South Atlantic Red Snapper (*Lutjanus campechanus*)

Monitoring in Florida for the 2012 season.

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Executive Summary

An intensive sampling program was developed and implemented to capture fishery dependent data from the six day South Atlantic red snapper season of 2012. A combination of survey methods were used to provide estimates of red snapper harvest for private boat and for hire mode fisheries for the September 2012 season, which occurred on consecutive weekends and lasted a total of six days. These methods included a telephone survey of charter vessels operators to obtain catch and effort information, a boat level angler intercept survey to obtain catch information for directed recreational trips, and an inlet based boat count survey to determine directed effort. Monitoring efforts also included a carcass drop off program, tournament sampling, as well as integrated sampling of the private boat and for-hire modes for biological information and otoliths.

Overall recreational harvest for the Florida portion of the South Atlantic red snapper fishery was estimated as 8,463 fish for both for-hire/charter and private boat recreational modes. For-hire charter boat harvest was estimated at between 609 and 1,359 fish with a mean harvest estimate of 984 fish. Private boat mode harvest was estimated at between 2,882 and 12,076 fish with a mean harvest estimate of 7,479 fish. Harvest for the second weekend was significantly higher than it was in week 1. Weather played a role in reducing fishing effort for week 1 as evidenced by sampler observations of fewer boats entering ocean waters and fewer reported trips by the charter fleet from the northern region where the majority of the directed effort was concentrated.

Age analyses based on samples obtained from carcass drop offs as well as tournament, charter and private boat and limited commercial catch sampling showed red snapper sampled were between 2 and 29 years old. The oldest fish was from a tournament sample. A mean age of 4.78 years was obtained. Fish varied in size from 255 mm (10”) to 890 mm (35”) fork length with an overall (unweighted) mean size of 575 mm (22.6”).

INTRODUCTION

Catch and harvest estimates for the recreational sector are achieved using a combination of established surveys. For all modes in Gulf of Mexico and Atlantic regions, catch information is obtained using the NOAA Fisheries MRIP Access Point Angler Intercept Survey (APAIS). Anglers are interviewed upon completion of their fishing trips at accessible sites such as docks, piers, boat ramps and marinas. For private boat and shore modes, catch information from the APAIS is coupled with effort data collected through the Coastal Household Telephone Survey (CHTS) to generate estimates of catch by species. For the charter or for-hire sector, the For-Hire Telephone Survey (FHTS) is used. In the CHTS, calls to obtain information on fishing effort are restricted to a two week period at the end of each two month-long wave. In the FHTS, industry representatives are called in a 10% sample of the regional vessel fleets. Vessel representatives report on their for-hire activity for the previous week and this information is used to develop wave level estimates of for-hire effort. In theory because the survey is conducted on a weekly basis, it should be possible to produce effort estimates of a higher resolution than those currently produced by increasing sample size. However, fleet size and sample sizes for some regions limit the ability of the FHTS to produce effort estimates at resolutions higher than the wave level. The ability to produce reliable weekly level estimates is also dependent on the sampling levels in the APAIS to produce reliable CPUEs. Expanded FHTS sampling has been used in the past to produce for hire estimates below the wave level for red snapper. In 2008, 40% FHTS sampling was used to produce red snapper effort estimates for the Gulf of Mexico. However, the portion of the Florida for hire fleet operating in South Atlantic waters represents about 30% of the total number of for hire vessels within the state and the red snapper fleet is less concentrated than the its counterpart in the Gulf. Moreover, APAIS oversamples by 5X in the Gulf compared to 1X in the South Atlantic. Also of consideration is the concentration of the for-hire mode APAIS sample in Southeast Florida which traditionally targets species other than red snapper, and that neither the FHTS not the APAIS was intended to provide estimates of catch of a higher resolution than the wave, it would appear necessary to pursue other methodologies to provide this information. The FHTS provides the basis for the survey instrument used to obtain effort information from vessel representatives. Fleet size is small enough (<550 vessels) that if criteria are assigned to eliminate vessels unlikely to participate in the red snapper fishery , then all or most of the remaining vessels could be surveyed for the additional information including catch which could be used to estimate red snapper harvest by the for-hire sector.

For private boat mode effort and catch a different approach was taken to tacking the problem of higher resolution estimates of directed harvest. The scale of the private angler sector, the short duration of the red snapper opening and limitations within the CHTS design, meant that capturing catch and effort information by modifying methodologies already in place was not a practical option. The approach taken was to develop a field based method to measure of private boat effort that would complement catch information obtained at boat ramps and to a lesser extent, marinas. As the east coast of Florida has several major access points to open waters, boat counts at those points could be conducted to obtain boat level estimates of effort directed to offshore waters. Information gathered dockside could provide information to obtain an estimate of the proportion of vessel trips observed exiting the limited number of egress points were targeting red snapper. A major difference between angler intercept in this targeted approach to the APAIS was the luxury of being able to target specific information related to the catch of a single species rather than the non-preferential treatment of species in the APAIS.

The MRIP APAIS, CHTS and FHTS are easy prey for critics but significant changes have been made and continue to be made regarding the statistical validity of catch and effort estimates produced. A goal of this directed data collection exercise was to complement data collection by existing MRIP surveys. Adaptation of FHTS methodology was done in a way that would minimize interference with existing data collection activities. Care was taken to complement existing data collection programs while maintaining the priority of these programs in which FWC is a participant and the data from which, are used to inform management decisions for a large number of saltwater species on both coasts.

SECTION 1: For Hire Harvest Estimates

METHODS

Fleet Characterization

The NOAA Fisheries For-Hire Telephone Survey (FHTS) vessel list used for calls in wave 5 (September-October, 2012) was used create a list of vessels likely to target red snapper off the Atlantic Coast of Florida for the two three-day weekend openings in September 2012. The FHTS list is maintained by the Gulf States Marine Fisheries Commission (with input from the states involved in the survey) and is used to generate a vessel sample frame for weekly calls to saltwater for-hire operators to obtain information on their fishing activity for the previous week. The survey is used to estimate saltwater for-hire fishing effort by week and region within the state. The data are combined with NOAA Fisheries Marine Recreational Information Program (MRIP) angler intercept information on catch to produce catch estimates at the wave level. Although the list size may vary from wave to wave depending on the addition or removal of vessels, there are generally between 2,150 and 2,200 vessels operated as for-hire on the list for the entire state of Florida. The number varies in size as vessels enter or leave the fishery. A total of 2,177 vessels were listed on the wave 5 list used to select vessels for this survey. East coast vessels (Nassau – Dade Counties) accounted for 546 of the state's total. Only 10% of those vessels are sampled in the weekly FHTS calls, of which a small fraction would be expected to target red snapper. To increase the likelihood that for hire directed effort would be captured, additional calls were made to vessels considered accessible to the fishery. Criteria such as vessel size and location were considered in the selection of vessels to be surveyed. Vessel size was the chosen to eliminate from consideration, those vessels that would be highly unlikely to make trips into Atlantic coast federal waters to target red snapper. Actively chartering vessels less than 21' in length were removed from the list for FHTS regions 4 (Nassau-Indian River) and 5 (Brevard-Dade). This initial draw resulted in 102 vessels for Northeast Florida (FHTS Region 5: Nassau-Brevard counties) and 159 vessels for Southeast Florida (FHTS Region 4: Indian River – Dade Counties) for a total of 261 vessels. Identifying vessels that could potentially target red snapper based on size was a first "cut" at focusing survey calls to capture directed effort for red snapper for-hire trips. The distribution of vessel sizes by county, are shown in figure 1. Box plots are arranged from left to right to represent the distribution of vessel sizes from north to south. Although vessels less than 22 ft have been removed, geographic differences in vessel size are evident. Vessels tend to be smaller in Northern-most counties Nassau and Duval as well as Brevard and Indian River. This is not too surprising as there are large inshore guide fleets in both areas. Vessels in FHTS region 4 tend to be larger in general than those in FHTS region 5 but there are concentrations of larger vessels in St. Johns and Volusia Counties. By and large, these areas correspond to where offshore fishing trips are concentrated, the difference being that FHTS region 4 offshore trips tend to target pelagic species whereas those in FHTS region 5 are more directed towards bottom fish. Historically, red snapper trips have been concentrated in counties of FHTS region 5 with some activity south of Cape Canaveral. The primary reason for this concentration is access to red snapper fishing grounds that are centered in federal waters to the north of the Cape. Trips originating in Palm Beach through Dade Counties were considered feasible but highly unlikely because of the distance and associated cost required to travel to red snapper grounds. As a precaution, these vessels were called but did not receive as high a priority as vessels from remaining counties. All locations in FHTS region 5 (Nassau – Brevard) were considered accessible to red snapper fishing and as a result location was not used to further refine the vessel list for this region. However, in Florida region 4 (Indian

River – Dade) location was considered because offshore for hire activity southeast Florida has typically focused on pelagic and highly migratory species with little or no effort directed to snapper fishing. Exclusion of vessels that operated from Broward and Dade Counties resulted in the removal of 54 vessels whereas if Palm Beach County boats were also excluded, the final vessel list for the remaining counties in region 4 contained just 30 vessels. Exclusion of vessels from the three southernmost counties was based on the assumption that the distance from marinas in those counties to red snapper fishing grounds in federal waters was too great for normal charter activity (1/2-full day trips). Red snapper catches are rarely recorded for for-hire sites included in the NOAA Fisheries Marine Recreational Fisheries Statistics Survey (MRFSS). As this represented the first time catch and effort have been collected in this manner and as a means of validating assumptions made regarding the active red snapper fleet, vessels from Palm Beach – Dade counties were called. Vessels in the Florida Keys (N=440) were excluded from the analysis but representatives for vessels selected for weeks 37 and 38 of the FHTS were asked if they targeted red snapper for the two September weekends that the season was open.

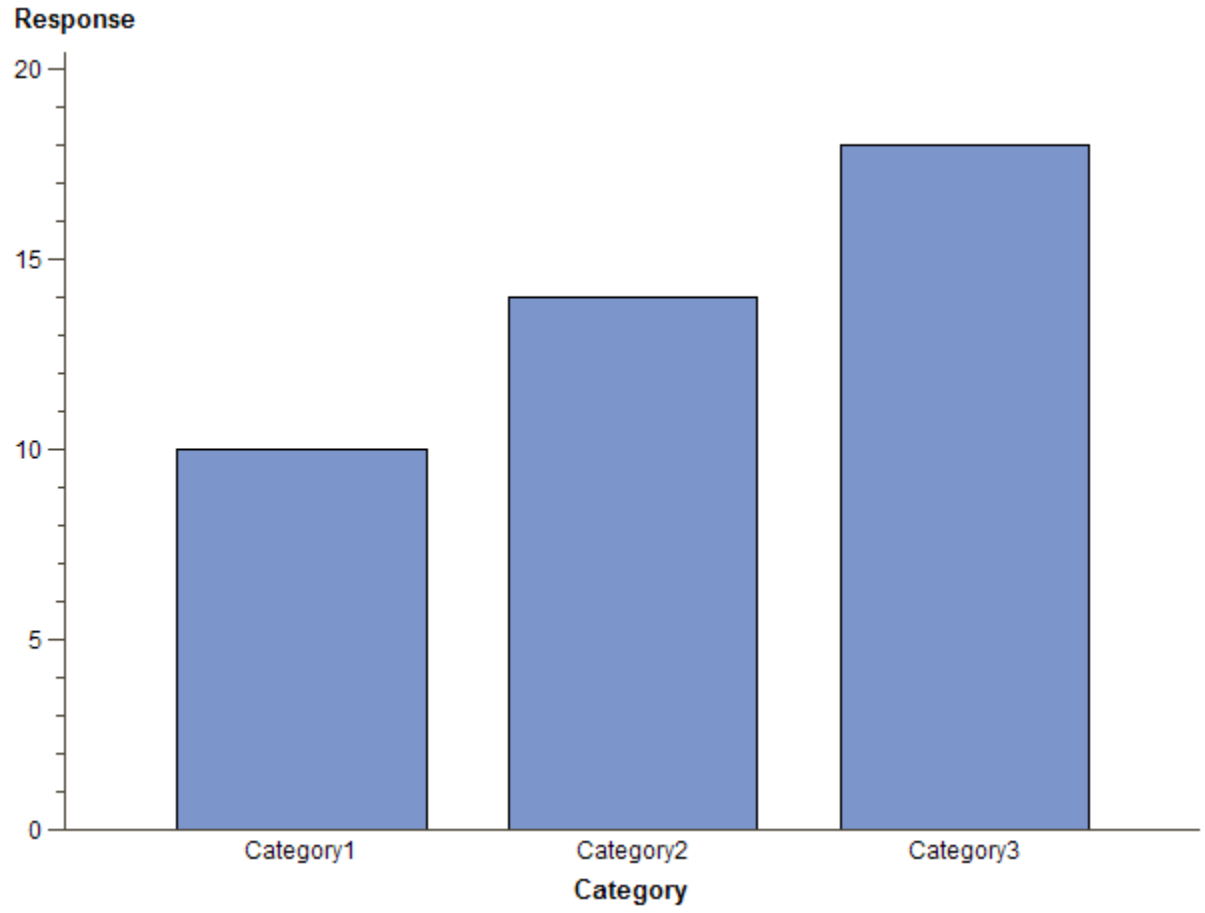


Figure 1. Box plots of vessel size (ft) by county (NE-1 = Nassau, NE-2 = Duval, NE-4 = St. Johns, NE-7 = Volusia, NE-8 = Brevard, SE-1 = Indian River, SE-2 = St. Lucie, SE-3 = Martin, SE-4 = Palm Beach, SE-5 = Broward, SE-6 = Dade). NE-1 to 8 refer to counties in FHTS region 5, SE-1 to 6 refer to FHTS region 4 counties. North to South is from right to left. Vessels less than 21 ft in length were excluded

from this plot. Plots show high and low vessel size, 25th and 75th percentiles and median. Outliers are shown as open circles.

Survey methods

Most vessel operators on the FHTS list are familiar with the FHTS survey questionnaire. Vessel representatives receive notification by mail that they have been selected for the FHTS. Included with the notification for their convenience is a sheet to log pertinent information for the week's vessel activity. To minimize the response burden on vessel representatives, it was felt important to utilize the basic FHTS survey questionnaire. This would allow vessels on the directed survey list already selected for the FHTS in both weeks of the red snapper season to complete a single questionnaire. Moreover, a level of validation of the assumption that vessels selected for the red snapper survey were representative would be provided from information gathered from vessels selected for the FHTS but not selected for the directed survey. Presumably, these vessels would not have caught or targeted red snapper.

Although the goal was to be as consistent as possible with the FHTS, the FHTS is not used to collect catch information. Catch information is provided from the NOAA Fisheries MRIP Access Point Angler Interview Survey (APAIS). Rather, the FHTS is used to obtain information on fishing effort and trip characteristics (e.g., numbers of trips, number of anglers, days fished, waters fished, time fished, primary and secondary species targeted) through a weekly sample of 10% of active for-hire vessels. Generally, fishing activity for a given week is obtained the following week. If a vessel representative is unavailable during this call period and requests that they be called later, callers may extend the period so that the information can be obtained. Generally, up to five calls are made in the week following the reporting period. Extending the call period into the following week increases the call load for surveyors and can result in recall issues for vessel representatives. As the red snapper season represented a total of six days (Friday-Sunday) on consecutive weekends and the goal of the survey was to provide estimates of harvest for red snapper only, a modified FHTS survey form was developed so that directed effort and numbers of red snapper harvested and released could be recorded for reported trips. In addition to the incorporation of catch information, an initial screener question to immediately identify ocean-based for-hire activity was included to expedite information gathering by focusing the survey on relevant vessel trips (the front and back of the modified FHTS survey form is shown in appendix A). If a vessel operator reported that they did not take ocean trips, they were not called the second week (unless selected for the FHTS). Call attempts were also recorded on the data form. The portion of the fleet that could not be reached (non-responses) was assumed to have similar for-hire/fishing activity to the respondents.

Estimation of for-hire effort and catch.

Calls were made following both weekends as part of the regular FHTS call schedule (weeks 37 and 38). For the purposes of discussion, FHTS week 37 will be referred to as week 1 and FHTS week 38 will be referred to as week 2). For the purposes of estimation, the numbers of directed red snapper vessel trips and the numbers of red snapper harvested and released per trip were summed for the portion of the fleet contacted. The portion of the fleet that was not contacted was assumed to have had similar activity to

vessels for which a response was obtained. For each region-week combination (Northeast – weeks 1 and 2 and Southeast – weeks 1 and 2), effort was calculated as follows.

Raw Total effort (region-week):

$$R = \sum_{i=0}^{n} T$$

Where R = Number of red snapper directed trips reported in a given region and week, T = number of vessel trips reported by each vessel that targeted and/or caught red snapper, n = number of vessel reporting.

Expansion Factor for non response:

$$C = \left(\frac{n}{N}\right)^{-1}$$

Where C = Expansion for non response ($C \geq 1$), n = number of vessels reporting, N = total number of vessels for which contact attempts were made. Since only a portion of vessels

Total Effort corrected for non-response:

$$E_c = RC$$

Where E_c = Effort estimate adjusted for non response, R= raw total effort for the portion of the for-hire fleet that responded to the survey and C=the adjustment for non-response. An adjustment is also required to correct for eligible vessels not called.

Expansion Factor for vessels selected but not called:

$$V_c = \left(\frac{N}{N+a}\right)^{-1}$$

Where V_c = Expansion for vessels omitted from survey calls, N = number of vessels for which contact attempts were made (i.e., vessels called), a = vessels selected but not called. As there is also the possibility of vessels reporting that were not originally selected (e.g., through the addition of new vessels or movement of vessels between regions), an adjustment must also be made to include their activity.

Adjustment for vessels not selected:

$$A_{ns} = \frac{(N + a + b)}{(N + a)}$$

Where A_n = Adjustment for unselected vessels, N = number of vessels selected and called, a = vessels selected but not called, and b = number of vessels not selected that reported in the survey.

Total Effort is estimated as:

$$E_t = A_{ns}\, E_c V_c$$

Note that the product of A_{ns} and V_c can be simplified as:

$$A_{ns}V_c = \frac{(N + a + b)}{N}$$

Further, total effort can be represented by:

$$E_t = R\,\frac{(N+a+b)}{n}$$

Where R = raw total effort for n, the number of vessels reporting, N = number of selected vessels called, a = number of selected vessels not called, b = number of unselected vessels that reported and n = number of vessels reporting.

