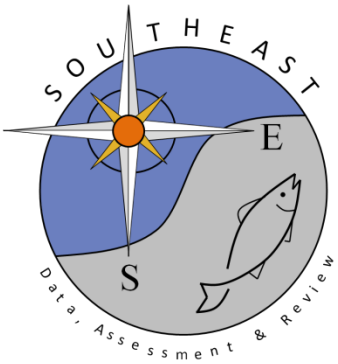

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Florida Fish and Wildlife Conservation Commission
Fish and Wildlife Research Institute
Saint Petersburg, FL

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Saint Petersburg, FL

Table of Contents

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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 2017 recreational season for Red Snapper in the South Atlantic. Sampling activities were conducted over two weekends in November (Friday through Sunday, November 3-5 and November 10-12) when recreational harvest of Red Snapper was initially open in the South Atlantic, and one additional weekend in December (8-10) when the season was extended. One week prior to the initial 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. Inclement weather prevented many anglers and charter vessel operators from attempting to fish offshore, and on Monday November 13, one day after the season closed, a preliminary landings estimate of 3,313-4,460 fish harvested by private boat anglers in Florida was provided to the NMFS Southeast Regional Office (SERO). An estimate for charter boats was not available; however, the private boat segment typically accounts for the majority of landings in Florida. The season was extended one additional weekend (December 8-10) to provide anglers another opportunity to harvest the available quota. Thus, field sampling activities in Florida were resumed in December so that landings could be estimated for the full nine-day season. Charter vessel operators also received a second log sheet followed up with an additional phone contact. Following the third weekend, an updated preliminary estimate was requested by SERO and was provided on January 9, 2018. Results reported herein are complete and replace all prior preliminary estimates provided during the days and weeks following the three weekend openings. Final estimates are provided for both the private boat and charter segments of the recreational fishery over the nine days that the recreational season for Red Snapper was open on the east coast of Florida during 2017.

During 2017, boat activity was monitored through nine inlets that provide access to the Atlantic Ocean along the east coast of Florida, and 259 private boat parties were interviewed upon returning from trips targeting Red Snapper to collect information on CPUE and biological characteristics of harvested fish. Information from the two surveys was combined to estimate effort and catch for the private boat segment of the recreational fishery. An estimated 5,390 (SE ±475) Red Snapper were harvested during 8,878 angler trips (SE ±385) over the nine-day season. The mean length and weight for Red Snapper sampled from

private boat trips was 542.9 mm (±7.2) midline length and 3.195 kg (±0.115). For the federally permitted charter fleet, 80.3% of vessel operators selected to report during November and December responded to the survey, and 22.7% of responses were log sheets that were returned in the mail. Overall, an estimated 898 (±81) Red Snapper were harvested during 834 (±75) angler trips from charter vessels over the nine days. Most charter landings occurred in northeast Florida (743±71), with a CPUE (1.18±0.03) that is almost two times higher than in the Florida Keys (0.69 ± 0.08). Red Snapper sampled from charter boats averaged 586.918 mm (±7.258) and 3.998 kg (±0.137).

The Red Snapper harvest season also provided an opportunity to collect fishery dependent biological samples. During 2017, age structures were collected from 211 Red Snapper sampled from charter trips and 517 fish sampled from private boat trips. Age structures were collected from fish sampled during intercept surveys with private boat parties, 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). When two otoliths could be collected from the same fish, FWRI's Age and Growth lab is sharing one with researchers at the University of Florida for microchemistry analysis. Fin clips were also collected from 180 Red Snapper and provided to FWRI's Genetics Lab.

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 nine-day season in 2017. 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 959 hours eastern daylight savings time (EDT, November 3-4) or 1059 hours eastern standard time (EST, after November 4). The mid-day period was defined as 1100-1459 EDT or 1000-1359 EST, and the p.m. period began at 1500 EDT or 1400 EDT and ended at local sunset time. Each inlet was observed at least once during each day of the nine-day season. Within each three-day weekend, an inlet was observed during at least 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 the three spaced 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 the three weekends of the 2017 season. 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). A new question was also added to the intercept survey this year to measure how frequently private boat anglers use tools to mitigate barotrauma, including venting and recompression devices, when discarding Red Snapper.

Effort Estimation.— Three main steps were used to estimate fishing effort during the 2017 Red Snapper season: 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.

Step 1

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:

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

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

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

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 2014, N = 8 days * 3 four-hour periods per day), and summed across inlets as:

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

Variance was calculated by:

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

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:

$$p_h = t_h / n_h \qquad (1.5)$$

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 0700 hours are excluded from both the numerator and denominator in equation 10. Error for the proportion was calculated as:

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

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:

$$\hat{T}_h = N_h p_h \quad (1.7)$$

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:

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

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 (0700 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:

$$\hat{T}_{h,adj} = \frac{\hat{T}_h}{p_h} \quad (1.9)$$

and error was propagated by:

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

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:

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

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:

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

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:

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

Variance is given by:

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

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

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

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

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

Lastly, total catch was estimated by:

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

with variance:

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

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

Results

Fishing effort for Red Snapper was highest between Mayport and Port Canaveral (Table 1.1), similar to previous seasons (Sauls et al. 2017). Due to low numbers of intercepted boat parties, Fort Pierce and St. Lucie inlets were pooled before effort estimates were calculated (Table 1.1). Overall, fishing effort during 2017 was reduced compared to prior years. This was due in part to poor conditions offshore for small craft, and cold temperatures during the third weekend in December. Sustained wind speed measured inland at major airports in the region were as high as 24 mph during the second weekend in November, and average air temperatures were as low as 44 degrees F during the third weekend (Table 1.2). Boat parties that targeted Red Snapper during 2017 also reported fishing closer to shore compared to previous years (Figure 1.2).