For estimation purposes, catch per unit effort (CPUE) was calculated for all vessel trips that targeted red snapper. Red snapper catch was averaged for targeting vessels. Vessels were considered to be targeting red snapper if they fished in ocean waters and named red snapper as their target or they fished in ocean waters and caught red snapper.

Catch Per Unit Effort:

$$C_t = \sum_{i=1}^{t} H_t/n_t$$

Where C_t = mean catch per vessel trip, H_t = number of red snapper harvested per vessel trip, n_t = number of vessel trips. t = number of vessel trips. Note:

$$n_t C_t = \sum_{i=1}^{t} H_t$$

Harvest (region-week):

$$H_{total} = n_t C_t E_t$$

Where H_{total} = harvest, n_t = number of vessel trips, C_t = CPUE and E_t = Total Effort. Harvest was summed across region-week combinations to generate a final coast wide estimate of red snapper harvest.

RESULTS

Summary of telephone call information

A summary of the call distribution is presented in table 1 for the three vessel selection scenarios. Under the three scenarios only the number of calls for FHTS region 4, differ. For NEFL (FHTS region 5), 82% of vessels selected were called for week 1 whereas 81% of vessels were called in week 2. For FHTS region 4 vessels, 74% and 89% were called in weeks 1 and 2, respectively. When the lists reflected the exclusion of Broward and Dade, the proportion of vessels called increased to 78% in week 1 and decreased slightly to 87% in week 2. When vessels from Palm Beach through Dade counties were excluded, 84% and 90% of vessels that remained were called on respective weeks. Core groups of 64 and 99 vessels were called for NEFL and SEFL on both weeks. NEFL had 20 vessels that were called in week 1 only and 19 others that were called in week 2 only. For SEFL, 20 were called in week 1 only and 45 were called in week 2 only. Under all scenarios, response rates for SEFL varied from a low of 56% in week 2 for the entire fleet to a high of 71% under scenario 2 (Broward-Dade vessels excluded) also in week 2. Response rate for NEFL was 56 % for the first week and 58% for the second week.

A small number of vessels that were not on the original vessel list for FHTS regions 4 and 5 were encountered during phone calls to vessel representatives. The maximum number encountered was three for the full vessel list and when Broward and Dade vessels were excluded. The FHTS normally only obtains information for vessels selected in weekly draws, even if a representative may have more than one boat active in a given week. Wave level corrections for off-frame vessels in the FHTS are made based on the proportion of MRIP dockside angler intercepts from "new" or previously un-encountered vessels. There are some concerns with this method because it assumes the proportion of for-hire anglers from new vessels reflects relative activity of those vessels relative to the rest of the fleet. Moreover, this method makes no adjustment for vessel replacement. However, as the goal of this study was to target all for-hire vessels that made directed trips for red snapper, vessel representatives called were allowed to report for any of their vessels. However, activity for new vessels not associated with a representative already on the FHTS vessel list would not have been captured in the survey. Adding the unselected vessels that reported

to the total for the selected vessels (to produce the extended draw) essentially treats unselected vessels as new, thereby decreasing the response rate for a more conservative assessment of their impact on overall effort.

A comparison of sample sizes for the FHTS in both regions shows that a total of 25 of the vessels selected for week 1 and 21 in week 2 were also selected for the FHTS. This represents a minimum increase of 4.5X to 6.75X the sample size assuming conservatively that all FHTS calls resulted in successful contacts. If similar contact rates were obtained for the FHTS selected vessels, the overall increase in sample size in the directed survey varied from 9-13X.

Table 1. Summary of vessel and call information by week and region for three survey scenarios (All counties, Broward and Dade excluded, Palm Beach, Broward and Dade excluded). With the exception of the bottom two rows, all numbers refer to numbers of observations (vessel calls). The extended draw refers to vessels selected for calls in addition to those that responded but were not selected. Proportion called (den) refers to the proportion of vessels called to vessels in the extended draw. Proportion responded refers to the proportion of vessels called that responded (i.e., were contacted). NEFL refers to FHTS region 5, SEFL refers to FHTS region 4.

	All Counties (Nassau-Dade)				**Broward, Dade Excluded**				**Palm Beach, Broward, Dade Excluded**			
Week	1		2		1		2		1		2	
Region	NEFL	SEFL	NEFL	SEFL	NEFL	SEFL	NEFL	SEFL	NEFL	SEFL	NEFL	SEFL
vessels selected	102	159	102	159	102	84	102	84	102	30	102	30
Vessels selected in FHTS	10	15	9	12	10	7	9	5	10	3	9	1
Vessels called	84	119	83	144	84	67	83	76	84	26	83	28
Vessels not called	18	40	19	15	18	17	19	8	18	4	19	2
Vessels contacted	47	68	48	81	47	43	48	54	47	15	48	17
vessels in wk1 and not in wk2	20	20	0	0	20	11	0	0	20	4	0	0
vessels in wk2 and not in wk1	0	0	19	45	0	0	19	22	0	0	19	6
vessels in wk1 and wk2	64	99	64	99	64	54	64	54	64	22	64	22
vessels outside draw	0	2	1	3	0	2	1	3	0	1	1	1
Extended draw	102	161	103	162	102	86	103	87	102	31	103	31
Proportion called (den)	0.82	0.74	0.81	0.89	0.82	0.78	0.81	0.87	0.82	0.84	0.81	0.90
Proportion responded	0.56	0.57	0.58	0.56	0.56	0.64	0.58	0.71	0.56	0.58	0.58	0.61

Summary of call results and status

In the FHTS, calls can be categorized depending the call results or status. Tables 2 and 3 contain summaries of both classifications for both weeks' calls for FHTS regions 4 and 5 compared (Southeast and Northeast). Callers were able to reach and conduct interviews with almost 56% of vessels called for week 1 in FHTS in the Northeast and 51% of vessels contacted in the Southeast. Callers were more successful contacting vessels in the Southeast in week 2, with 47% of vessels called completing the interview in the Northeast, compared to a little more than 54% in the Southeast (Table 3). Call results confirm that by and large, vessel representatives either completed the in interview process or declined to answer at the beginning of the call (initial refusal). Voicemail was the most common result for un-contacted vessels. As mentioned earlier, callers were tasked with making a minimum of five attempts to contact vessel representatives. The results of telephone calls (by call attempts) are summarized in tables contained in Appendix B. Survey design should be a consideration in any comparison between the FHTS and this directed red snapper survey call results. Unlike the FHTS in which 10% of the active for-hire fleet is sampled weekly (with replacement), in the directed survey the same vessel representatives are called in two consecutive weeks. If the call period was extended for any reason, the call attempts for the first week may not accurately reflect the outcome of the calls because the representative if reached only in week 2 will respond only once in the survey.

Trip information

Information collected on each week's telephone calls to vessel representatives included, number of trips (including non-charter trips), number of for-hire trips, number of passengers on for-hire trips, trip start and end times, number of hours fished, depth fished, whether they fished in state or federal waters, numbers of red snapper harvested and number of red snapper released. Summaries for all these trip variables (with the exception of waters fished) are presented in figures 2-5. Only red snapper trips from federal waters were reported by vessel representatives. Detailed trip information is presented in appendix C. Most notable was the impact of unfavorable weather on the numbers of trips reported in week 1. Samplers observed rough seas for vessel count points on each inlet and on the water from FWC law enforcement boats. In Northeast Florida, seas up to 7 ft were reported in week one and vessels were observed returning to boat ramps following difficulties with rough seas at the entrances of the inlets. For weeks 1 and 2, the total number of trips reported equaled the total number of for-hire trips (Fig. 2 a-d). This is not surprising as non-for-hire trips normally reported are usually for repairs, which would probably be done during the week rather than on weekends. In the NEFL, vessels reported having made between 0 -3 trips on the first week and 0 -4 trips on the second week. In contrast, vessels in SEFL reported 0 -5 trips for the first week and 0 -3 trips for the second week. Average number of trips reported was less than 0.5 for both regions on both weekends with the exception of SEFL in week 1 which averaged 0.55 for-hire trips. The frequency for the numbers of trips reported for both weeks in both regions shows that most boats reported no activity (zero trips) but that the proportion of vessels that reported no activity decreased in week 2 in NEFL (Fig. 2 b, d). Some indication of geographic differences in the numbers of passengers, depth fished and time fished, were evident from the data (Fig. 3 a-f; Appendix C.). Numbers of trips reported for SEFL vessels were low, however. On average, SEFL vessels tended to carry less passengers, fish in more shallow water but fish slightly longer than counterparts in NEFL. Trips in SEFL averaged about 4.3 passengers per trip as opposed to almost 6

passengers on NEFL trips. The range of depths fished by vessels in NEFL was larger than SEFL boats. Trips varied in depth from 47-205 ft for NEFL trips reported for two weekends, whereas trips in SEFL varied from 75 to 140 ft over the two weekends.

Data on trip start and end times, were limited for vessels from SEFL. For NEFL vessels, the time of the trips (start and end times) were pretty consistent between weeks with the majority of trips leaving the dock at 7:00 am and returning at 4.00 pm. Half and full day trips were evident in the NEFL data with spikes in the return times at 12:00pm and 4:00pm. What was somewhat surprising was the proportion of trips that left the dock before 7:00am. Although data were limited, SEFL trips did show s peak in the end time at 3.00pm, possibly indicating that full day trips ended earlier in this region (Fig. 4).

In terms of harvest, the one fish limit per angler per trip appeared to have been exceeded for trips reported for SEFL in week 1 and NEFL trips in week 2. On closer inspection it was found that in both cases, information the numbers of fish harvested had not been reported for one trip. Overall, it appeared that vessels made their bag limit for red snapper trips. Reported numbers of fish released per trip varied from 0-50. Trips for week 2 in NEFL averaged more than 13 fish per trip reported as released. Only in week 2 in SEFL, did the proportion of fish released to the number harvested drop to < 1 (in other word, vessel representatives reported less fish per trip, released than harvested. There are some indications from the absence of the reports of released catch that numbers greater than 10 are rounded to the nearest five (Fig.5).

Table 2. Summary of telephone call status and results for week 1 (September 14-16, 2012) for each FHTS region. Northeast = Nassau-Indian River counties, Southeast = Brevard – Dade counties.

	Northeast		Southeast		
Status	Frequency	Percent	Frequency	Percent	
Complete interview	47	55.95	61	51.26	
Inactive	3	3.57	3	2.52	
Ineligible	2	2.38	2	1.68	
Initial refusal	15	17.86	35	29.41	
Key questions answered	0	0	0	0	
Mid interview refusal	1	1.19	0	0	
Unable to contact	16	19.05	18	15.13	
	84		119		203

	Northeast		Southeast		
Call_Result	Frequency	Percent	Frequency	Percent	
Fax/Computer	0	0	0	0	
Ineligible	2	2.38	1	0.84	
NIS/Wrong Number	1	1.19	6	5.04	
No Answer	2	2.38	3	2.52	
Refusal	17	20.24	28	23.53	
Successful Contact	45	53.57	67	56.3	
Voicemail	17	20.24	13	10.92	
Wrong Number/New available	0	0	1	0.84	
	84		119		203

Table 3. Summary of telephone call status and results for week 2 (September 21-23, 2012) for each FHTS region. Northeast = Nassau-Indian River counties, Southeast = Brevard – Dade counties.

	Northeast		Southeast		
status	Frequency	Percent	Frequency	Percent	
Complete interview	39	46.99	78	54.17	
Inactive	3	3.61	2	1.39	
Ineligible	3	3.61	3	2.08	
Initial refusal	29	34.94	24	16.67	
Key questions answered	0	0	1	0.69	
Mid interview refusal	1	1.2	1	0.69	
Unable to contact	8	9.64	35	24.31	
	83		144		227

	Northeast		Southeast		
Call_Result	Frequency	Percent	Frequency	Percent	
Fax/Computer	1	1.2	0	0	
Ineligible	1	1.2	6	4.17	
NIS/Wrong Number	2	2.41	7	4.86	
No Answer	1	1.2	1	0.69	
Refusal	16	19.28	36	25	
Successful Contact	47	56.63	75	52.08	
Unavailable	1	1.2	0	0	
Voicemail	14	16.87	19	13.19	
	83		144		227

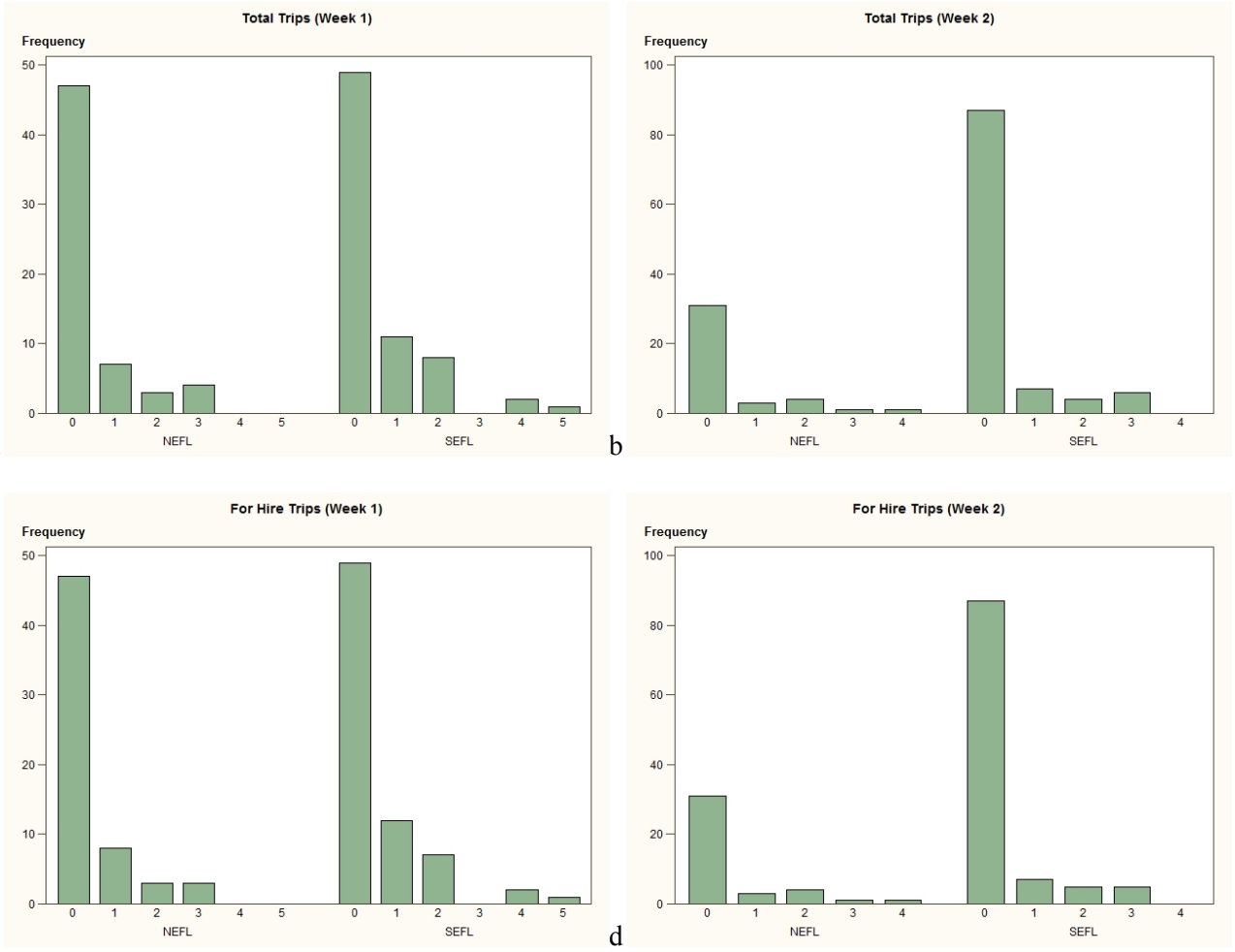


Figure 2. For hire vessel activity compared for weeks 1 and 2 of the red snapper season, in terms of the total number of trips reported (a, b), and for hire trips reported by vessels called in the directed survey (c, d). SEFL and NEFL refer to FHTS regions 4 and 5, respectively. Week 1 results are on the left, week 2 results are on the right.

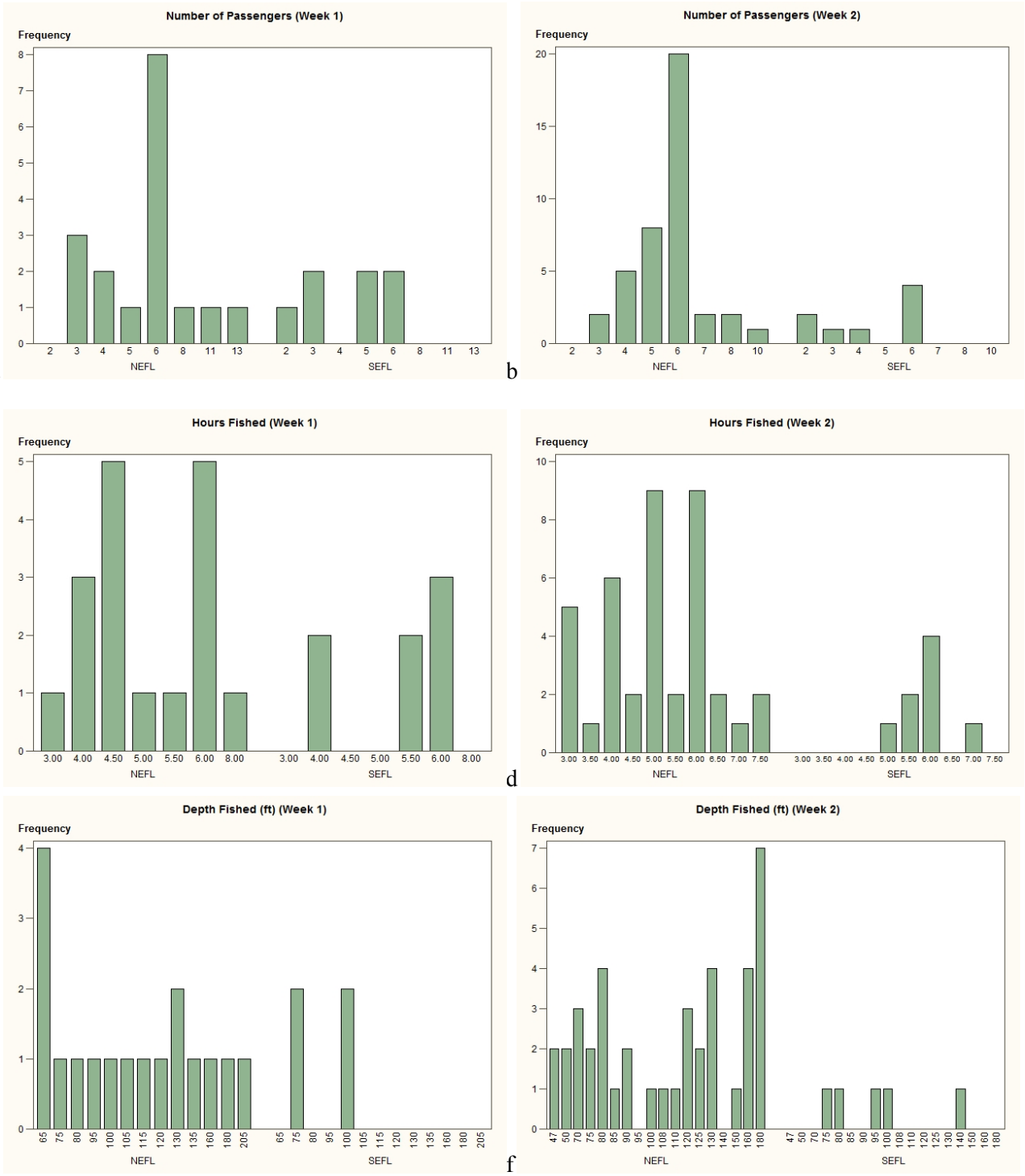


Figure 3. For hire vessel activity compared for weeks 1 and 2 of the red snapper season, in terms of number of passengers (a, b), hours fished (c, d), and depth fished (e, f). SEFL and NEFL refer to FHTS regions 4 and 5, respectively. Week 1 results are on the left, week 2 results are on the right.

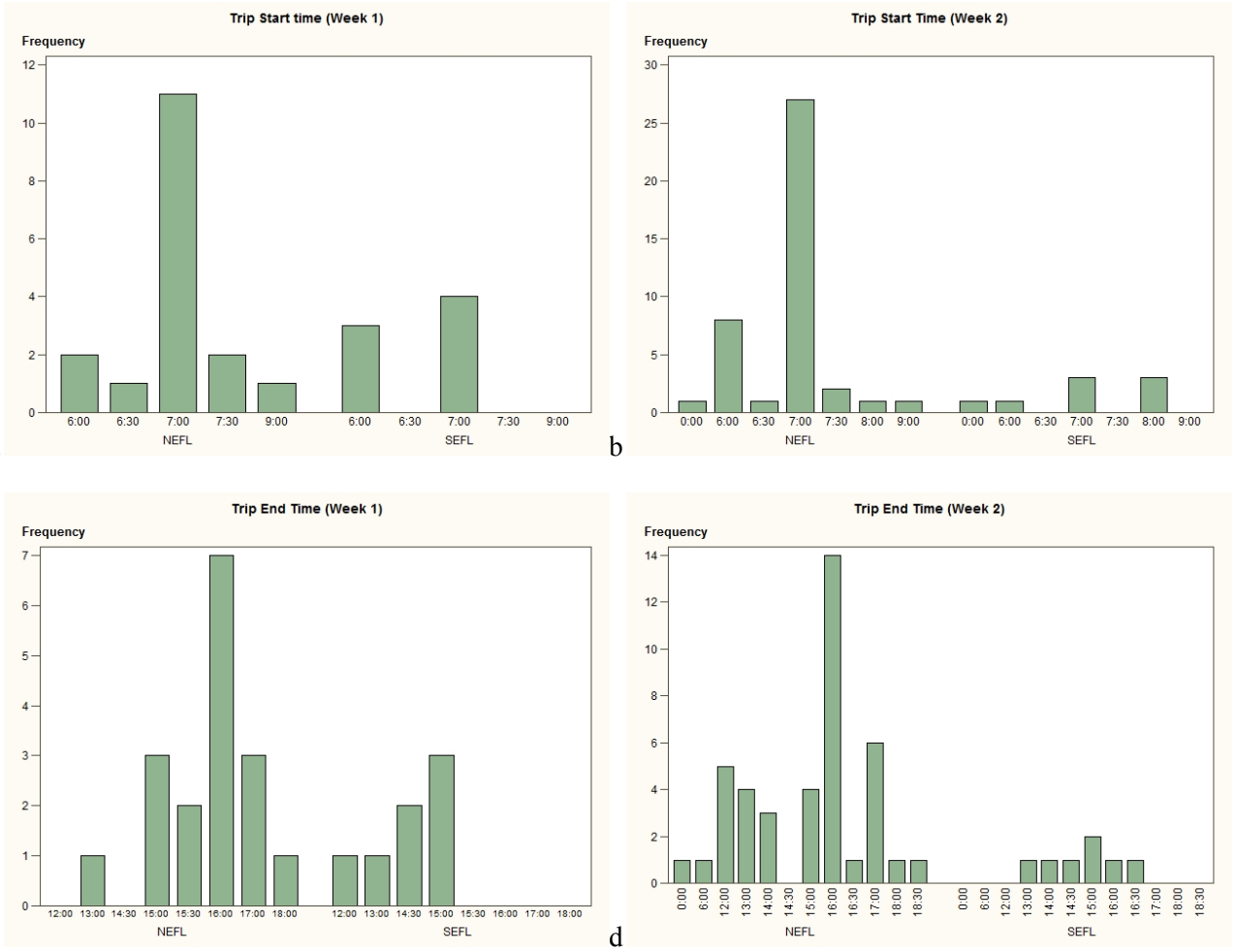
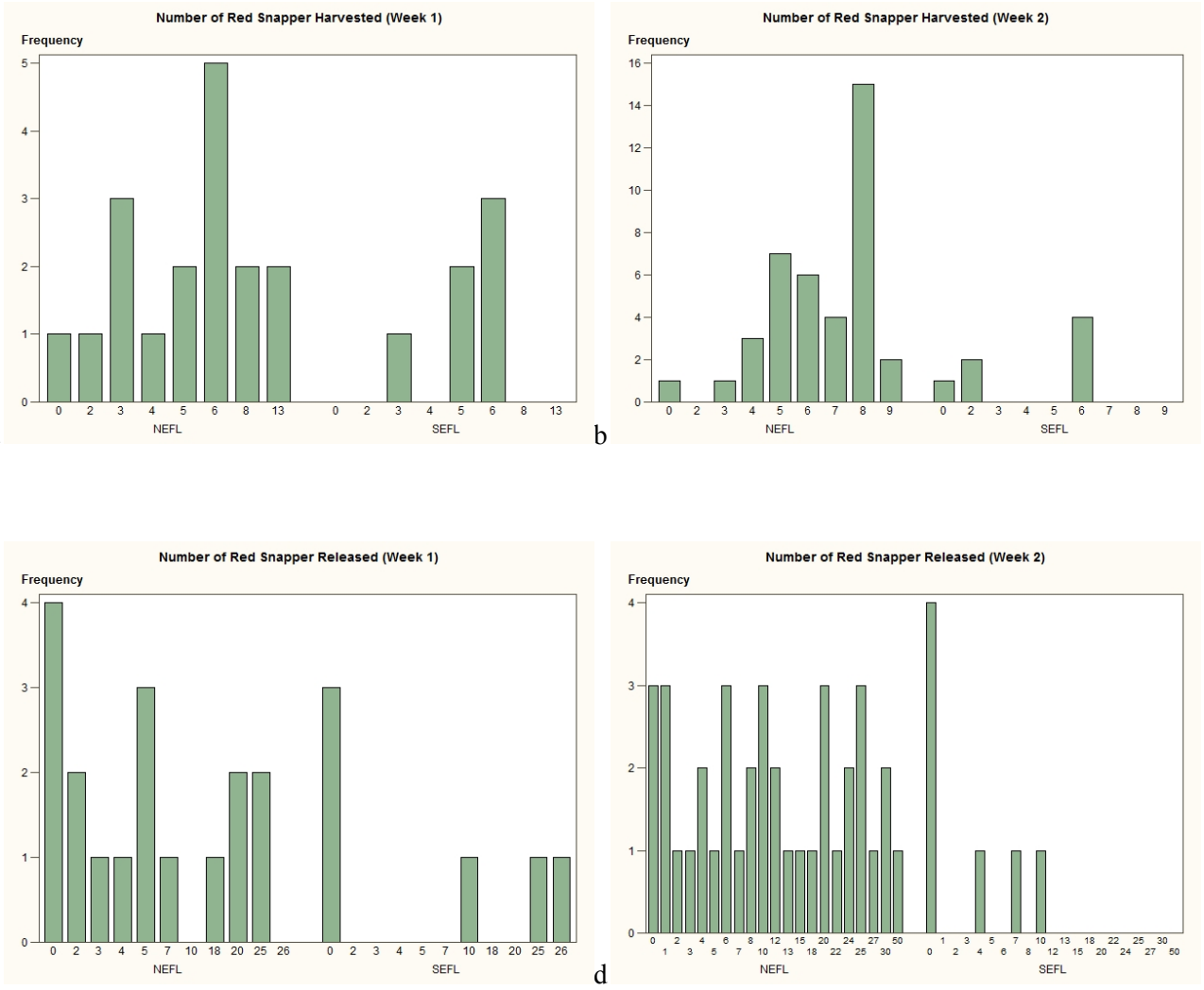


Figure 4. For hire vessel activity compared for weeks 1 and 2 of the red snapper season, in terms of trip start time (a, b), and trip end time (c, d). SEFL and NEFL refer to FHTS regions 4 and 5, respectively. Week 1 results are on the left, week 2 results are on the right.



a b c d

Figure 5. For hire vessel activity compared for weeks 1 and 2 of the red snapper season, in terms of harvested fish (a, b), and released fish (c, d). SEFL and NEFL refer to FHTS regions 4 and 5, respectively. Week 1 results are on the left, week 2 results are on the right.

Harvest Estimates

Harvest was estimated regionally and by week by summing catch per trip for trips that either targeted red snapper or reported catch (Table 4). Red snapper harvest was estimated at 984 individuals with a standard deviation estimate of 375. Catch was then expanded proportionally to the entire fleet. Corrections were made for (1) vessels called but not reached (non-respondents), (2) vessels selected but not called and (3) vessels that were not selected but encountered during calls. The latter comprised a low number and represent only vessels that were reported by contacted vessel representatives. Unlike the FHTS, all corrections/expansions factors were derived solely from the phone survey data. Field intercepts of vessels and anglers were not used. Of the vessels called, the response rate was consistent across regions and weeks at about 56-58% which translates to and expansion of between 1.73X and 1.79X for the number of red snapper trips. The expansion is based on the assumption that activity for the non-respondent portion of the fleet is similar to that of the responding portion. Red snapper effort was further expanded to take into consideration vessels selected but but not called. In both weeks a portion of vessels selected were not called, which resulted in about a 10-35% increase in the number of estimated trips. The apparent omission of calls may have more to do the manner in which the data were recorded. There were logistic/data recording challenges with extending the call period for the first week because callers were calling the same vessels representatives in consecutive weeks. In the case of this survey, the expansion factor for vessels selected but not called has a similar impact on estimates as modifying the expansion for non-response and was considered more appropriate for application to effort from both weeks. The final adjustment was made to effort as a result of unselected vessels appearing in the call reports. Normally in FHTS sampling omission of unselected vessels is appropriate. However, since this was an attempt to call all possible vessels rather than sample a portion of the fleet and to directly targeted red snapper trips, catch and effort data from unselected vessels was accepted. Samplers making the calls to vessel representatives have remarked that they have to be cautious in the FHTS that representatives with more than one vessel, report only for the selected vessel. Vessels are routinely replaced and move between regions but the fishing effort contribution of new vessels is assessed in the FHTS through dockside encounters in the MRIP APAIS. The above method used to expand for unselected vessels only accounts for vessels reported by selected vessel representatives. It is possible that more vessels may have entered the fleet but observations from boat counts and private boat intercepts did not support the scenario of a large number of vessels becoming active. In general only a handful of new for-hire vessels are encountered statewide for addition to the fir hire vessel list.

Total effort for red snapper directed trips across regions and weeks was estimated at about 164 for hire trips (excluding headboat trips). Consistent with observations of reduced effort in the first week due to poor weather conditions, a weather differential was evident for effort in NEFL with approximately a 3X increase in week 2.CPUES for red snapper trips were applied to total effort estimates within each region and week combination. Associated variances estimates (standard deviations) were expanded to provide estimates by region for each week. These estimates were summed to provide an overall estimate of variance. There are statistical reasons for not using this method because estimators are not unbiased. However, the estimate is provided herein as a gauge of uncertainty for the overall estimate. A more appropriate estimate would be to consider variance of reported trips also. However, sample sizes were low for effort with most for–hire vessels reporting zero trips.

Table 4. Red snapper harvest estimates for the for-hire sector in week 1 and week 2 in FHTS regions 4 (SEFL) and 5 (NEFL) of Florida. SD CPUE = Standard Deviation of mean catch per unit effort. SD Harvest is an expansion of CPUE SD and as such is not a true unbiased estimator.

		Number of Red Snapper Trips reported	**Proportion of fleet contacted that reported**	**Expansion for Non-Response**	**Effort corrected for Non Response**	**Expansion for vessels selected but not called**	**Effort expanded for vessels selected but not called**	**Adjustment for vessels not selected**	**Total Effort**	**CPUE**	**SD CPUE**	**Harvest**	**SD Harvest**
Week	Region	*R*	*n/N*	*C*	*Ec*	*Vc*	*EcVc*	*Ans*	*Et*	*Ct*	*SD (Ct)*	*Ht*	*SD (Ht)*
1	NEFL	17	0.56	1.79	30.38	1.21	36.89	1.00	36.89	5.71	3.44	211	127
	SEFL	7	0.57	1.75	12.25	1.34	16.37	1.01	16.57	5.17	1.87	86	31
2	NEFL	44	0.58	1.73	76.08	1.23	93.50	1.01	94.42	6.60	1.87	624	176
	SEFL	8	0.56	1.78	14.22	1.10	15.70	1.02	16.00	4.00	2.58	64	41
	Total											**984**	**375**

DISCUSSION

For hire estimates

Overall, we feel the methodology was robust given the time frame for design, implementation and completion of the monitoring efforts and analyses. The methodology used represents a departure from the structured statistical sampling of vessels in the FHTS. Assumptions had to be made regarding the appropriateness of the fleet selected for surveys, the handling of non-respondents and off-frame vessels that may need refinement and improvement for future use. However, minor changes to the data collection process in the FHTS would allow for a less arbitrary determination of what constituted the red snapper fleet. We looked at all vessels on the FHTS list operating from Nassau-Dade Counties that exceeded 21 feet in length and used this as the population to be surveyed. Only a relatively small fraction of those vessels actually participated in the two three day weekend openings for the red snapper fishery which drew attention to (1) improve the response rate and (2) the need to better identify vessels that participate in targeted fisheries. The addition of questions to the FHTS questionnaire or development of an independent survey to collect information on fishing behavior would probably achieve this goal and make future surveys more targeted in terms of the population sampled.

A pitfall of attempting what essentially was a census of vessels potentially involved in the red snapper fishery was the issue of non-response. It may be best to have a single call period if consecutive weekends are chosen to discourage passive non-response and delayed responses by vessel operators because the information could be provided in a single call rather than two separate calls. In the future a single round of calls (of at least five attempts) could be made after the second week. Call completions could be monitored during the call period so that response rates could be improved and to make sure that all vessels selected are called. Limiting calls to a single week would reduce interference with weekly FHTS calls. The limited nature of the season opening which was well advertised and the memorable nature of associated trips would probably have little impact on vessel representative recall for catch information. Effort could still be parsed by week and region.

Future estimates of harvest should probably focus on the variance of estimates and the impact of expansion factors on variance estimates.

SECTION 2: Private Boat Catch and Effort

METHODS

Study Area

The study area was the east coast of Florida from Fort Pierce north to the state's border with Georgia. A total of nine inlets in the study area serve as navigable egress points to offshore fishing grounds in the Atlantic Ocean (Figure 6) and any red snapper fishing trip that originates from within the study area must pass through one these inlets. Fort Pierce Inlet is the southern limit for recreational access to fishing areas where red snapper are sufficiently abundant to target. Cumberland Sound defines the border between Florida and Georgia and fishing effort from this egress point may originate from either state.

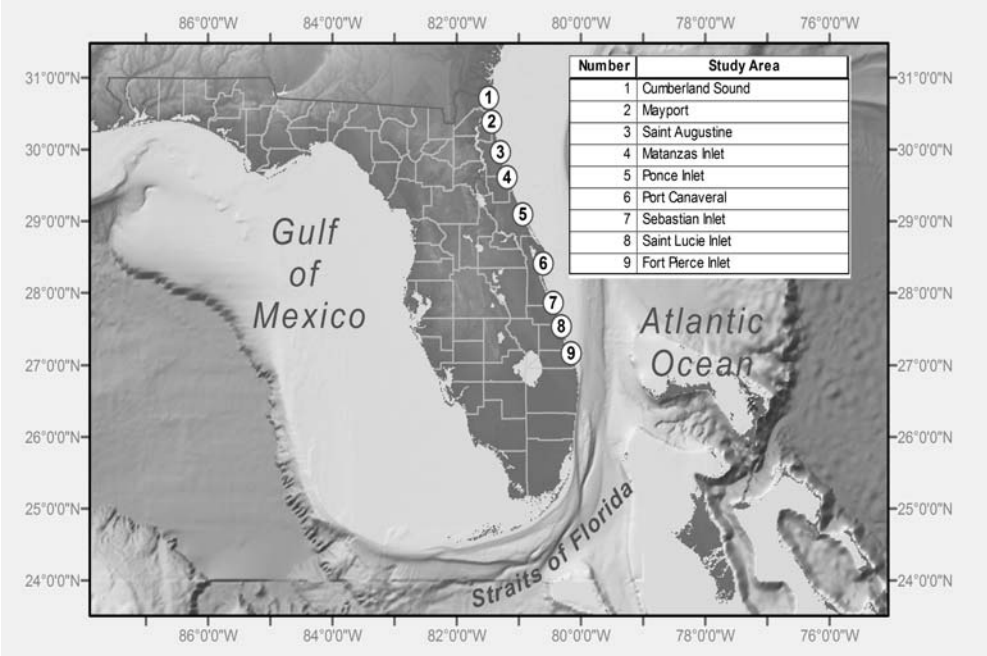


Figure 6. Navigable egress points to the Atlantic Ocean included in the study area.