Harvest rates varied across inlets, with an overall CPUE of 0.607 fish per angler trip (Table 1.3). Even though there was no size limit to discourage discarding, on average 0.488 Red Snapper per angler trip were reported released (Table 1.4). Over the 9-day season, a total estimated 5,390 ($\pm$475) Red Snapper were harvested by private boat anglers, with a mean weight of 3.195 ($\pm$0.115) per landed fish (Table 1.3); and an estimated 4,331 ($\pm$561) fish were discarded (Table 1.4). Landings during 2017 were not as high as previous years, which was due to low effort (Table 1.5).

References

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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	12	4.67±0.570	0.714±0.180	0.583±0.195	197±085	658±283
Mayport	59	3.70±0.184	0.800±0.064	0.542±0.079	422±083	1,477±281
St Augustine	16	2.75±0.273	0.857±0.140	0.438±0.197	326±158	1,090±530
Ponce Inlet	40	3.06±0.216	1.000±0.00	0.425±0.133	663±213	2,217±713
Port Canaveral	108	3.25±0.135	0.688±0.044	0.602±0.041	304±033	1,017±114
Sebastian Inlet	17	3.56±0.406	0.929±0.069	0.882±0.087	272±039	911±133
Fort Pierce*	7	3.14±0.552	0.200±0.131	0.286±0.140	258±213	863±712
St. Lucie*					250±206	837±688
Overall	259	3.47±0.268			2,713±418	9,070±1,400

*Intercept data pooled

Table 1.2. Weather in study area.

Location	Date	Average air temperature (F)	Sustained wind speed (MPH)	Wind direction
Jacksonville International Airport	Nov 3	71	13	NE
	Nov 4	71	14	NE
	Nov 5	70	17	NE
	Nov 10	60	18	NNE
	Nov 11	63	24	NE
	Nov 12	72	21	ENE
	Dec 8	50	18	N
	Dec 9	44	21	WNW
	Dec 10	44	12	NNW
Daytona Beach International Airport	Nov 3	72	20	NNE
	Nov 4	72	17	NNE
	Nov 5	74	17	NE
	Nov 10	68	20	NE
	Nov 11	73	23	ENE
	Nov 12	75	20	NNE
	Dec 8	54	20	NNE
	Dec 9	47	14	N
	Dec 10	50	10	N

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

Inlet	CPUE	Landings (numbers of fish)	Landings c.v.	Mean weight (kg)	Landings (kg)
Cumberland	0.929 (±0.083)	853 (±109)	0.128		
Mayport	0.725 (±0.057)	1,186 (±111)	0.093		
St Augustine	0.455 (±0.124)	408 (±131)	0.321		
Ponce	0.471 (±0.083)	880 (±179)	0.204		
Port Canaveral	0.693 (±0.045)	685 (±50)	0.073		
Sebastian	0.895 (±0.056)	869 (±65)	0.075		
Fort Pierce/St. Lucie	0.318 (±0.141)	509 (±226)	0.444		
Overall	0.607 (±0.047)	5,390 (±475)	0.088	3.195 (±0.115)	17,221 (±1,637)

Table 1.4. Mean CPUE (discards per angler trip) and estimated total discards ±SE.

Inlet	CPUE	Discards (numbers of fish)	Discards c.v.
Cumberland	0.339 (±0.106)	312 (±102)	0.326
Mayport	0.588 (±0.082)	961 (±142)	0.148
St Augustine	0.955 (±0.287)	856 (±295)	0.344
Ponce	0.510 (±0.140)	952 (±279)	0.293
Port Canaveral	0.544 (±0.064)	538 (±66)	0.122
Sebastian	0.509 (±0.092)	494 (±91)	0.185
Fort Pierce/St. Lucie	0.136 (±0.098)	111 (±82)	0.743
Overall	0.488 (±0.060)	4,331 (±561)	0.129

Table 1.5. 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
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

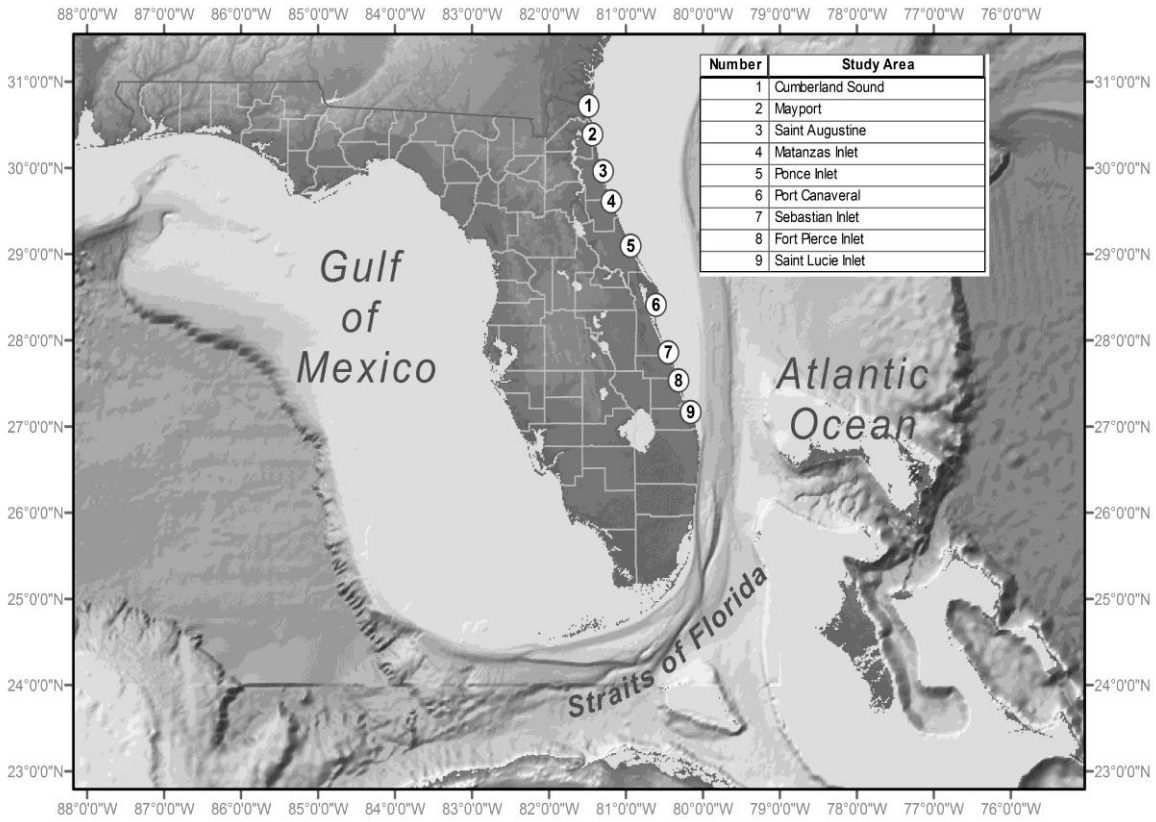

Figure 1.1. Inlets included in study area.

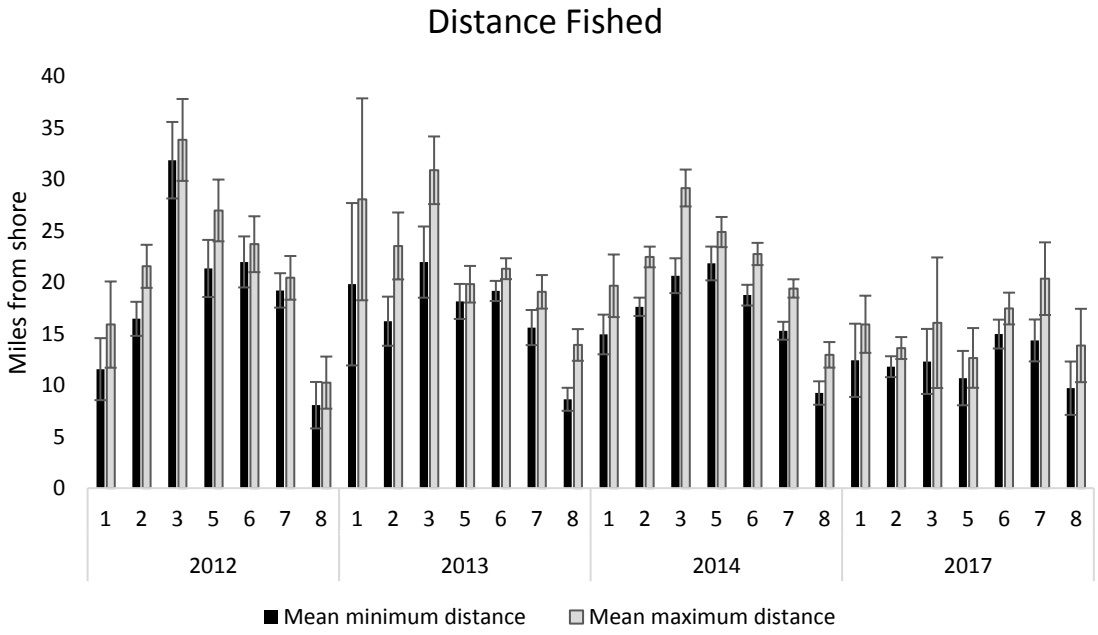

Figure 1.2. Mean minimum and maximum distance from shore (in miles) where anglers from each inlet (Figure 1.1) reported fishing during the 2017, compared to three previous years.

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 6, 2017, 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 one or more weeks in the FHTS.

During the week before the November 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 (Appendix 1). 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 (Appendix 2). When the season was extended for an additional weekend in December, a new list of vessels with a federal permit that were not selected for the FHTS was generated, vessel representatives were contacted via mail the week prior, and a new log sheet and postage paid envelope was enclosed with the notification letter. 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 for the month(s) selected.