Survey Design

Vessel Count Survey

For the purpose of estimating the total number of directed red snapper recreational private boat trips, two reference inlets were monitored continuously from 7:00 am to 7:00 pm each of the six days that the fishery was open. The two reference inlets selected for this study were Saint Augustine and Sebastian Inlet (numbers 3 and 7 in Figure 6). For each of the remaining seven inlets, boat traffic was monitored for six hours during an a.m. (7:00 am to 2:00 pm) or p.m. (2:00 pm to 7:00 pm) time period during each of three days. A list of all possible inlet, day, and time period combinations was generated and three combinations per inlet were randomly selected without replacement. A fourth combination was selected for Ponce Inlet because there was a misunderstanding by the scheduled sampler for how long to remain on site during the first three scheduled assignments (ended a.m. assignments at noon instead of 2:00 pm). Boat counts were not conducted earlier than 7:00 a.m. because of the difficulty identifying private recreational vessels before daylight. Also, for several inlets, sites where vessel counts took place were inside state or municipal parks that were not open before sunrise. Field samplers were stationed at the outermost area of the inlet where vessels could clearly be viewed exiting into the Atlantic Ocean. Each

boat observed was identified either as a commercial vessel, charter vessel, headboat, private recreational power boat, or other (e.g. sailboat, kayak, etc.). With the exception of the inlet at Mayport, vessels were easily identified without the aid of binoculars (Figure 7). Binoculars were provided for each assignment and if the viewer could not be certain that a vessel was a private recreational power boat then the vessel was classified as "undetermined". If the same vessel was observed making multiple passes through an inlet, then field samplers made notes on the data sheets to indicate this.

Figure 7. A private recreational boat exiting Cumberland Sound that was viewed from Fort Clinch State Park. The adjacent shore of Georgia is clearly visible across the inlet.

Samplers were permitted to take short breaks and the start and stop times for each break was recorded. Breaks averaged less than 8 minutes in duration. Only four breaks were >10 minutes long and the longest break was 31 minutes. To account for vessels that were potentially missed during sampler breaks, the number of boats per minute of observation time was calculated for the hour that the break was taken (for example, for a five minute break from 12:20 to 12:25, all boats observed during the 12:00 hour was divided by 55 minutes). For breaks longer than 10 minutes, the mean boats per minute was calculated for two hours around the break period. To estimate the number of boats missed during a break, the boats per minute was multiplied times the number of minutes that the sampler was on break.

Access Point Trip Intercept Survey

Regional field staff who are responsible for conducting access point angler intercept surveys for the Marine Recreational Information Program (MRIP) in the study area were asked to compile a list of sites where private recreational boats that conduct offshore fishing trips may be intercepted. A total of 54 sites distributed among the nine inlets were identified (Table 5). Since we did not have estimates of fishing pressure specifically for offshore fishing at these sites, sites were assigned a pressure of high (50+), medium (20-49), or low (<20) based on the number of anglers (inland and offshore) that are typically encountered during MRIP intercept assignments. Sites were assigned to one of two regions. The northern region included sites associated with 5 inlets from Cumberland Sound south to Ponce Inlet and the southern region included 4 inlets from Cape Canaveral south to Fort Pierce. A list of all possible site, day, and time (8:00 a.m. to 2:00 p.m., or 2:00 p.m. to 8:00 p.m.) combinations was generated and the survey select procedure in SAS was used to select site combinations in each region. Probability proportional to size (pps) sampling was used to ensure that an inlet with a low number of high, medium or low pressure

sites had the same probability for selection as an inlet with a larger number of sites. In the northern region the first 10 high pressure, 6 medium pressure, and 4 low pressure site/day/time combinations were assigned to field staff. Similarly, in the southern region the first 8 high pressure, 6 medium pressure, and 2 low pressure site/day/time combinations were assigned. A supplemental list of selected site/day/time combinations was provided to regional field coordinators, and this list was used to schedule additional assignments where manpower was available.

During the first weekend of field work, a very low number of offshore fishing trips returned before 10:00 a.m. and field procedures were adapted during the second week to ensure that all scheduled assignments were productive. In the second week, field samplers were instructed to arrive at their assigned site at 10:00 a.m. and remain on site until sunset, regardless of whether the assignment was selected for the a.m. or p.m. time period.

Figure 8. Biologists intercepted private boats as they completed recreational trips. If the party was targeting red snapper, members of the party were interviewed and biological samples were collected from harvested fish.

During a scheduled assignment, field staff arrived on site at the scheduled time with data sheets, a fish measuring board, a digital scale, and a bio-sample kit for otolith extraction. As vessels returned from recreational boating trips, the field biologist would first determine whether the trip was recreational in nature (as opposed to commercial fishing, for-hire fishing, or some other purpose such as law enforcement). If this could not be determined, the captain of the vessel was approached to confirm the nature of the trip. For all private recreational boat trips, the captain was interviewed to first determine whether or not the vessel exited through the inlet into the Atlantic Ocean at any time during the trip. If not, the interview was complete. If the vessel did enter the Atlantic Ocean, the interview continued to determine whether or not the party was fishing for red snapper. If the party was fishing for red snapper, the following information was collected for the trip:

- Time the vessel exited the inlet
- Number of people in the party
- Number of people in the party that fished
- Number of red snapper harvested for the party
- Number of red snapper released for the party

- Number of hours spent fishing
- The distance from shore (in miles) where fishing took place (average, minimum and maximum distance)

If red snapper were harvested during the trip, the field biologist asked for permission to inspect the fish and recorded the length (mm at the midline) and weight (in kg) for each fish and, if possible, extracted otoliths. If the party reported that they released one or more red snapper, they were asked to recall how many of those fish were less than 16 inches, between 16 and 20 inches, and greater than 20 inches in length.

Table 5. List of sites by inlet, initial pressure assigned to each site, and the number of days each site was sampled during each of the two weekends that red snapper was open to recreational harvest.

Inlet	Site	Name	Pressure	Week 1	Week 2
Cumberland Sound	0013	Fernandina Beach Marina	M		
	1419	Amelia Island Yacht Basin	L		
	3132	North End Boat Ramp	H	2	2
Mayport	0016	Jacksonville Beach Boat Ramp	M	1	
	0155	Calucci Boat Ramp	M		1
	0369	Mayport Public Boat Ramp	H	3	2
	1682	Sisters Creek Boat Ramp	H		2
	1684	Oak Harbor Boat Ramp	L		
	9001	Morningstar Marina	L		1
	9002	Ft. George Island Marina	L		1
	9003	Dames Point Marina	L		
Saint Augustine	0030	St. Johns County Boat Ramp	H	1	2
	0150	Lighthouse Boat Ramp	M	1	
	1408	Camachee Cove	L		1
	3292	Cat's Paw Marina	L		
Matanzas Inlet	0161	Bing's Landing	L		
	0174	Devil's Elbow Fish Camp	L		
Ponce Inlet	0187	Inlet Harbor Marina	L		
	0242	North Causeway Boat Ramps	H		2
	0273	Port Orange Boat Ramps	H	1	1
	0521	Halifax Harbor Marina	L	1	
	0987	Ponce Inlet Boat Ramp	M	1	1
	1398	Adventure Yacht Harbor	L		
Port Canaveral	0146	Freddie Patrick Park	H	2	2
	0363	Rodney Ketchum Park	M		
	1475	Sunrise Marina	L		
	1680	Scorpions New Port Marina	L		
	3485	Bluepoints Marina	L	1	
Sebastian Inlet	0166	Sebastian Inlet State Park	M		

	0504	Jorgensen's Landing	L		
	0935	Sebastian Main Street	M		
	0950	Sebastian Yacht Club	M	1	1
	1455	Inlet Marina	L		
	3419	Christenson's Landing	M	1	
	9004	Sebastian Inlet Marina	L		1
St. Lucie Inlet	0076	Sheppard Park	L		
	0081	Manatee Marina	M		
	0083	Sailfish Marina	M		1
	0294	Pirates Cove Marina	L		
	0297	Jaycee Boat Ramps	M		
	0314	Sandsprit Park Marina	H	1	
	0331	Boat Ramp, Port Salerno	L		1
	0333	Jensen Beach Cswy. West	M		
	1754	Jimmy Graham Park	M		
	1817	Leighton Park	M		
	3358	Jensen Beach Boat Ramp	M		
Fort Pierce	0065	Ft. Pierce Cswy. Boat Ramp	M		1
	0094	Jaycee Park	M	1	1
	0288	Black Pearl Ramp	H	1	1
	0928	South Causeway	L		
	1761	Little Mud Boat Ramp	M		
	1773	Veteran's Memorial Ramp	M		
	1936	Stan Blum Park	H	1	
	3500	Fisherman's Warf	L		

Estimation Methods

Estimating Ocean Boat Trips for Reference Inlets

For each day that red snapper was open to recreational harvest, the number of observed boats that exited through each inlet was summed for each hour of observation (h). Only private recreational power boats and undetermined vessels were included in the summations. If the same vessel was observed multiple times while an inlet was under observation, such as a drift fishing boat making multiple passes through the inlet, then the vessel was only included once in the summation.

For reference inlets, the number of boats observed each day (j) was summed to get the raw total number of boats that exited through a reference inlet from 7:00 a.m. until sunset. If observation of a reference inlet began later than 7:00 a.m. (for example, a park could not be entered before 7:00 a.m.), the first 15 minutes of observation time was used to fill in the missing minutes of observation time. No observation time started later than 7:15 a.m. The number of observed boat trips (BT) that exited a reference inlet on a given day (j) was calculated as:

$$BT_{obs\_ref\ inlet\_j} = \sum_{hours\ h\ to\ n} BT_{obs\_ref\ inlet\_h}$$

For the seven randomly sampled inlets, the number of boats observed exiting each inlet (i) on each day observed (j) between the hours of h to k was expressed as a proportion (p) of the number of boats observed in a reference inlet on the same day between the same hours, calculated as:

$$p_j = \sum_{h\ to\ k} (BT_{obs\_rand\ inlet}) / \sum_{h\ to\ k} (BT_{obs\_ref\ inlet})$$

For example, if 10 boats exited Cumberland Sound between 7:00 am and 2:00 pm on September 15, this number was expressed as a proportion of the number of boats that exited through Saint Augustine on the same day between the same hours. The mean proportion and variance was calculated for each ith inlet as:

$$mean\ p_i = (\sum_{days\ j\ to\ n} p_j) / n$$

$$var\ p_i = ((p_1^2+p_2^2+p_3^2)/n) * meanp_i^2$$

Where n is the number of days the sampled inlet was observed. The estimated number of boat trips that entered the Atlantic Ocean through a random sampled inlet between 7:00 a.m. and sunset during the red snapper harvest season was calculated as:

$$BT_{est\_\ rand\ inlet\ i} = (\sum_{days\ j\ to\ n} BT_{obs\_ref\ inlet}) * mean\ p_i$$

The 95% confidence interval was calculated as:

$$LCL\ BT_{est\_\ rand\ inlet\ i} = (\sum_{days\ j\ to\ n} BT_{obs\_ref\ inlet}) * (mean\ p_i - 1.96(sqrt(var\ p_i)/sqrt(n)))$$

$$UCL\ BT_{est\_\ rand\ inlet\ i} = (\sum_{days\ j\ to\ n} BT_{obs\_ref\ inlet}) * (mean\ p_i + 1.96(sqrt(var\ p_i)/sqrt(n)))$$

Where LCL is the lower confidence limit and UCL is the upper confidence limit.

Trip interviews obtained during the access point trip intercept survey were used to calculate the proportion of boats entering the Atlantic Ocean that targeted red snapper. To account for variable sample sizes across inlets (due to variable numbers of scheduled assignments), a weight (Wt) for each inlet i was calculated as:

$$Wt_i = (N_i/N) / (n_i/n)$$

Where N_i is the number of observed boat trips ($BT_{obs\_ref\ inlet}$) or estimated boat trips ($BT_{est\_rand\ inlet}$) for a given inlet, N is the sum of observed and estimated boat trips for all inlets, n_i is the number of ocean boat interviews in the access point trip intercept survey obtained from inlet i, and n is the total number of ocean boat interviews for all inlets combined. Inlets with $Wt_i < 1$ are down weighted to account for oversampling and inlets with $Wt_i > 1$ are inflated to account for undersampling. The weighted proportion of ocean boat trips from inlets i to x targeting red snapper (p_{targ}) was calculated as:

$$p_{targ} = \sum_{\text{inlet i to x}}(nt_i * Wt_i) / \sum(n_i * Wt_i)$$

Where nt_i is the number of ocean boat trip interviews that reported targeting red snapper. Red snapper are less abundant south of Cape Canaveral and the proportion of targeted trips is expected to vary among northern and southern regions within the study area. Therefore, p_{targ} was calculated separately for inlets from Cape Canaveral north and for inlets from Sebastian inlet south.

Effort in this study could not be observed prior to 7:00 a.m.; however, the time that boats went through an inlet and entered the Atlantic Ocean was collected during the access point trip intercept survey for trips targeting red snapper. The portion of targeted trip interviews that exited through inlets before 7:00 a.m. was used to adjust targeted effort estimates. Sample weights were again calculated for each inlet using the equation for Wt_i above, except for this calculation n and n_i included only trip interviews that reported targeting red snapper. The weighted percent increase (% incr) in targeted trips was calculated for all inlets in each region as:

$$\% \text{ incr} = \sum_{\text{inlet i to x}}(ne_i * Wt_i) / (\sum_{\text{inlet i to x}}(n_i * Wt_i) - \sum_{\text{inlet i to x}}(ne_i * Wt_i))$$

Where ne_i is the number of trip interviews that reported exiting through an inlet before 7:00 a.m.

The total adjusted number of targeted trips for a reference inlet was calculated as:

$$TT_{ref} = (\sum_{\text{days j to n}}BT_{\text{obs\_ref inlet\_j}} * p_{targ}) + (\% \text{ incr}*(\sum_{\text{days j to n}}BT_{\text{obs\_ref inlet\_j}} * p_{targ}))$$

And for a random sampled inlet as:

$$TT_{rand} = (BT_{\text{est\_ rand inlet i}} * p_{targ}) + (\% \text{ incr}*(BT_{\text{est\_ rand inlet i}} * p_{targ}))$$

Upper and lower confidence limits were calculated for random sampled inlets as:

$$LCL = (LCL\ BT_{\text{est\_rand inlet}} * p_{targ}) + (\% \text{ incr}*(LCL\ BT_{\text{est\_rand inlet}} * p_{targ}))$$

$$UCL = (UCL\ BT_{\text{est\_rand inlet}} * p_{targ}) + (\% \text{ incr}*(UCL\ BT_{\text{est\_rand inlet}} * p_{targ}))$$

Weighted Catch per Unit Effort

Weighted catch per unit effort was calculated for each of two regions (Cape Canaveral north and Sebastian Inlet south). To obtain the sample weight (W_i) for a given inlet, proportional effort was divided by the proportion of trip interviews obtained during access point intercept assignments:

$$W_i = (TT_i/TT) / (n_i/n)$$

Where TT_i /TT is the estimated number of targeted trips (TT) from inlet i divided by total estimated targeted trips for all inlets in a given region, and n_i/n is the number of trip interviews from inlet i in the sample population divided by the total number of trip interviews for all inlets in the region. Inlets with $W_i < 1$ are down weighted to account for oversampling and inlets with $W_i > 1$ are inflated to account for undersampling.

To calculate a weighted catch rate, the number of harvested fish recorded during trip interviews was summed for each inlet (i to x) and multiplied times the respective weighting factor (W_i). The weighted harvest per unit effort (hpue) was calculated as follows:

$$\text{hpue} = [\sum_{\text{inlet i to x}} (H_i * W_i)] / n$$

Where H_i equals the number of harvested red snapper recorded during trip interviews in inlet i and n is the total number of trip interviews for all inlets in the region. The same method was used to calculate weighted catch rates for released fish using the number of red snapper that were reported to have been released during trip interviews from inlet i (R_i). The weighted number of discards per unit effort (dpue) was calculated as follows:

$$\text{dpue} = [\sum_{\text{i=1 to x}} (R_i * W_i)] / n$$

Weighted Length Frequency and Biomass of Harvested Fish

Individual fish mid-line lengths were placed in one cm length bin categories and the number of fish in each length bin category was summed by inlet and multiplied times the weighting factor described above. The weighted proportion of fish in a single length bin (p_b) was calculated as follows:

$$p_b = \frac{\sum_{\text{inlet i to x}} [(\sum L_i) W_i]}{\sum_{\text{bin b to z}} \sum_{\text{inlet i to x}} [(\sum L_i) W_i]}$$

Where L_i equals the number of fish in length bin b for a given inlet; and W_i is the weighting factor for the same inlet. The denominator is the sum of all numerators for length bins b to z.

Not all harvested fish measured during trip interviews in the field could be weighed (i.e. fish were filleted, anglers were in a rush, or scales were inoperable). Predicted values were generated for missing weights using the log-transformed linear regression model:

$$\ln(y) = m * \ln(x) + b, \text{ and}$$

$$y = \exp(\ln(y))$$

Where y is whole weight in kg and x is body length measured at the midline in mm for harvested red snapper that were both measured and weighed during trip interviews. Coefficients of the regression model are represented by m and b. The 95% confidence interval was used to identify outliers and the model was re-run with extreme outliers removed. Once missing weights were filled in, individual fish were placed in 0.1 kg weight bin categories (b). The number of fish in

each bin (L_i) was summed by inlet and multiplied times the weighting factor W_i. The mean kg per harvested fish was calculated as:

$$\text{kg per fish} = \frac{\sum_{\text{bin b to z}} [(\sum_{\text{inlet i to x}} (\sum L_i) W_i) * b]}{\sum_{\text{bin b to z}} \sum_{\text{inlet i to x}} [(\sum L_i) W_i]}$$

Where the numerator is the total biomass of fish in bins b to z, and the numerator is the total number of fish in bins b to z.