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:

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

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.

Results and Discussion: Charter Mode

The implementation of a dual mail / phone survey to collect trip level data from the federal for-hire fleet during the 2017 South Atlantic Red Snapper season resulted in the highest response rates reported from the fleet since the first South Atlantic Red Snapper charter surveys were conducted in 2012. The response rates by region and season range from 75.4-87.5%, with an overall response rate of 80.3% for charter vessels surveyed (Table 2.2). The increase in response rate may be due, in part, to providing a method for vessel representatives to return survey responses by mail in addition to telephone calls after the season. The percentage of responses received via mail accounted for 17.2-34.3% of the responses observed, with the highest mail response rate occurring in Region 4, the Gulf coast of Florida. The advanced warning and log sheet provided captains with a convenient method to report, particularly for charter vessels that do not regularly participate in the South Atlantic Red Snapper fishing season. It also served to highlight what information would be requested during the follow up calls at the end of each fishing period, which may be evident in the high proportion of interviews completed with a single phone attempt (Figure 2.1). The lowest response rate was seen in the Florida Keys, 75.4%. This may be due in part to displacement of charter captains after Hurricane Irma, as evidenced by the higher frequency of individuals who could not be contacted after multiple attempts in that region (Figured 2.1).

Before generating catch and effort estimates, the length frequency distribution of vessel lengths was compared to between the full charter vessel population, the vessels that responded, and the respondents that participated in the Red Snapper fishing season to determine if the respondents and participants are representative of the full population. The vessel length distributions of the full charter population and respondents appear to have similar shape, and are likely representative. The vessel length distribution of participants shows a shift in the mode from the 30 to the 40 ft. depth bin (Figure 2.2). Estimates of boat trips, angler trips, harvest, and discards were only generated for Regions 1 (NEFL – Nassau to Martin Counties) and Region 3 (Florida Keys - Monroe County); no trips were taken by respondents from Regions 2 (SEFL – Palm Beach to Miami-Dade) and Region 4 (WFL – Escambia to Collier Counties). An estimated 147 (±12) boat trips were taken by charter captains during the South Atlantic Red Snapper season, with a total of 834 (±75) angler trips (Table 2.3). It was estimated that 898 (±81) fish were harvested, and almost double that number were released during Federal for-hire trips, 1,622(±253). Most Red Snapper were harvested in northeast Florida (743±71), with a CPUE (1.18±0.03) that is almost two times higher than in the Florida Keys (0.69 ± 0.08).

Each vessel provided trip level information about the depth and distance from shore where fishing occurred. On average vessels in the Florida Keys fished between 8 and 10 miles from shore, reaching an average depth of 245 ft., whereas anglers in northeast Florida traveled approximately 17 miles offshore to reach depths of 92 ft. (Table 2.4). The depth and distance from shore range does not vary between the two fishery openings (Table 2.4), though the weather reports indicated higher winds and seas in December (Table 1.4).

Charter vessels without federal permits were not included in this survey; however, when fishing in state waters they must abide by the 20” size limit. Legal sized fish are rare in state waters off the northeast coast of Florida, where Red Snapper are most abundant, although legal sized fish could be targeted in state waters off Dade and Monroe Counties during the South Atlantic season. However, given that state waters are open year-round there is no incentive for state vessels to target Red Snapper during the short South Atlantic season. In 2017, the MRIP did not intercept any Red Snapper harvested by charter anglers during any wave from state waters off the Atlantic coast of Florida. For these reasons, it is unlikely that charter landings were missed by not including state vessels in this survey.

We did not attempt to validate self-reported effort or catch for charter vessels during this survey. However, charter vessels were readily observed exiting through inlets, returning to boat ramps during Red Snapper intercept surveys, and during biological sampling of catch during MARFIN assignments. Unfortunately, vessel identifier information was not collected during 2017; however, these survey efforts present opportunities under a randomized sample design to collect data that could be used to verify whether fishing activity and landed catch are accurately reported in the mail and telephone survey. In future seasons, a validation component will be added to these surveys so data may be used to verify self-reported charter effort and catch.

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
1	Nassau, Duval, Clay, St. Johns, Flagler, Volusia, Brevard, St. Lucie, Martin
2	Palm Beach, Broward, Miami-Dade
3	Monroe
4	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 Summary data related to sample size of the charter population (N=451 total vessels) and associated response rates by region and season.

Region	Opening	Charter Vessels	Total Selected	Total Responded	% Mail Response	% Phone Response	Response Rate
1	Nov	102	74	61	27.3	72.7	82.4
	Dec		78	66	26.2	73.8	84.6
2	Nov	53	38	29	17.2	82.8	76.3
	Dec		-	-	-	-	-
3	Nov	178	135	106	18.9	81.1	78.5
	Dec		138	104	22.1	76.9	75.4
4	Nov	118	80	70	34.3	65.7	87.5
	Dec		-	-			-
Overall							*80.3*

Table 2.3 Summary effort and catch estimates for the federally permitted charter fleet from Region 1 (NEFL) and Region 3 (Keys), by region and season for the 2017 South Atlantic Red Snapper season.