Catch Estimates

Total estimated catch during the six day season was calculated as follows:

$$\text{Number harvested} = \text{hpue} * (\sum_{\text{ref inlet i to x}} TT_{ref} + \sum_{\text{rand inlet i to x}} TT_{rand})$$

$$\text{Kilograms harvested} = \text{Number harvested} * \text{kg per fish}$$

$$\text{Number released} = \text{rpue} * (\sum_{\text{ref inlet i to x}} TT_{ref} + \sum_{\text{rand inlet i to x}} TT_{rand})$$

RESULTS

Private Boat Effort Estimates

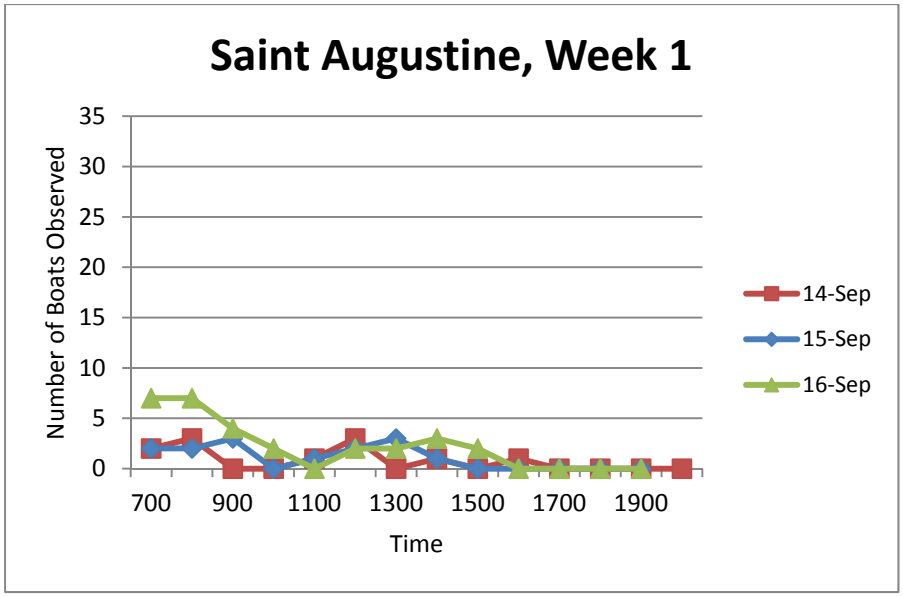
The observed number of private recreational power boats and unidentified boats that exited through each reference inlet between the hours of 7:00 am and 7:00 pm ($BT_{obs\_ref\ inlet}$) is provided in Table 6, below. The number of vessels classified as "undetermined" for any given inlet was less than 4% of all observations for private recreational power boats and undetermined observations combined. For any given inlet and sample day, the calculated number of boats missed during break periods added up to less than one boat (mean=0.22 boats missed per day, range=0 to 0.29). Therefore, missing observation times were not filled in for break periods.

Table 6. Raw number of private recreational power boat trips (including undetermined boats) observed exiting through reference inlets each day, and adjusted for when observation of the inlet started later (up to 15 minutes) than 7:00 a.m.

Reference Inlet	Day	Observed Ocean Boat Trips	Adjusted
Saint Augustine (northern)	9/14	18	18
	9/15	17	17
	9/16	38	38
	9/21	41	46

	9/22	72	81.7
	9/23	49	51.3
	SUM	**235**	**252**
Sebastian Inlet (southern)	9/14	2	2
	9/15	42	42
	9/16	81	81.9
	9/21	101	107.7
	9/22	169	169
	9/23	185	185
	SUM	**580**	**587.6**

Vessel activity monitored in reference inlets was low during the first weekend and increased during the second weekend (Figures 9 and 10). Wave height data from the National Weather Data Buoy off Port Canaveral for the month of September are provided in Figure 11. Conditions offshore where red snapper fishing grounds are located were not conducive to recreational boating during the first weekend of red snapper season. The average distance from shore reported during access point trip interviews where red snapper fishing took place ranged from less than 10 miles in the southern most inlets to more than 30 miles offshore from Saint Augustine (Figure 12). Vessel activity through the reference inlets increased during the second weekend in response to moderately improved offshore boating conditions. Activity for departing vessels was highest in the early a.m. hours and tapered off in the afternoon hours (Figures 9 and 10).



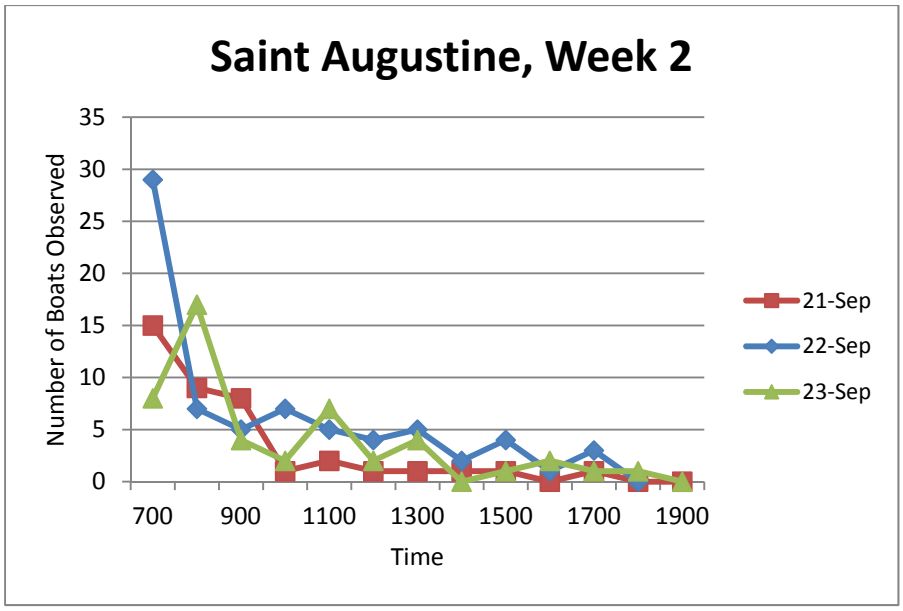
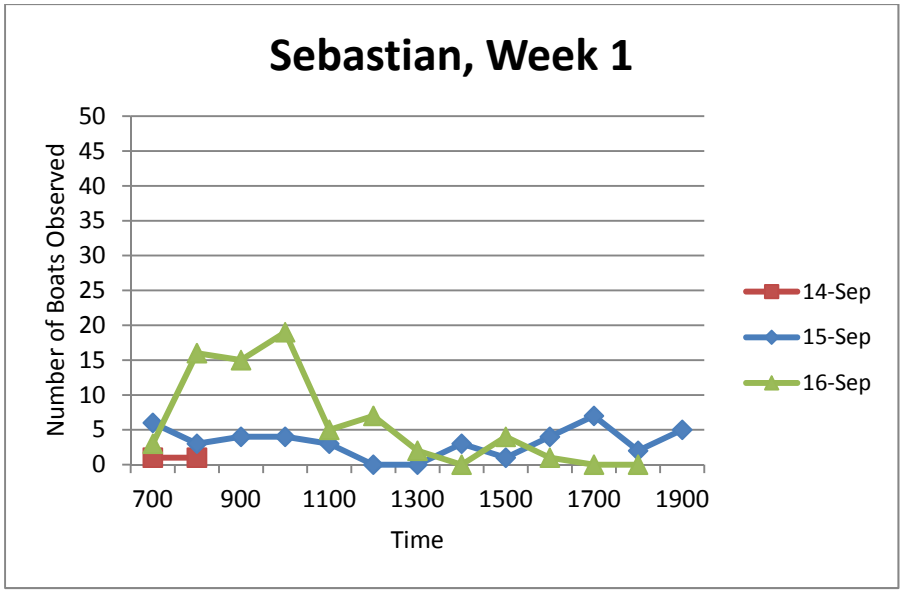


Figure 9. Number of boats observed exiting through the northern reference inlet by observation hour for week 1 (top) and week 2 (bottom).



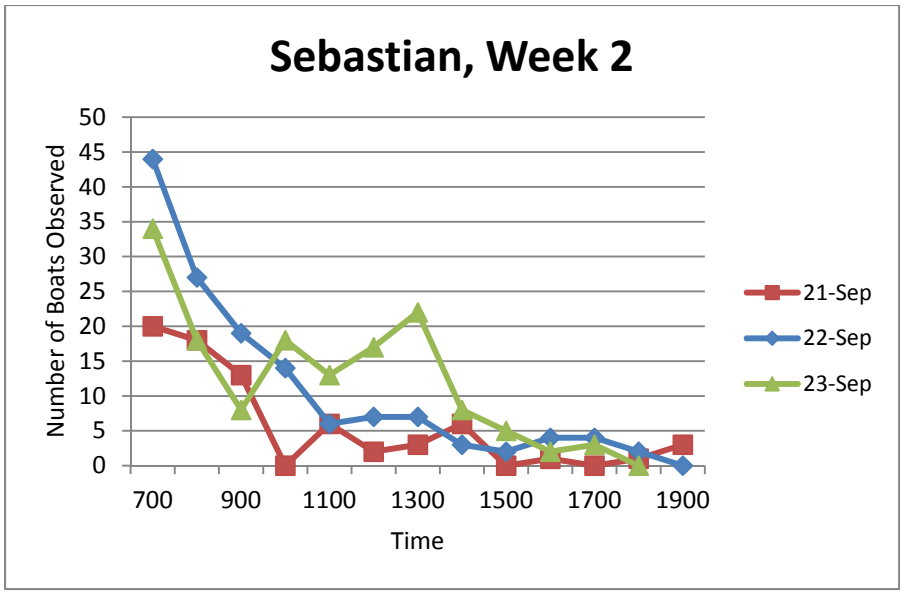
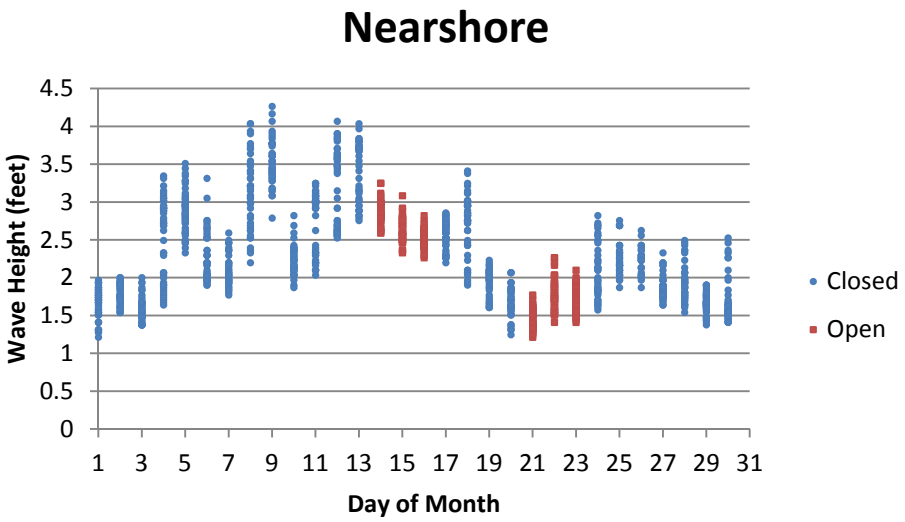


Figure 10. Number of boats observed exiting through the southern reference inlet by observation hour for week 1 (top) and week 2 (bottom).



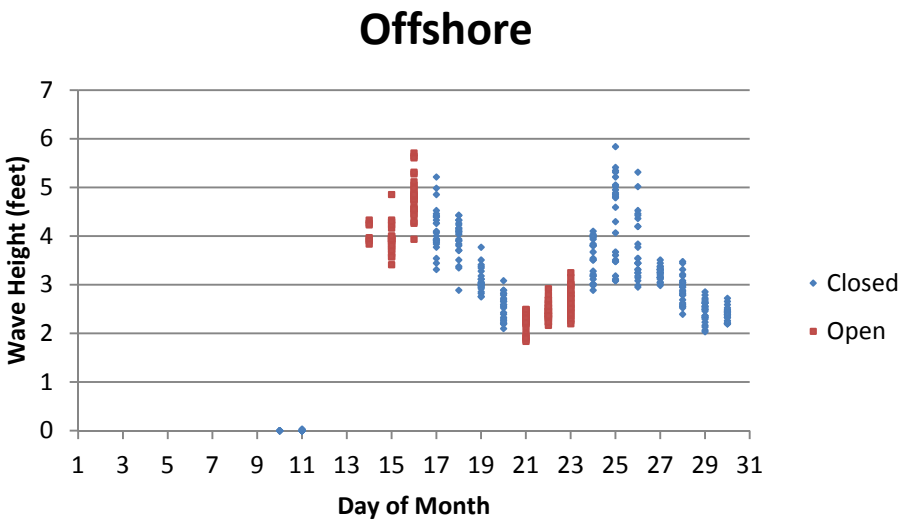


Figure 11. National Data Buoy Center wave height readings east of Cape Canaveral for the month of September, 2012. The top graph is nearshore readings from Station 41113 SCRIPPS location: 28.400N 80.53W, and the bottom graph is readings 20 miles offshore from Station 41009 location: 28.523N 80.184W. Red points are days when the red snapper recreational harvest season was open.

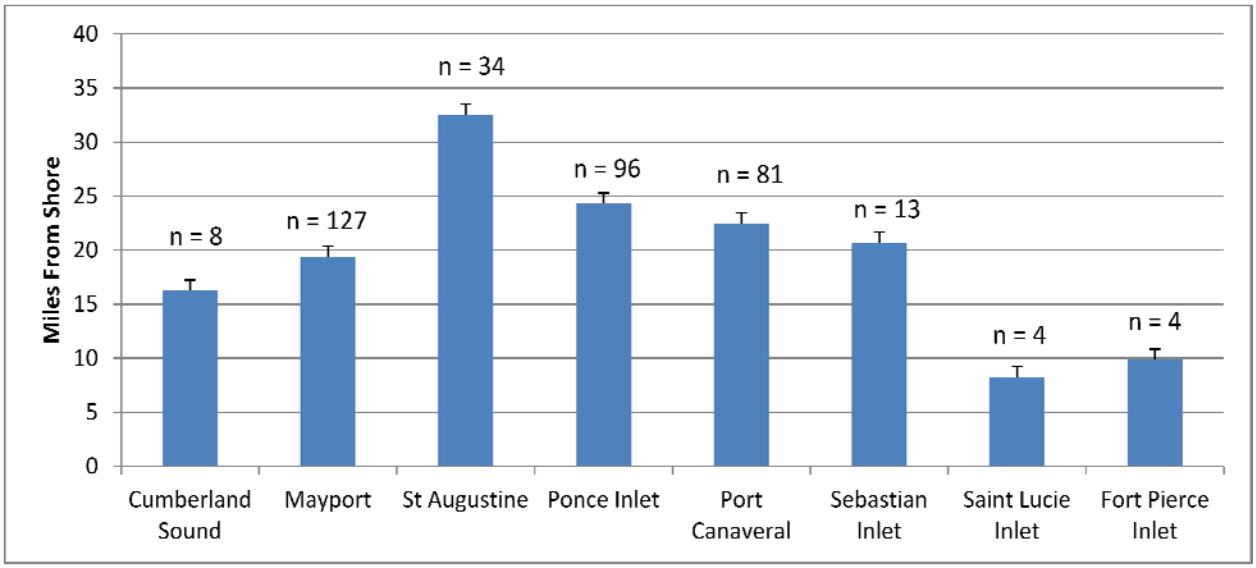


Figure 12. Average reported distance fished (miles from shore) during targeted trip interviews (n=number of trip interviews) with error bars for 95% confidence intervals.

The mean proportion of boats observed departing through each randomly sampled inlet with respect to a reference inlet is provided in Table 7 below. The observed numbers of boat trips was more variable among days in the southern reference inlet (Sebastian Inlet) compared to the northern reference inlet (Table 6). On September 14, no boats were observed exiting through Sebastian Inlet during the p.m. time

period, which made it impossible to calculate a proportion for random sampled inlets referenced to that day and time period. When Port Canaveral and Fort Pierce were referenced to Sebastian inlet, confidence intervals for estimated ocean boat trips were large and included 0. When these same inlets were referenced to Saint Augustine, confidence intervals were significantly reduced and no longer included 0. Therefore, effort estimates based on the Saint Augustine reference inlet are considered more reliable and were used in all subsequent calculations.

Table 7. Mean daily proportion of observed boats with respect to reference inlets and total estimated ocean boat trips for each sampled inlet. Estimates based on Sebastian Inlet as a reference are shown only for comparison and were not used in any further calculations.

Inlet	Reference Boat Trips (BT_{obs})	Mean p	95% LCL	95% UCL	n	Estimated Boat Trips (BT_{est} = mean p * BT_{obs})	Lower BT_{est} (= LCL * BT_{obs})	Upper BT_{est} (= UCL * BT_{obs})
Cumberland	Saint Augustine = 252	0.683	0.13	1.24	3	172.07	32.03	312.12
Mayport		1.728	0.62	2.84	3	435.40	155.82	714.98
Matanzas Inlet		0.892	0.53	1.26	3	224.81	133.03	316.60
Ponce Inlet		4.892	1.36	8.43	4	1,232.75	341.52	2,123.98
Port Canaveral		4.113	1.16	7.06	3	1,036.47	292.92	1,780.01
St. Lucie Inlet		3.061	1.13	4.99	3	771.27	285.87	1,256.67
Fort Pierce		1.563	1.08	2.05	3	394.00	271.72	516.28
Port Canaveral	Sebastian Inlet = 588	8.169	-3.43	19.77	3	4,800.34	-2014.25	1,1614.93
St. Lucie Inlet		0.553	0.29	0.81	3	324.85	171.95	477.75
Fort Pierce		2.415	-1.10	5.93	3	1,418.81	-648.72	3,486.35

The estimated number of targeted trips that exited each inlet between 7:00 a.m. and sunset, and adjusted estimates for vessels that departed prior to 7:00 a.m. are presented in Table 8. Targeted fishing effort was centered around Ponce Inlet and Port Canaveral. Two red snapper fishing tournaments were based out of Ponce Inlet during both weekend openings, which contributed to targeted effort in this area. The weighted percent of ocean boat trips that targeted red snapper was 81% for the area from Port Canaveral north, and was considerably lower (37.8%) from Sebastian Inlet south. This result was expected based on the distribution of red snapper on the east coast of Florida (higher abundance from Port Canaveral north). After accounting for targeted trips that exited through inlets before 7:00a.m., there was a 43.1% increase in targeted trip estimates for Port Canaveral north and a 24.8% increase in targeted trip estimates for Sebastian Inlet south.

Table 8. Total estimated recreational fishing trips targeting red snapper.

Inlet	Ocean Boat	Ocean Boat Trip	Targeted Interviews	Percent Targeting	Early a.m. Targeted	Percent Increase	Total Estimated	LCL	UCL

	Trips (N_i)	Interviews (n_i)	(nt_i)	(p_{targ})	Interviews (ne_i)	(% incr)	Targeted Trips (TT)		
Cumberland Sound	172.07	9	9	1.00	0	0	192.09	35.75	348.43
Mayport	435.40	143	134	0.94	20	17.54%	486.05	173.95	798.15
Saint Augustine	252.00	43	35	0.81	14	66.67%	281.31	281.31	281.31
Matanzas Inlet	224.81	-	-	-	-	-	250.97	148.50	353.43
Ponce Inlet	1,232.75	132	112	0.85	33	41.77%	1,376.15	381.25	2,371.06
Port Canaveral	1,036.47	127	86	0.68	30	53.57%	1,157.04	327.00	1,987.08
North Region	**N = 3,353.50**	**n = 454**	**nt = 376**	**Weighted 0.80961**	**ne = 107**	**Weighted 37.885%**	**3,743.61**	**1,347.76**	**6,139.45**
Sebastian Inlet	587.60	29	14	0.48	2	16.67%	276.89	276.89	276.89
St. Lucie Inlet	771.27	12	4	0.33	0	0	363.45	134.71	592.18
Fort Pierce	394.00	13	4	0.31	3	300%	185.66	128.04	243.28
South Region	**N = 1,752.87**	**n = 54**	**nt = 22**	**Weighted 0.37766**	**ne = 5**	**Weighted 24.776%**	**826.00**	**539.65**	**1,112.36**
Total							**4,569.61**	**1,887.41**	**7,251.81**

Since the two reference inlets were monitored all six days, targeted trips could be estimated for each of the two weekends that red snapper was open to harvest. During the first weekend, offshore conditions were not conducive to recreational boating and vessel counts through the reference inlets were low. Offshore conditions improved during the second weekend and the majority (>70%) of targeted trips from the two reference inlets took place during the second weekend (Table 9).

Table 9. Weekly targeted trip estimates for reference inlets.

		Boat Trips Observed	**Percent Targeting (p_{targ})**	**Early Departure Ajustment (pi)**	**Targeted Trips (TT)**	**Percent TT by Week**
Saint Augustine	Week 1	73.00	0.8096	0.378848	81.492	28.97%
	Week 2	179.00	0.8096	0.378848	199.823	71.03%
Sebastian Inlet	Week 1	125.90	0.3676	0.258747	58.258	21.43%
	Week 2	461.70	0.3676	0.258747	213.642	78.57%

The numbers of people in targeted trip parties ranged from one to 10 people (including non-anglers), and more than 65% of trips carried two to four people (Figure 13).

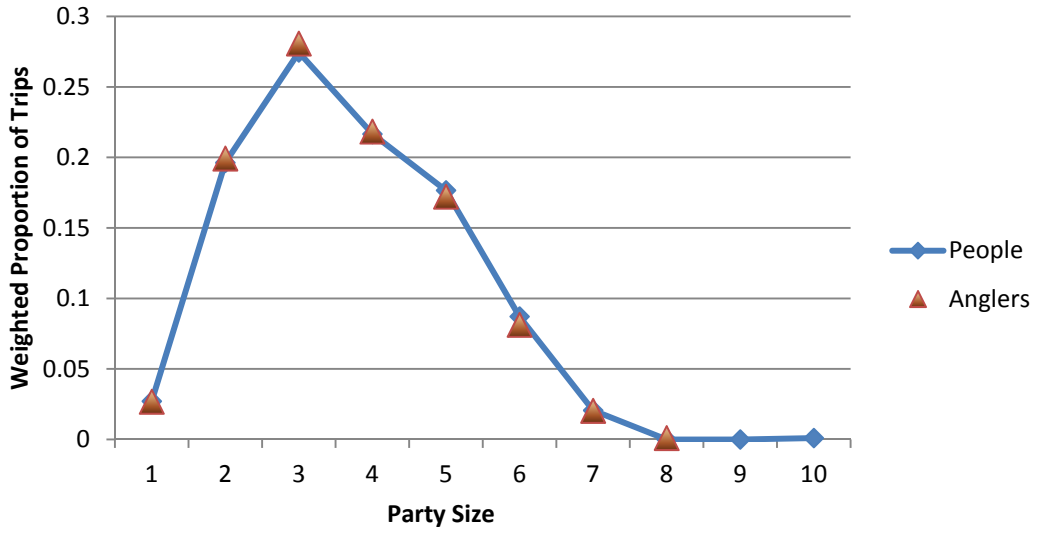


Figure 13. Proportion of targeted trip interviews by party size. Red triangles include only people in the party that were reported to be fishing and blue points include all people in the party.

Private Boat Catch Estimates

The weighted number of fish harvested per unit effort (hpue) was 1.83 fish per targeted trip for the region from Cape Canaveral north. The weighted hpue was lower (0.78) for the region from Sebastian Inlet south where red snapper are known to be less abundant (Table 10). The weighted biomass per harvested fish was 4.1131 kg, and total catch estimates in both numbers and biomass are presented in Table 11.

Table 10. Raw and weighted number of red snapper harvested and discarded per unit of effort (hpue and dpue, respectively), where a unit of effort equals one targeted private recreational boat trip.

Inlet (i)	Targeted Trip Interviews (n_i)	Estimated Targeted Trips (TT_i)	Weight (W_i)	Number Harvested (H_i)	Fish Harvested per Trip (hpue)	Number Released (R_i)	Fish Discarded per Trip (dpue)
Cumberland	9	192.09	2.104	8	0.89	1	0.11
Mayport	130	486.05	0.369	176	1.35	163	1.25
Saint Augustine	34	281.31	0.816	67	1.96	32	0.95
Matanzas	-	250.97	-	-	-	-	-
Ponce Inlet	111	1,376.15	1.222	225	2.03	337	3.04
Cape Canaveral	85	1,157.04	1.342	196	2.30	111	1.30
North Region	**n** = 369	**N** = 3,743.61			**Weighted**		**Weighted**

					1.82514		1.75885
Sebastian Inlet	13	276.89	0.542	26	2.00	36	2.77
St. Lucie Inlet	4	363.45	2.310	0	0.00	0	0.00
Fort Pierce	4	185.66	1.180	2	0.50	10	2.50
South Region	**n** = 21	**N** = 826.00			**Weighted** 0.78283		**Weighted** 1.49024

Table 11. Total catch estimates.

	Estimated Harvest			Estimated Harvest (biomass)			Estimated Discards		
	Number	**Lower**	**Upper**	**Kilograms**	**Lower**	**Upper**	**Number**	**Lower**	**Upper**
North Region	6,832.63	2,459.86	11,205.39	28,102.60	10,117.42	46,087.78	6,833.83	2,370.52	10,798.40
South Region	646.62	422.45	870.79	2,659.55	1,737.55	3,581.55	1,230.95	804.21	1,657.68
Total	**7,479.25**	**2,882.32**	**12,076.18**	**30,762.15**	**11,854.97**	**49,669.33**	**8,064.77**	**3,174.73**	**12,456.08**

Characteristics of Private Boat Catch

The length-weight regression model for harvested fish is presented in Figure 14. Four outliers were removed before this model was run. The length frequency distribution for harvested fish is plotted in Figure 15, and peaks indicate multiple year classes were included in the catch. Age readings from otolith samples are presented in Section 3 of this report. For interviews where anglers could recall sizes for released fish (119 trips), approximately 35% of discards were <16" (<40.6 cm total length), approximately 35% were between 16" to 20" (40.6 to 50.8 cm total length), and almost 30% of reported discards were over 20" (Figure 16). When one or more red snapper were released, the majority (60%) of those trips retained the bag limit of one fish per person (Figure 17). However, 40% of trips that released one or more red snapper did not retain the full bag limit, which indicates that the absence of a minimum size limit did not prevent at least some private boat anglers from releasing red snapper.

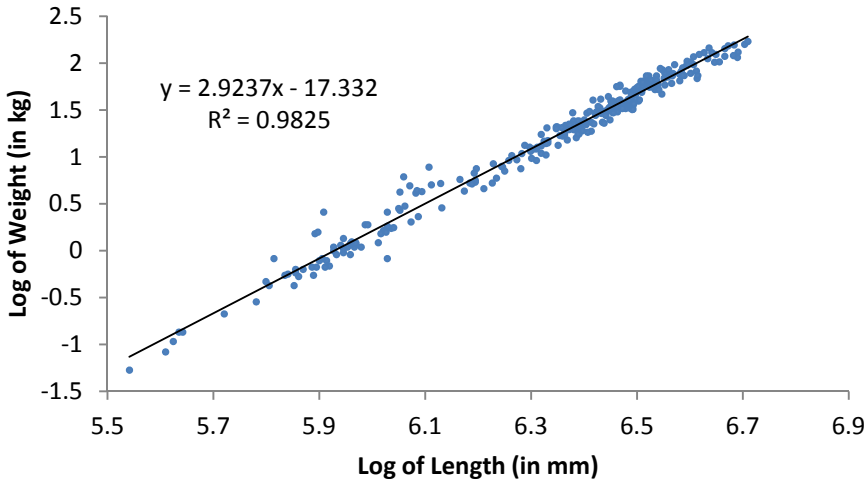


Figure 14. Log-transformed length-weight regression for harvested red snapper intercepted during private boat trip interviews. Sample size = 301, predicted weight = exp(y).

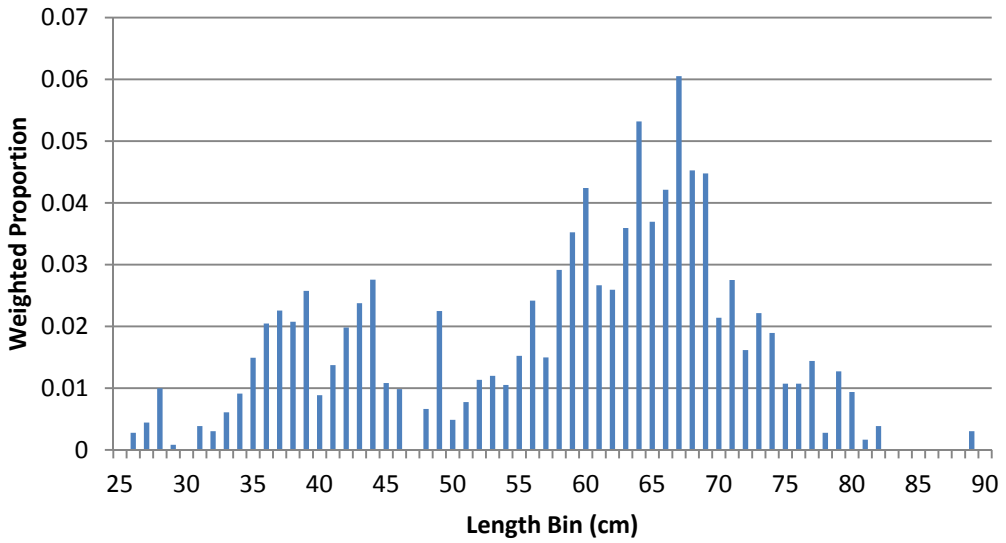


Figure 15. Weighted midline length frequency of harvested red snapper intercepted during private boat intercepts. The raw sample size for this distribution was 440 red snapper measured from 167 trips.

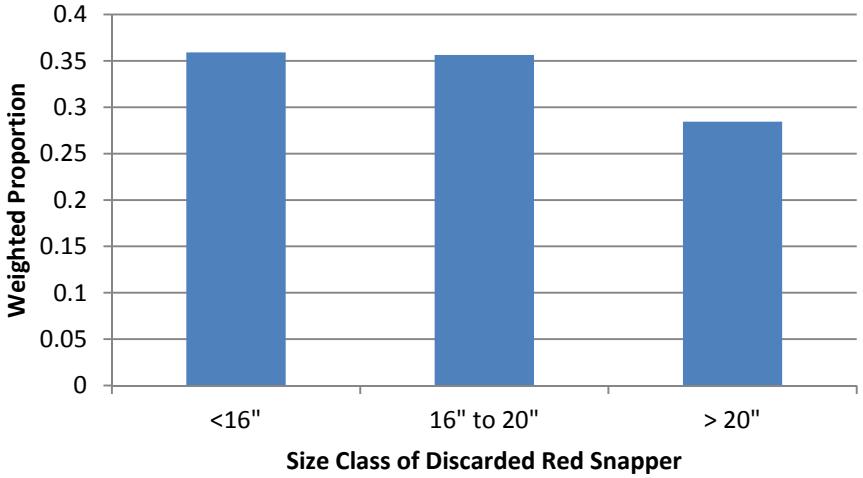


Figure 16. Reported size (total length) of discarded red snapper from private boat trip interviews (n=119 trips, 583 fish).

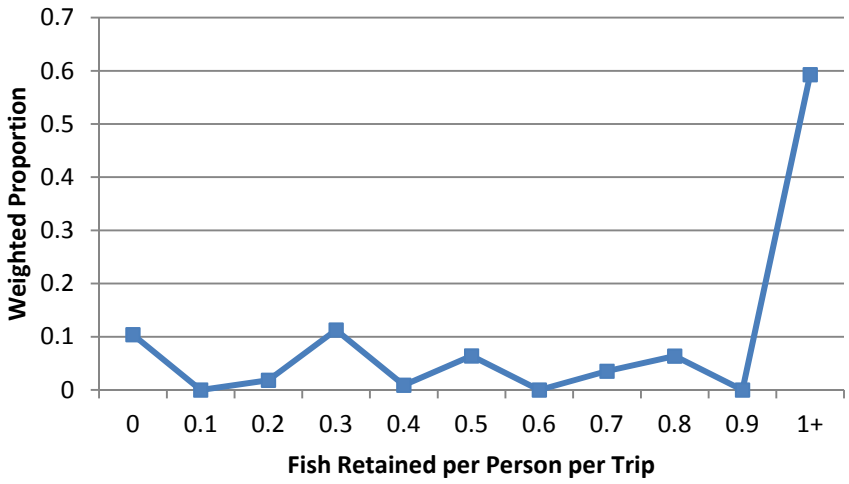


Figure 17. Targeted trips that released one or more red snapper (n=122), and the proportion of those trips that retained less than one fish per person (0 to 0.9) up to the full bag limit of one fish per person (1+). Note: one trip retained more than one fish per person.

DISCUSSION

Estimates of recreational fishing effort from the Marine Recreational Information Program (MRIP) indicate that just over 20% of saltwater recreational fishing trips from private boats on the east coast of Florida take place more than 3 miles offshore in the Atlantic Ocean. MRIP was designed to survey all saltwater fishing, including inshore fishing from estuaries, lagoons, and saltwater portions of rivers, as well as state territorial seas and the Exclusive Economic Zone (EEZ). This study was designed to survey a short six-day harvest season specifically for red snapper in the Atlantic Ocean. Offshore fishing is a small percentage of saltwater fishing trips for a variety of reasons, including the time, cost of fuel, and the size of vessel required to travel offshore; offshore conditions that may limit fishing days; harvest restrictions for offshore target species; and angler preferences. An intentional effort was made in this study to choose sites for the access point trip intercept survey that were near major inlets where offshore boat trips were expected to be intercepted. Even with this targeted approach, offshore trips in several of the inlets included in this study were a low percentage of all trips intercepted, and red snapper fishing trips were an even lower percentage (Figure 18). In Port Canaveral, 90% of intercepted trips entered the Atlantic Ocean; however, this basin is unique in that it is a man-made cruise, cargo and naval port designed for ocean access, and inland lagoon access is restricted through a loch. Results from this study demonstrate the importance of a directed effort to adequately sample offshore trips in an access point intercept survey. A directed approach was also important for this particular fishery because of both the short time scale during which red snapper was open to recreational harvest and the regional concentration of the fishery north of Sebastian Inlet.

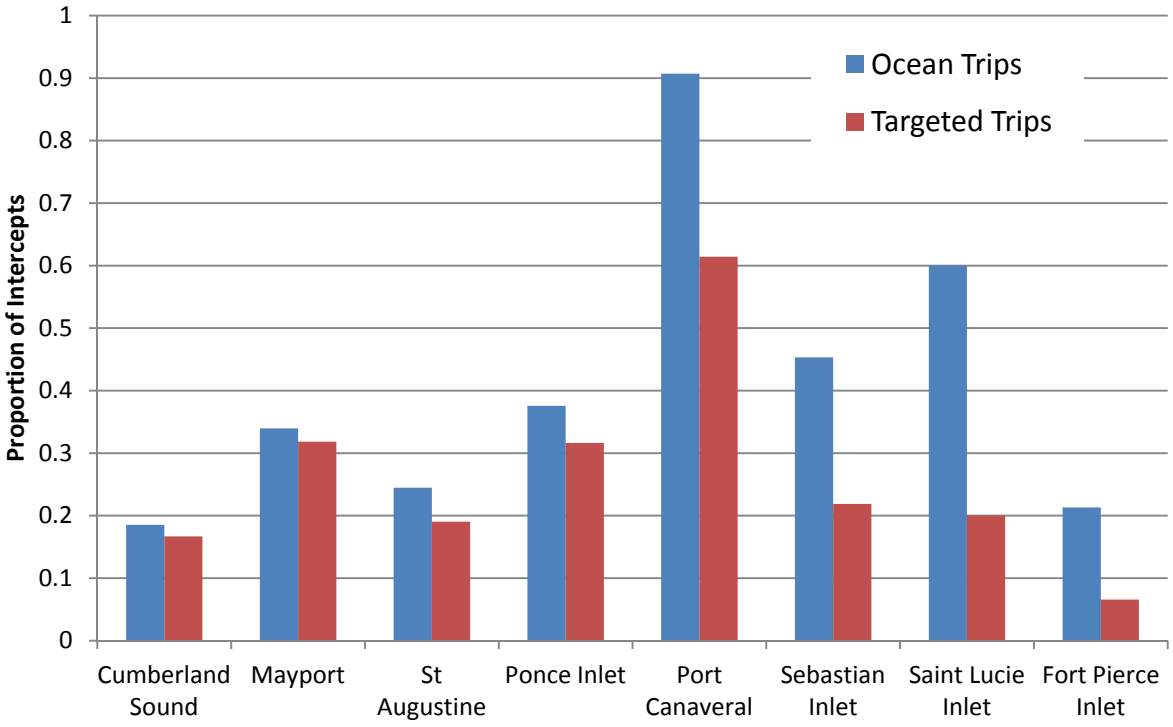


Figure 18. Proportion of total access point trip intercepts by inlet that entered the Atlantic Ocean and that were targeting red snapper.