Variable	Region	Season	Estimate	S.E.	Var	95% CI		C.V.
Boat Trips	1	Nov	90	9	87	72	109	0.103
		Dec	26	3	11	20	33	0.125
	3	Nov	29	6	35	17	40	0.207
		Dec	2	1	1	0	4	0.645
	Overall		*147*	*12*	*134*	*124*	*170*	*0.079*
Angler Trips	1	Nov	510	58	3350	394	626	0.113
		Dec	119	16	266	86	152	0.137
	3	Nov	196	44	1911	110	283	0.223
		Dec	9	6	30	-2	20	0.645
	Overall		*834*	*75*	*5558*	*687*	*981*	*0.089*
Harvest	1	Nov	607	69	4709	470	744	0.113
		Dec	136	19	370	98	174	0.142
	3	Nov	146	40	1598	67	225	0.274
		Dec	9	6	30	-2	20	0.645
	Overall		*898*	*82*	*6707*	*737*	*1059*	*0.091*
CPUE	1	Nov	1.20	0.032	0.0010	1.14	1.27	0.027
		Dec	1.13	0.041	0.0017	1.05	1.22	0.036
	3	Nov	0.67	0.082	0.0067	0.49	0.85	0.122
		Dec	1	-	-	-	-	0
	Overall		1.06	0.027	0.0007	1.00	1.11	0.025
Discards	1	Nov	1366	246	60297	875	1857	0.180
		Dec	246	59	3511	127	364	0.241
	3	Nov	10	6	41	-3	23	0.636
		Dec	0	0	0	0	0	.
	Overall		*1622*	*253*	*63849*	*1125*	*2119*	*0.156*

Table 2.4 Descriptive statistics for 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 2017 South Atlantic Red Snapper season.

Variable	Region	Season	Mean	S.E.	Var	95% CI		C.V.
No. Anglers	1	Nov	5	0	0.039	5	6	0.036
	1	Dec	5	0	0.045	4	5	0.044
	3	Nov	4	0	0.041	4	5	0.049
	3	Dec	5	.	.	.	.	0.000
	Overall		5	0	0.014	5	5	0.024
Harvest	1	Nov	7	0	0.073	6	7	0.041
	1	Dec	6	0	0.097	5	6	0.057
	3	Nov	3	0	0.151	2	4	0.139
	3	Dec	5	.	.	.	.	0.000
	Overall		5	0	0.032	5	6	0.033
Release	1	Nov	15	2	3.904	11	19	0.134
	1	Dec	11	2	5.196	6	16	0.201
	3	Nov	0	0	0.010	0	0	0.636
	3	Dec	0	.	.	.	.	.
	Overall		10	1	1.249	8	12	0.111
Fishing Depth	1	Nov	87.2	2.6	6.766	81.9	92.6	0.030
	1	Dec	101.1	4.4	19.613	91.6	110.6	0.044
	3	Nov	240.2	18.3	334.306	200.4	280.0	0.076
	3	Dec	300.0	.	.	.	.	0.000
	Overall		131.9	4.7	22.449	122.3	141.4	0.036
Majority Distance	1	Nov	17.9	1.0	0.989	15.8	19.9	0.056
	1	Dec	16.9	0.6	0.372	15.6	18.2	0.036
	3	Nov	9.2	1.0	0.987	7.0	11.4	0.108
	3	Dec	8.0	.	.	.	.	0.000
	Overall		15.4	0.6	0.305	14.3	16.5	0.036
Minimum Distance	1	Nov	17.4	1.0	0.948	15.4	19.4	0.056
	1	Dec	16.5	0.6	0.397	15.2	17.8	0.038
	3	Nov	7.9	0.8	0.707	6.1	9.8	0.106
	3	Dec	8.0	.	.	.	.	0.000
	Overall		14.8	0.5	0.288	13.7	15.8	0.036
Maximum Distance	1	Nov	18.1	1.1	1.127	15.9	20.3	0.059
	1	Dec	17.2	0.6	0.333	16.0	18.4	0.034
	3	Nov	10.7	1.1	1.110	8.4	13.0	0.098
	3	Dec	8.0	.	.	.	.	0.000
	Overall		15.9	0.6	0.347	14.8	17.1	0.037