During the two red snapper harvest weekends, ten private boat mode MRIP intercept assignments were also completed on the Atlantic coast of Florida, in addition to assignments completed as part of this study. One MRIP assignment conducted during the first weekend from the Ponce Inlet area intercepted three targeted trips that each harvested one red snapper, and no red snapper were intercepted during any of the remaining nine assignments. By employing a directed survey approach during this special season opening, we were able to supplement MRIP's region-wide survey of all saltwater fishing to collect high resolution data specific to the offshore red snapper fishery. This supplementary approach took advantage of a rare opportunity to collect detailed information on the characteristics of the offshore recreational fishery and important biological characteristics of the red snapper catch that are not only useful for estimating total catch, but are also meaningful to fishery managers and stock assessment analysts. Results presented in this report demonstrate both spatial and temporal aspects of this fishery that could not be discerned from the broader MRIP survey. Major conclusions from this study are that fishing effort was highly influenced by variable offshore conditions between the two weekends sampled, that fishing effort was concentrated in the area between Ponce Inlet and Port Canaveral, and that the highest observed catch-per-unit-effort was centered around Cape Canaveral. This study also revealed that private recreational boats travel long distances between 10 and 30 miles offshore to target red snapper, and that the distance travelled varied regionally. There was also evidence from this study that the management decision to not restrict harvest to a minimum size limit did not prevent some discarding in the private boat recreational fishery. Forty percent of trips that released one or more red snapper did not retain the daily bag limit. For the 60% of trips that did retain the daily bag limit, no data were collected to determine whether fish were released after the daily bag limit was reached or if fish were released in favor of retaining larger fish.

The directed approach of this study also allowed for the collection of high quality data on biological characteristics of the recreational catch. A total of 440 red snapper were measured during 167 trip interviews, and age and growth samples (otoliths) were collected from 328 measured fish. Because the MRIP survey questionnaire is longer than the questionnaire used for this study, and MRIP covers all species and all saltwater trips, time does not permit otolith samples to be collected from harvested fish during MRIP intercept interviews. The intercept survey questions for this study were minimized to quickly screen out trips that did not take place in the Atlantic Ocean and that did not target red snapper so that the maximum amount of time could be spent collecting vital information on the species of interest in this study. Since the MRIP survey was taking place at the same time as this specialized survey, it was not necessary to collect information on other species and we were able to focus our entire effort on collecting as much data as possible on red snapper during this short two-week season.

The method for estimating effort in this study was a novel approach. Because the open harvest season was so short in duration, we were able to monitor all vessel activity at two inlets from sunrise to sunset for the entire season. Effort at the remaining seven inlets was observed 25% of the time (morning or afternoon on 3 separate days), and total effort for these inlets was estimated as a proportion of what was observed at the reference inlets. It was fortunate that two reference inlets were chosen for this study because only one of the reference inlets produced effort estimates with reasonable precision. The southern reference inlet produced highly imprecise estimates for ocean boat trips that included the possibility of zero ocean boat trips in the 95% confidence intervals around point estimates. Since we observed at least some boats departing through all of the inlets every day they were sampled, we are certain that the estimated number of private recreational boat trips is greater than zero and should at least be greater than the number of boats that were observed on randomly sampled days. Confidence intervals around estimates based on the northern reference inlet were more precise and also realistic. Activity for departing vessels was highest in the early morning hours, and the adjustment for effort that could not be observed at the inlets before sunrise was rather large (>40% increase) for northern inlets. However, given that the average distance travelled for red snapper fishing trips from this region was 20 to 30 miles offshore, such a high portion of early departures is not surprising. Trips from Sebastian Inlet south tended to fish closer to shore (10 miles or less) and, perhaps related to this result, a smaller adjustment (24.8% increase) was required to account for early departures in this region. The issue of missing early morning effort using this methodology is difficult to overcome because vessels could not be observed and identified as recreational in nature, at least not with reasonable certainty, until sunrise. Collecting information on departure times during the access point intercept survey seems to be the best method for at least accounting for missed effort during observations of vessel activity through inlets.

SECTION 3: Biological Sampling

METHODS

Biological samples, including fish length (mid-line in mm), weight (kg), and age structures (otoliths) were randomly collected during the Private Boat Access Point Trip Intercept Survey (described in Section 2). Opportunistic biological samples were also collected at for-hire charter boat and headboat docks and at private boat landing sites. For opportunistic samples, FWC biologists targeted sites where for-hire and private recreational offshore fishing vessels are known to land reef fish during the two weekends that red snapper was open to harvest. Biologists arrived on site as vessels returned from recreational trips and collected samples with permission from the anglers and vessel operators. Trip level information was also collected, which included the mode fished, county of intercept, access site, hours fished, trip start time and end time and area fished/distance from shore.

Two major red snapper fishing tournaments took place in Ponce Inlet. The Halifax Sport Fishing Club held a tournament all six days of the red snapper season, and six cash prizes were awarded to individual anglers with the heaviest red snapper. The 2012 King of the Inlet Offshore "Snapperpalooza" Fishing Tournament took place during the two Saturday openings of red snapper. Six cash prizes were awarded to registered vessels with the heaviest red snapper, with a limit of three snapper entered per vessel. The events were coordinated so that individual fish could be entered in both tournaments. The weigh in for "Snapperpalooza" was at Inlet Harbor Marina, and FWC biologists were present both days to collect biological samples from red snapper entered at this tournament location. A large chest freezer was also placed at this location, and participants in the Halifax Tournament were encouraged by organizers to donate carcasses to FWC by placing them in the freezer at Inlet Harbor Marina.

Volunteer carcass drop-off locations were advertised at multiple venues throughout the study area from Cumberland Sound to Saint Lucie Inlet (Table 12). The drop-off locations were advertised on FWC's website and in an FWC press release that was sent to outdoor writers and other media outlets. Pre-printed waterproof paper tags were provided for volunteers to provide information on the trip type (private recreational, charter, headboat, commercial) and plastic bags were provided for fish to be bagged with tags. FWC biologists visited each drop-off site at the end of each day to collect and process carcasses.

Table 12. Volunteer carcass drop-off locations.

Inlet	Location	Facilities
Cumberland Sound	Fernandina Harbor Marina http://www.fbfl.us/index.aspx?NID=100	FWC coolers
Mayport	Jacksonville Offshore Sportfishing Club located at Mayport Boat Ramp http://fishingjacksonville.net/jacksonville-boat-ramps/mayport-boat-ramp/	FWC chest freezer
	Sister Creek Boat Ramp operated by City of Jacksonville http://fishingjacksonville.net/jacksonville-boat-ramps/sisters-creek-marina/	FWC coolers
Saint Augustine	Conch House Marina Saint Augustine, FL 32080 http://www.conch-house.com/marina.htm	FWC coolers
Ponce Inlet	Inlet Harbor Marina	FWC chest freezer, FWC

	http://www.inletharbor.com/Marina/	biologists present at tournament on Saturdays.
	Fishin' Cove Marina 111 N Riverside Drive New Smyrna Beach, FL 32168 http://www.realpagessites.com/fishincovemarina/	Business provided freezer for FWC use.
	Critter Fleet Marina	Unadvertised, collected carcasses for FWC from resident for-hire vessels.
Port Canaveral:	Sunrise Marina 505 Glen Cheek Drive Cape Canaveral, FL 32920 http://sunrisemarina.com/	FWC freezer located at marina, Department of Transportation provided a flashing sign next door at Freddy Patrick Boat Ramp directing people to freezer location.
Sebastian Inlet:	Whitey's Bait and Tackle 9030 South Highway A1A Melbourne Beach, FL 32951	Carcasses collected by business and stored in their freezer for FWC.
	Tony's Fish Market 4705 1st St Grant, FL 32949	FWC cooler.
Fort Pierce Inlet:	Stan Blum Boat Ramp 613 North Causeway Drive Fort Pierce, Florida 34949 http://www.stlucieco.gov/beaches/21.htm	FWC cooler.
St. Lucie Inlet:	Snook Nook 3595 Northeast Indian River Drive Jensen Beach, FL 34957	Business collected carcasses for FWC.

Figure 19. Example of an opportunistic biological sampling site for red snapper landed from a headboat.

Figure 20. Department of Transportation sign directing boat ramp patrons to a near-by carcass drop-off location, and FWC carcass drop-off freezer.

Figure 21. Collecting biological samples at "Snapperpalooza" fishing tournament.

RESULTS

Biological samples

The numbers of biological samples by source and inlet is presented in table XX. Numbers represent fish for which measurements in length (midline length which corresponds to fork length in red snapper) and otoliths were obtained. Any discrepancies between the reported number of otoliths collected and aged is a result of a damaged or lost otolith (< 2%). Lengths were however available for specimens that could not be aged. Number of trips is reported where available. For tournament fish, collection of trip information was not possible because many fish were dropped off in a similar manner to those at carcass drop off locations.

Table 13. Distribution of biological samples by source and inlet.

Source	Inlet	Trips	# of Fish
Carcass Dropoff	Cumberland Sound	4	14
	Ft Pierce	2	6
	Mayport	6	11
	Ponce Inlet	4	32
	Port Canaveral	12	47
	Sebastian Inlet	1	2
	St Augustine	6	39
	St Lucie Inlet	1	1
Carcass Dropoff Total		*36*	*152*
Charter	Cumberland Sound	5	26
	Ft Pierce	1	6
	Mayport	.	.
	Ponce Inlet	34	198
	Port Canaveral	54	285
	Sebastian Inlet	.	.
	St Augustine	25	180
	St Lucie Inlet	.	.
Charter Total		*119*	*695*
Headboat	Cumberland Sound	.	.
	Ft Pierce	4	15
	Mayport	3	31
	Ponce Inlet	12	203
	Port Canaveral	16	244
	Sebastian Inlet	.	.
	St Augustine	3	10
	St Lucie Inlet	.	.
Headboat Total		*38*	*503*

Source	Inlet	Trips	# of Fish
Tournament	Cumberland Sound	1	2
	Ft Pierce	.	.
	Mayport	1	1
	Ponce Inlet	*Not Collected	236
	Port Canaveral	.	.
	Sebastian Inlet	.	.
	St Augustine	.	.
	St Lucie Inlet	.	.
Tournament Total		**Not Collected*	*239*

Size distributions of biological samples

Size distributions reported herein reflect sizes of fish (biological samples) by source and inlet. No adjustments were made for sample size or harvest. Length frequencies are shown as 1 cm bins although fish were measured in mm and subsequently converted to cm. Size information for private boat mode is not presented in this section as it has already been presented as part of the section on Private Boat mode harvest estimation. With the exception of tournament samples which were restricted to the Northern Region, Size information is presented by inlet within region. Three sets of figures are shown for carcass (Fig. 21 and 22) , charter boat (Fig. 23 and 24), Headboats (Fig. 25 and 26). Figure 27 shows tournament lengths which were restricted largely to Ponce Inlet in the Northern Region. Clearly evident from the size distributions is the concentration of fish in the Northern Region.

Fish from carcass drop offs showed a wide range of sizes but had noticeable peaks in numbers at about 41-45 cm (associated with Port Canaveral) and between 60-75 cm throughout the Northern Region. Sample sizes were extremely low for Southern Region fish but a similar distribution was somewhat evident (Fig. 21 and 22). Sizes of fish from charter trips were broadly distributed with most fish coming from fleets located at Ponce Inlet, St. Augustine and Port Canaveral. Fish from Port Canaveral samples were more uniformly distributed than those from Ponce and St. Augustine. Distributions of fish from the latter two locations showed a peak at 60-75 cm (similar to that seen in the Northern Region carcass length distributions) (Fig. 23). Samples were few for Southern Region locations (Fig. 24).

Sizes of fish sampled from headboats, largely obtained from Ponce Inlet and Port Canaveral, tended to be smaller than other modes and clustered between 33 and 37 cm (Figure .25). Although far fewer fish were obtained from headboat trips from locations in the Southern Region, the smaller size of headboat fish was evident (Fig. 26).

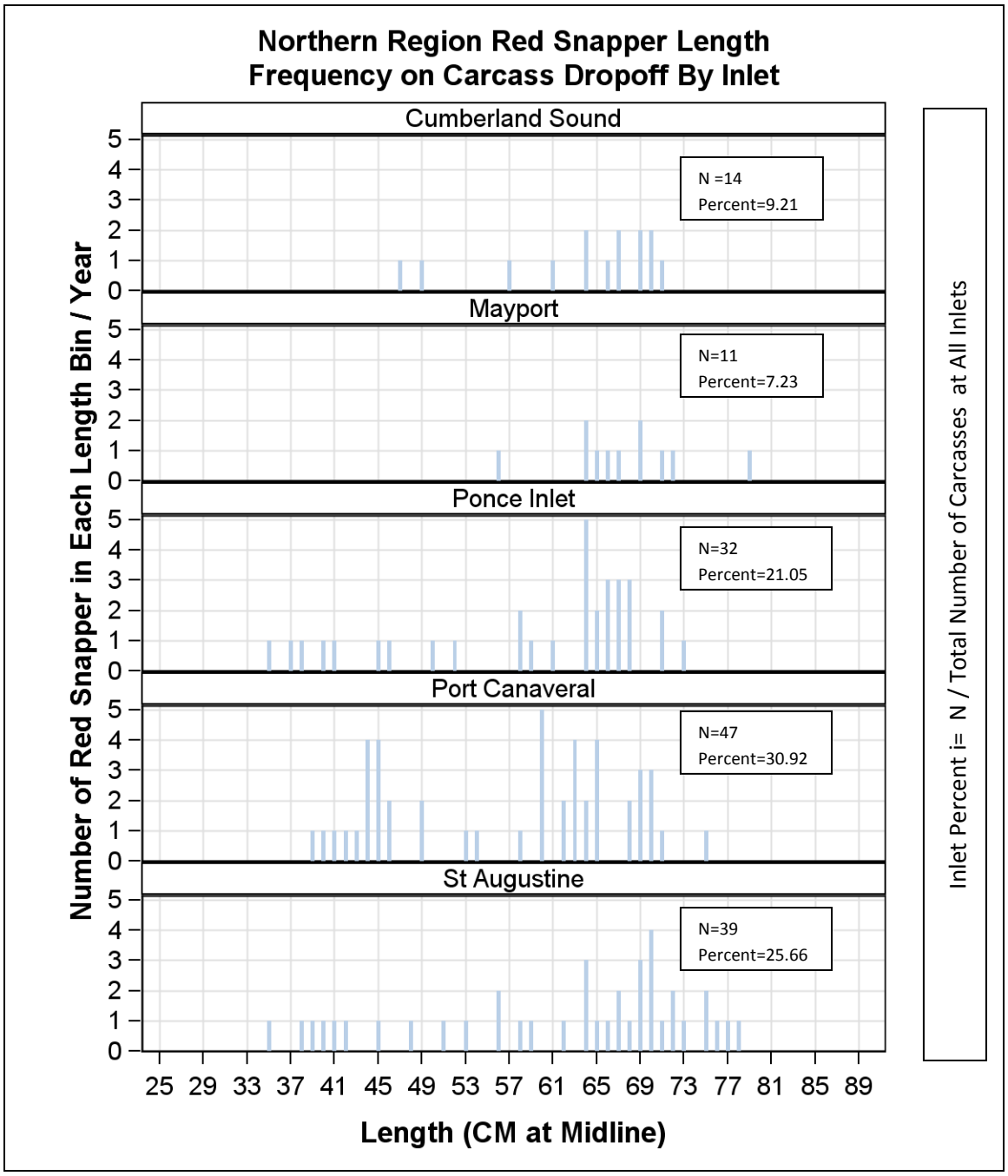


Figure 21. Length frequencies of red snapper collected through carcass drop off by inlet for the Northern Region. N = Number of observations, Percent = Number expressed as a percentage of overall totals for all inlets in the region.