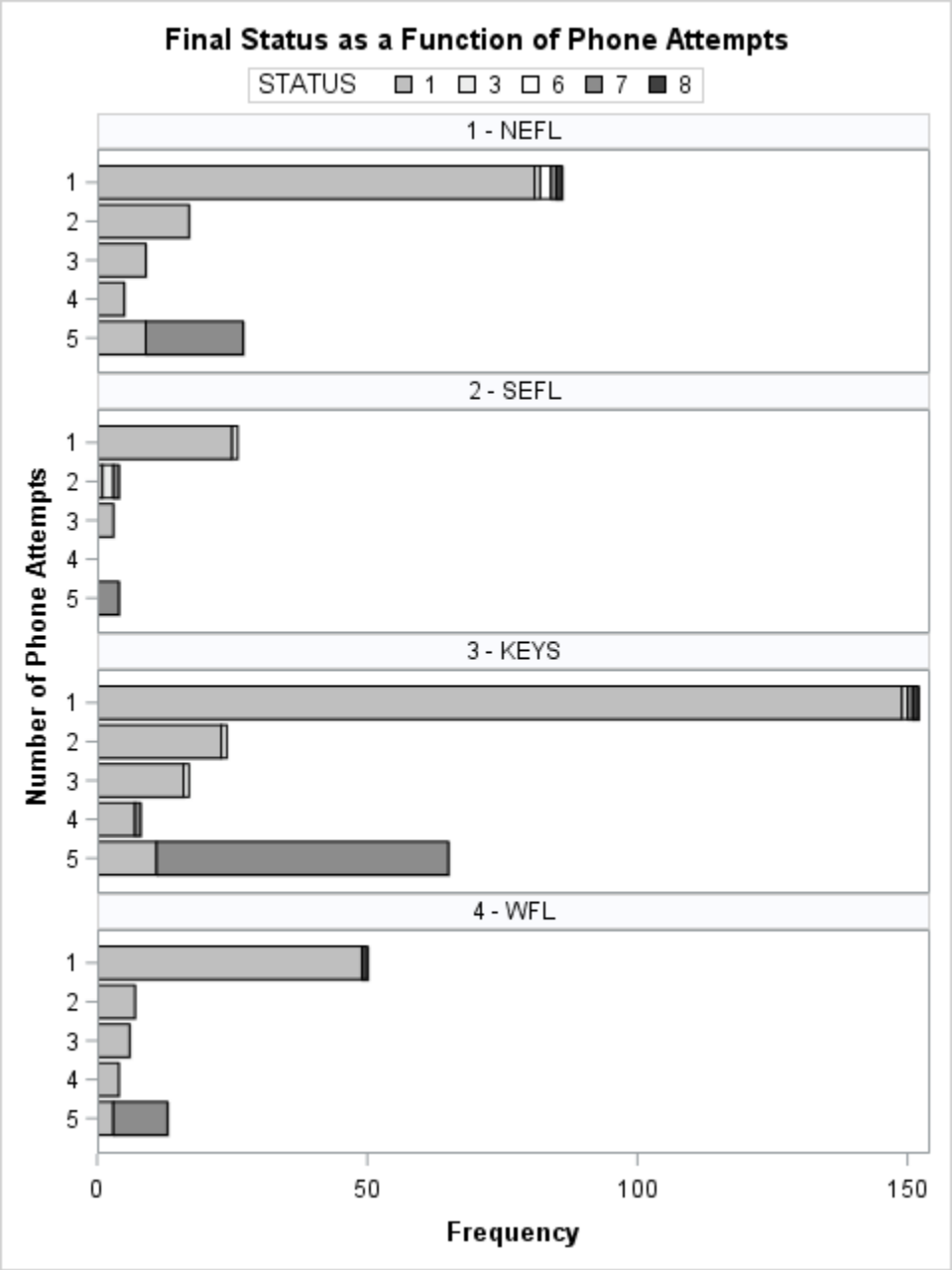

Figure 2.1 Frequency of attempted telephone calls to federally permitted charter representatives, as a function of the status after the final call. Status codes: 1=Complete interview, 2=Incomplete, but all key questions answered, 3=Refusal, 4=Language barrier, 5=Mid-Interview refusal, 6=Ineligible, 7=Unable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

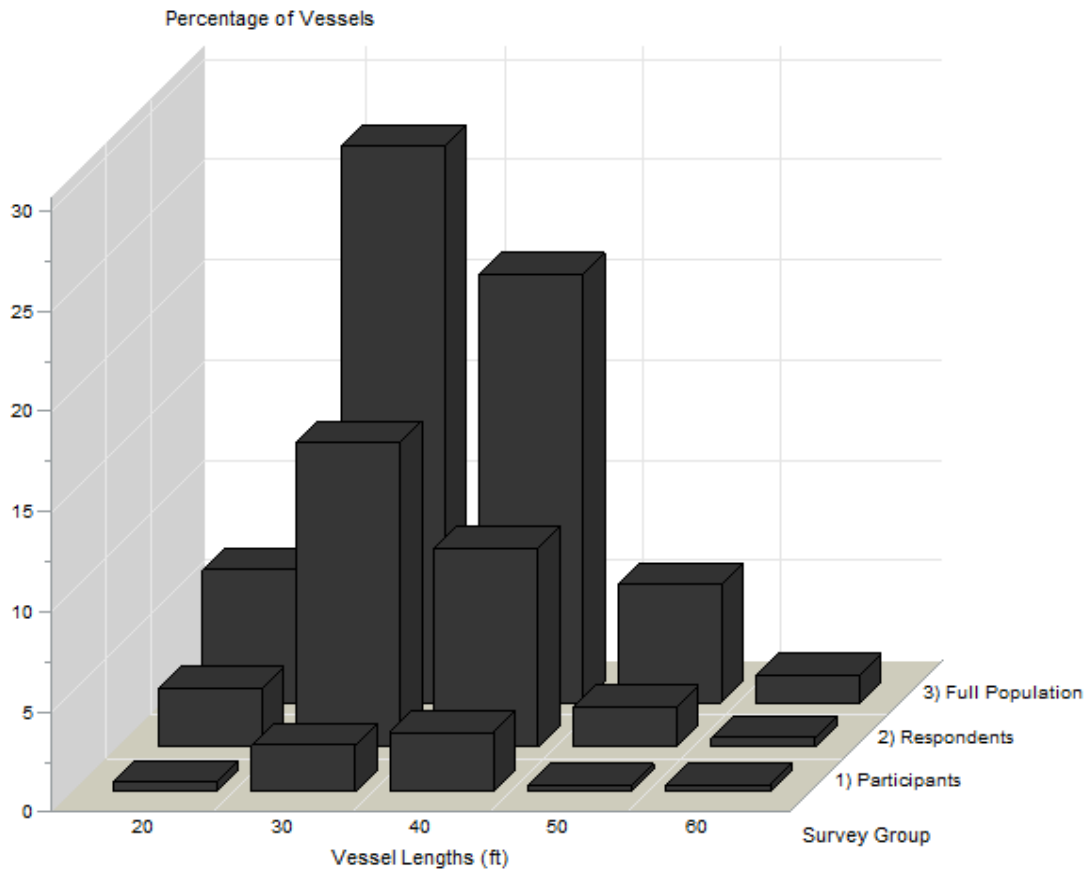

Figure 2.3 Percentage of vessels in 10 ft. length bins for three charter vessel groups: Full Population – all charter vessels, Respondents – vessels that responded to the survey, and Participants – vessels that responded to and conducted Red Snapper trips during the South Atlantic Red Snapper fishing season.

Section 3. Biological Sampling

Methods

The Red Snapper harvest season provides an opportunity to collect fishery dependent biological samples. During the 2017 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. During MARFIN assignments, biologists attempted to collect both the left and right otoliths, and for sampled fish where two intact age structures were collected, FWRI will share the right otolith and associated data with researchers at the University of Florida for microchemistry analysis. Fin clips were also collected during MARFIN assignments and the genetic samples will be processed at FWRI by the Genetics Lab.

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:

$$W_h = \left({}^{\hat{C}_h}\!/_{\hat{C}}\right) / \left({}^{n_h}\!/_{n}\right) \quad (3.1)$$

where ${}^{\hat{C}_h}\!/_{\hat{C}}$ is the ratio of estimated landings for inlet *h* over total estimated landings (reported in Table 1.3), and ${}^{n_h}\!/_{n}$ is the ratio of fish sampled in inlet *h* to total fish sampled (reported in results section below). Sample weights for each inlet were used to calculate the overall mean length and weight of landed fish (using the survey means procedure in SAS), and the sum of sampled fish from each inlet in 1 cm length bins was multiplied times the appropriate sample weight to calculate the overall 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 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.

Results

Private Boat Biological Samples

Sample sizes for numbers of Red Snapper measured, weighed, and sampled for age and growth are provided in Table 3.1. The mean length and weight for Red Snapper sampled from private boat trips was 542.878 ±7.216 mm midline length and 3.1951 ±0.1148 kg. The weighted length frequency of fish harvested by private boat anglers is shown in Figure 3.1.

Charter Boat Biological Samples

A linear regression was performed on log transformed lengths and weights from 279 Red Snapper that were weighed and measured during MARFIN assignments (imputed weight in kg = exp [-16.8971 + 2.86763*mm]). Weights were then imputed for fish sampled from charter trips if they were measured but not weighed (42 weights imputed out of 220 fish measured). Red Snapper sampled from charter boats averaged 586.918 mm (±7.258) and 3.998 kg (±0.137). The length frequency of fish harvested by charter boat anglers is shown in Figure 3.2.

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 (MARFIN).

Inlet	Mode	Number length samples	Number weight sampled	Number otolith samples
Cumberland	Private boat	45	40	45
Mayport		130	129	128
St. Augustine		54	50	51
Ponce Inlet		44	44	44
Port Canaveral		226	226	218
Sebastian Inlet		37	36	31
Fort Pierce and St. Lucie		7	7	0
Total		543	532	517
Cumberland	Charter boat	12	11	12
Mayport		0	0	0
St. Augustine		35	34	35
Ponce Inlet		20	20	20
Port Canaveral		111	108	102
Sebastian Inlet		42	5	42
Fort Pierce and St. Lucie		0	0	0
Total		220	178	211

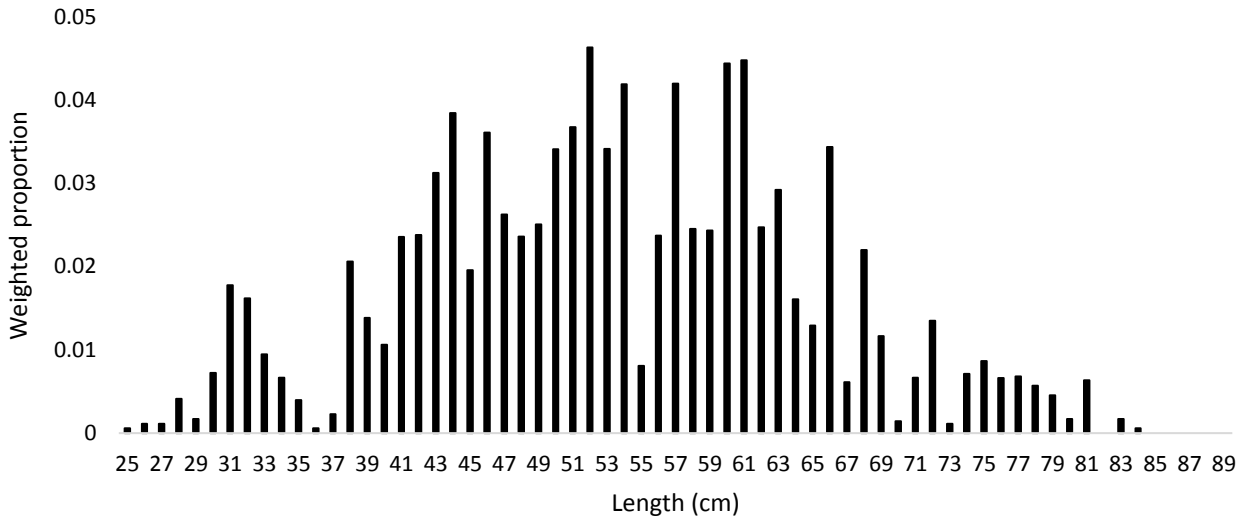

Figure 3.1. Size distribution of Red Snapper harvested by private boat anglers during 2017. Private boat samples include fish measured during Red Snapper intercept surveys and MARFIN assignments (n=543). Samples from each inlet were weighted proportional to total estimated landings.

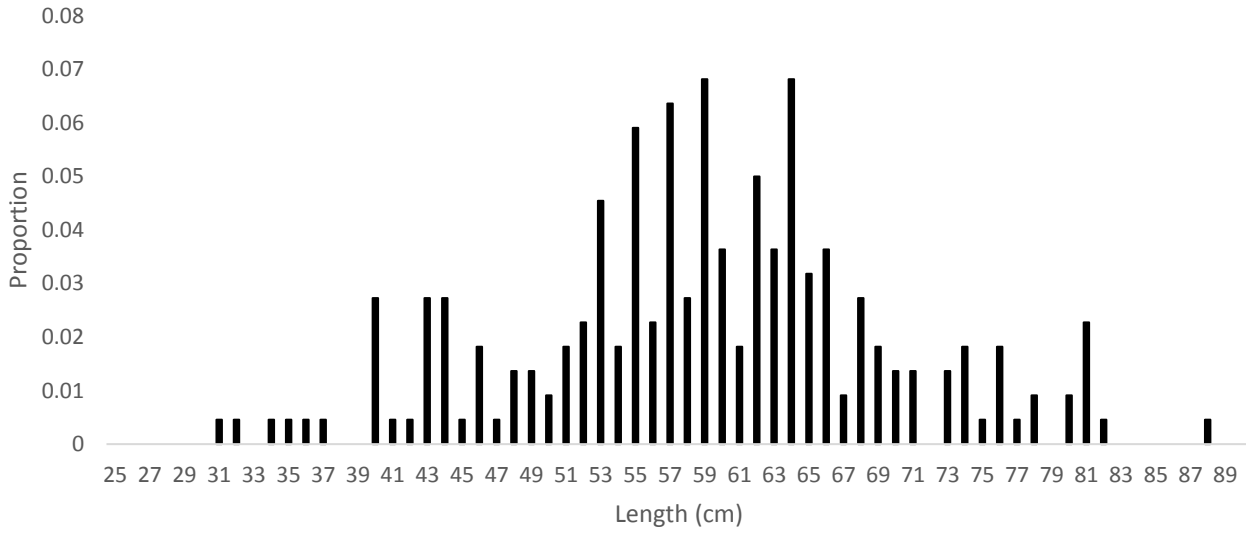

Figure 3.2. Size distribution of Red Snapper harvested by charter boat anglers during 2017 (n=220).

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

FWC RED SNAPPER SURVEY

October 30, 2017

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 November 3, 4, 5 and November 10, 11,12. 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 2017 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 2017 season, simply record this information at the top of the log sheet and mail it to us at your earliest convenience.

2. After November 12, 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. Therefore, your assistance during this special season is requested to ensure that we collect the best data possible to accurately assess the 2017 red snapper fishery.

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 at www.MyFWC.com/research. Also 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

Fish and Wildlife Research Institute
100 Eighth Avenue SE
St. Petersburg, Florida
33701-5020
Voice: (727) 896-8626
Fax: (727) 823-0166
Hearing/speech-impaired:
(800) 955-8771 (T)
(800) 955-8770 (V)
MyFWC.com/Research

USE THE ENCLOSED LOG SHEET TO TRACK RED SNAPPER TRIPS.
THANK YOU FOR YOUR COOPERATION.

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

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

Did you participate in the 2017 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 targeted, harvested, or released at sea.

Date	Day	Trip No.	Trip Type (Charter, Head, 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								
11/3/2017	FRI	1													
11/3/2017	FRI	2													
11/3/2017	FRI	3													
11/4/2017	SAT	1													
11/4/2017	SAT	2													
11/4/2017	SAT	3													
11/5/2017	SUN	1													
11/5/2017	SUN	2													
11/5/2017	SUN	3													
11/10/2017	FRI	1													
11/10/2017	FRI	2													
11/10/2017	FRI	3													
11/11/2017	SAT	1													
11/11/2017	SAT	2													
11/11/2017	SAT	3													
11/12/2017	SUN	1													
11/12/2017	SUN	2													
11/12/2017	SUN	3													

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 2017 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;
```