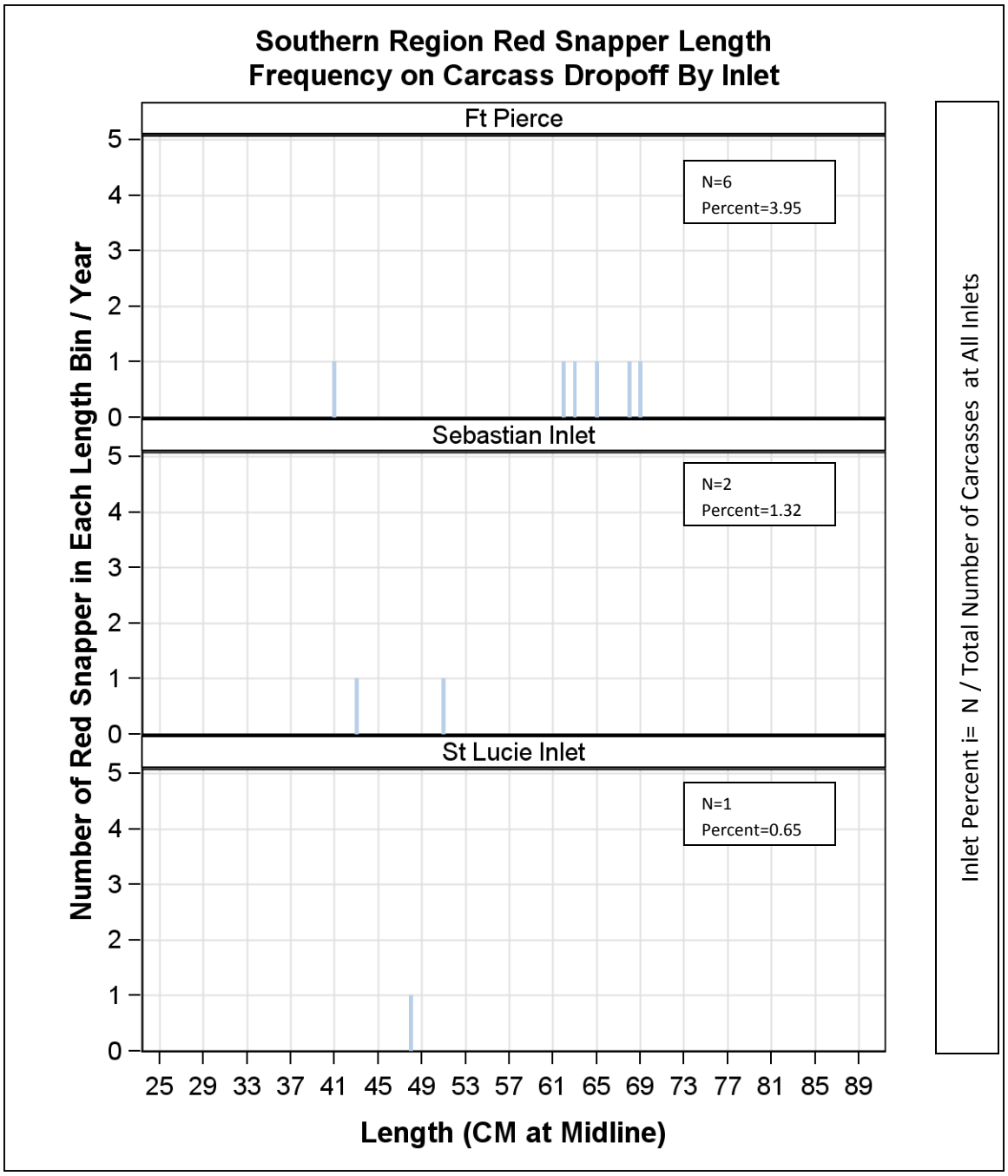


Figure 22. Length frequencies of red snapper collected through carcass drop off by inlet for the Southern Region. N = Number of observations, Percent = Number expressed as a percentage of overall totals for all inlets in the region.

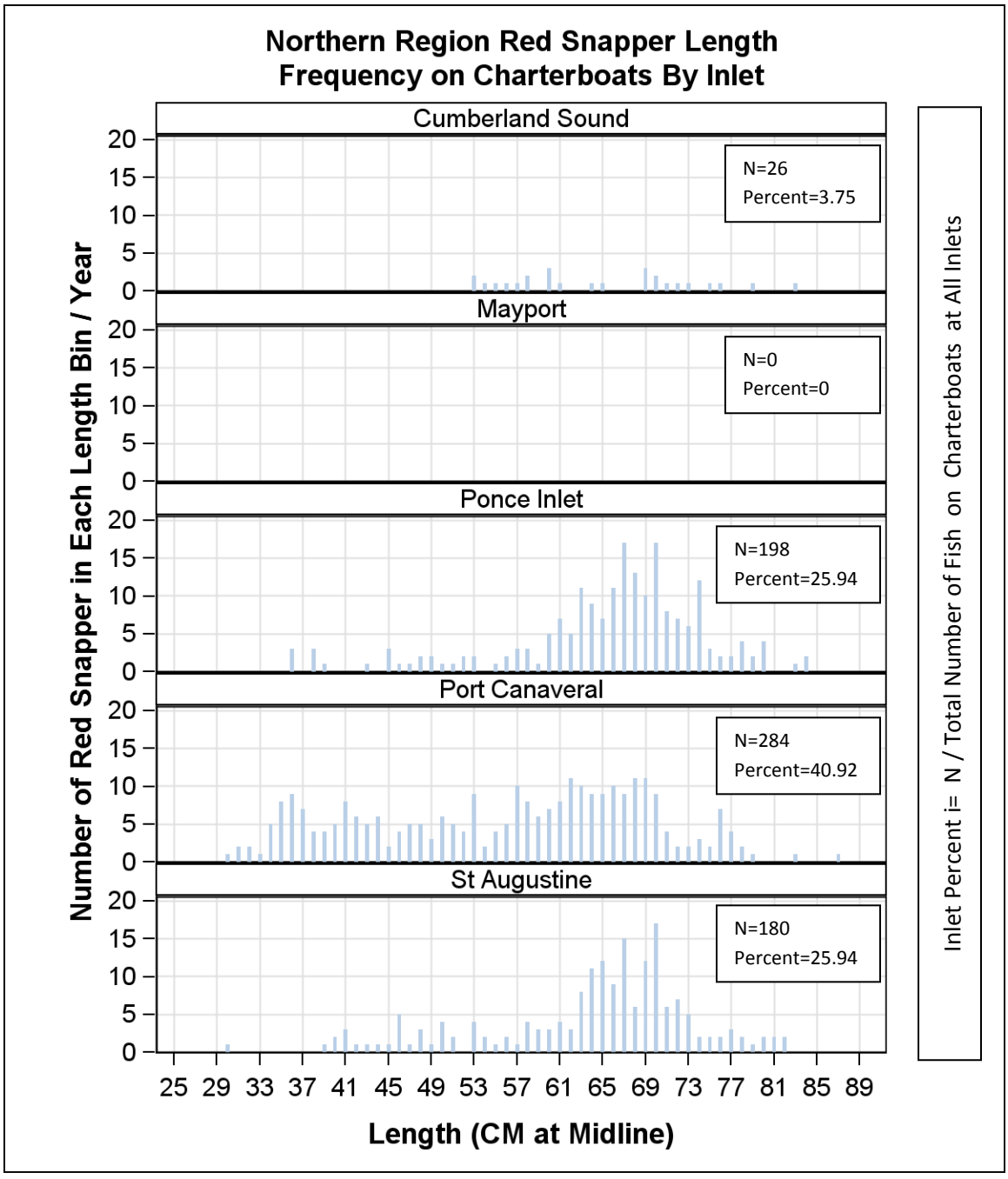


Figure 23. Length frequencies of red snapper form for-hire or charter mode by inlet for the Northern region. N = Number of observations, Percent = Number expressed as a percentage of overall totals for all inlets in the region.

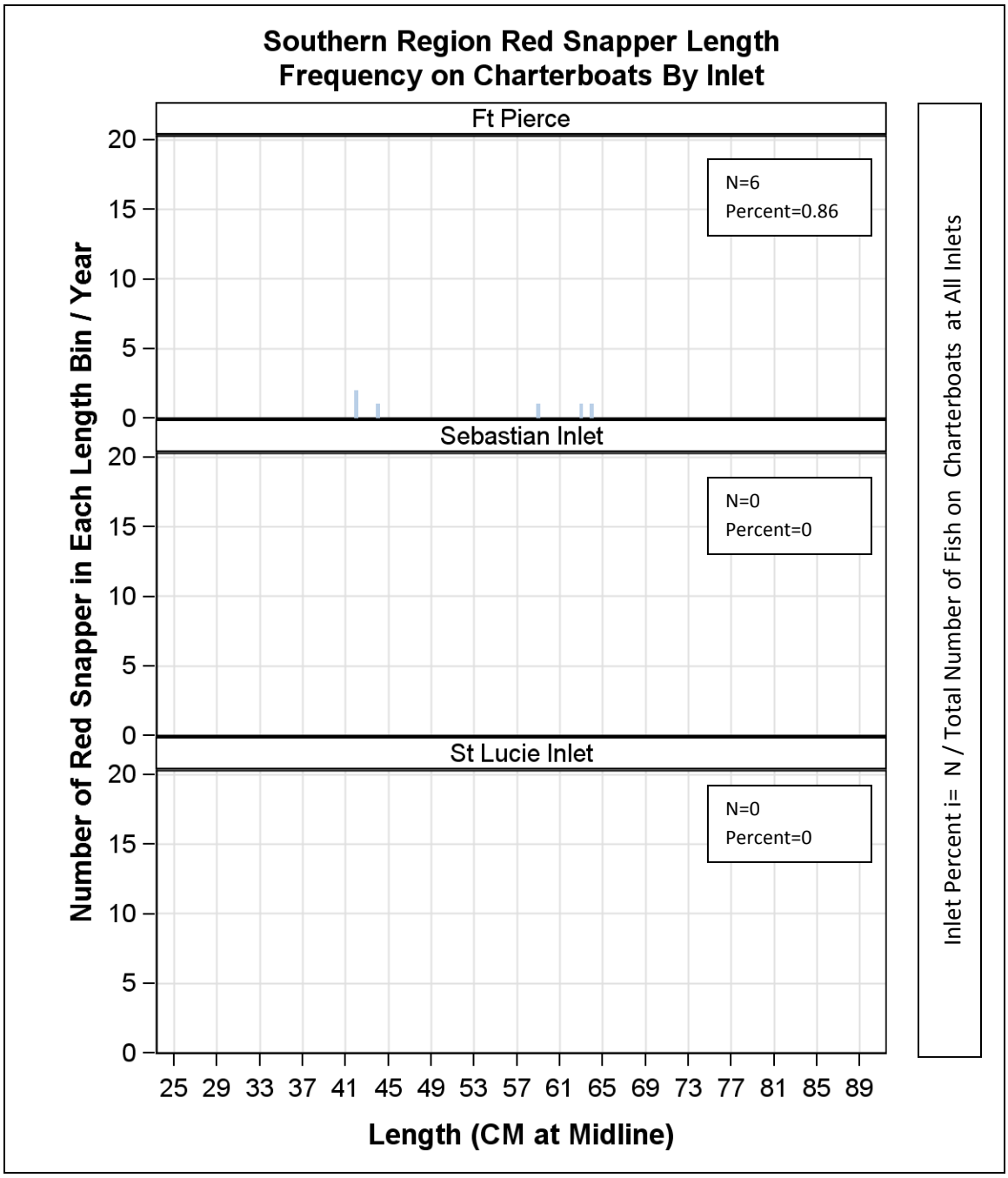


Figure 24. Length frequencies of red snapper form for-hire or charter mode by inlet for the Southern Region. N = Number of observations, Percent = Number expressed as a percentage of overall totals for all inlets in the region.

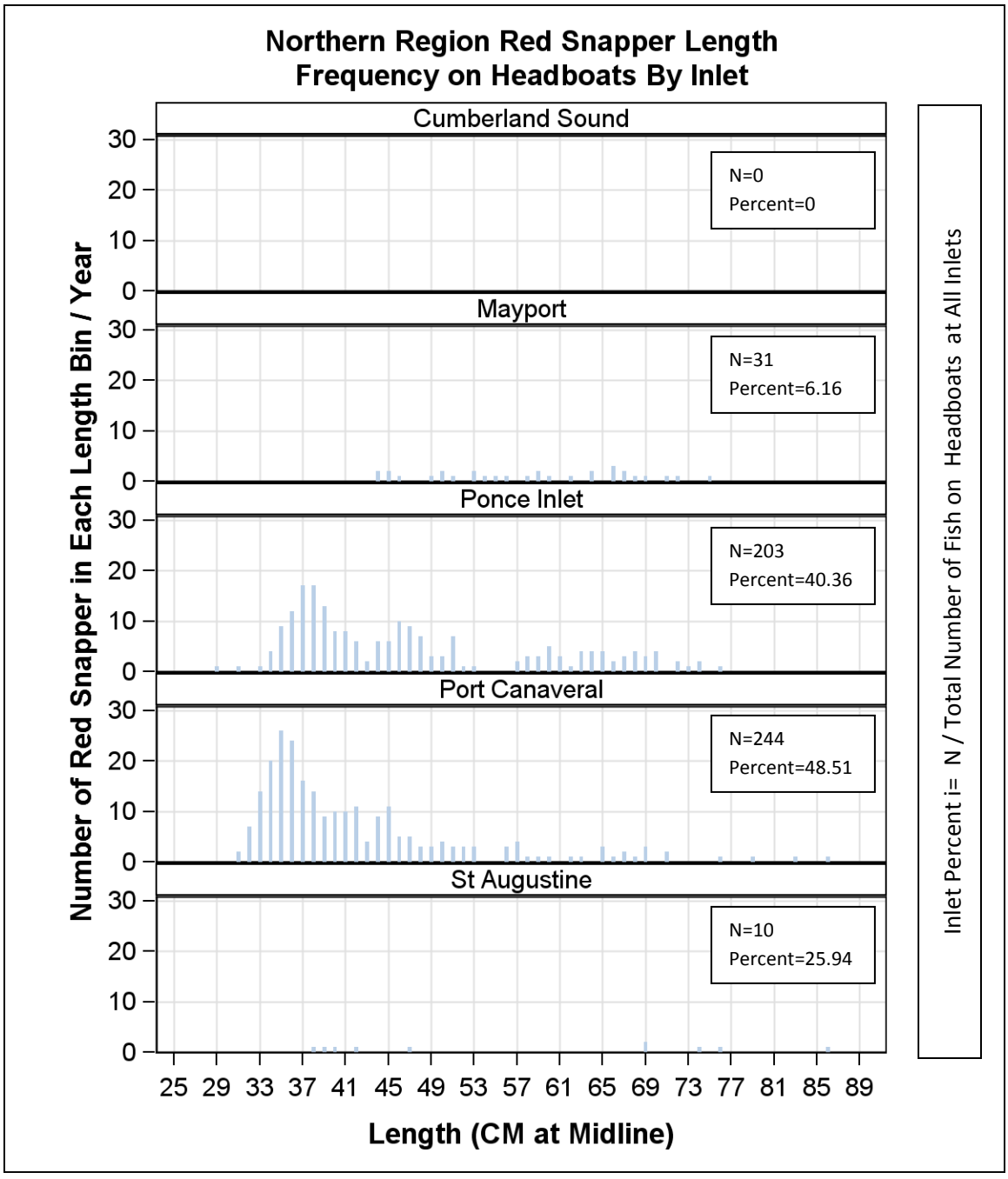


Figure 25. Length frequencies of red snapper from headboat trip by inlet for the Northern Region. N = Number of observations, Percent = Number expressed as a percentage of overall totals for all inlets in the region.

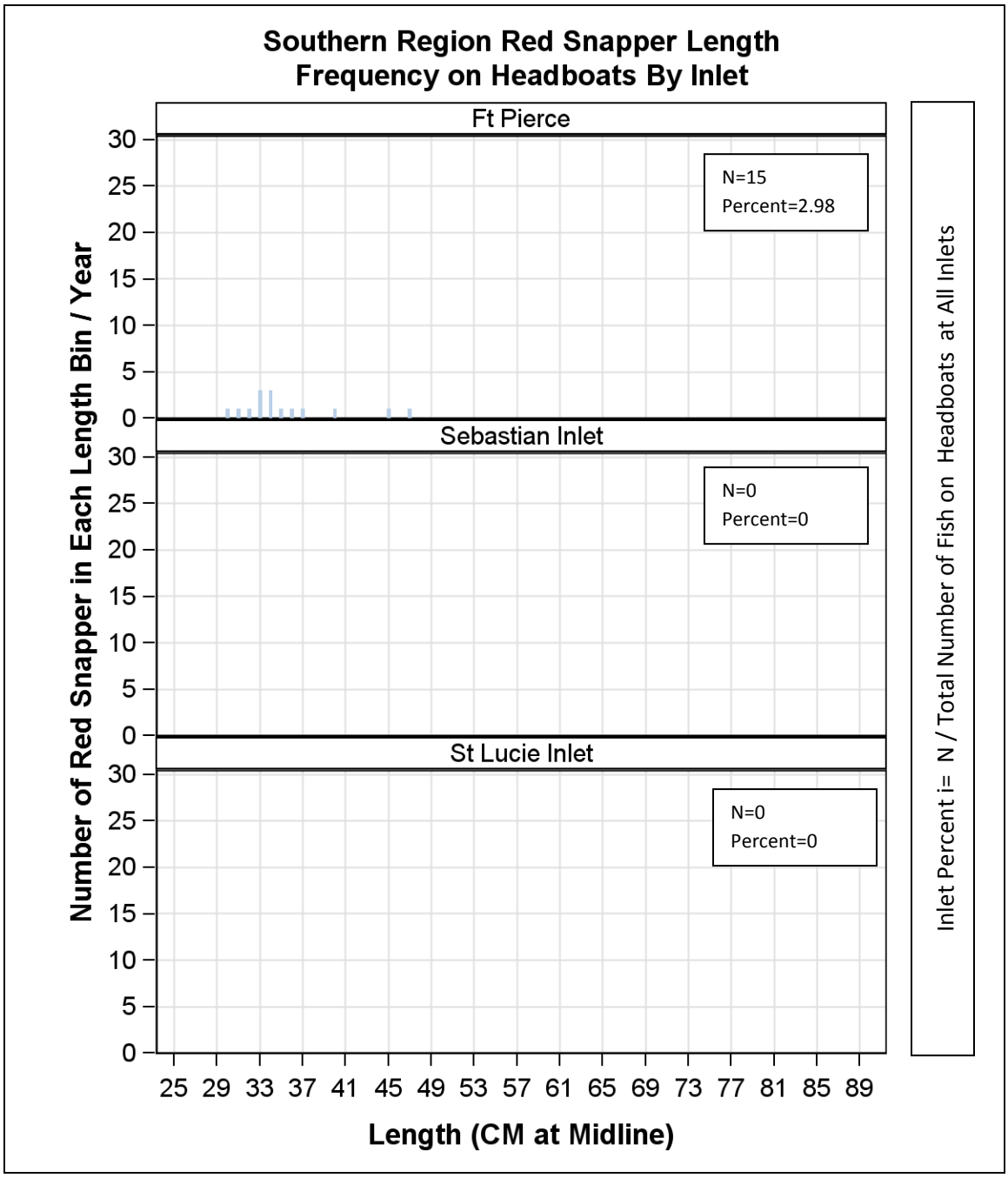


Figure 26. Length frequencies of red snapper from headboat trip by inlet for the Southern Region. N = Number of observations, Percent = Number expressed as a percentage of overall totals for all inlets in the region.

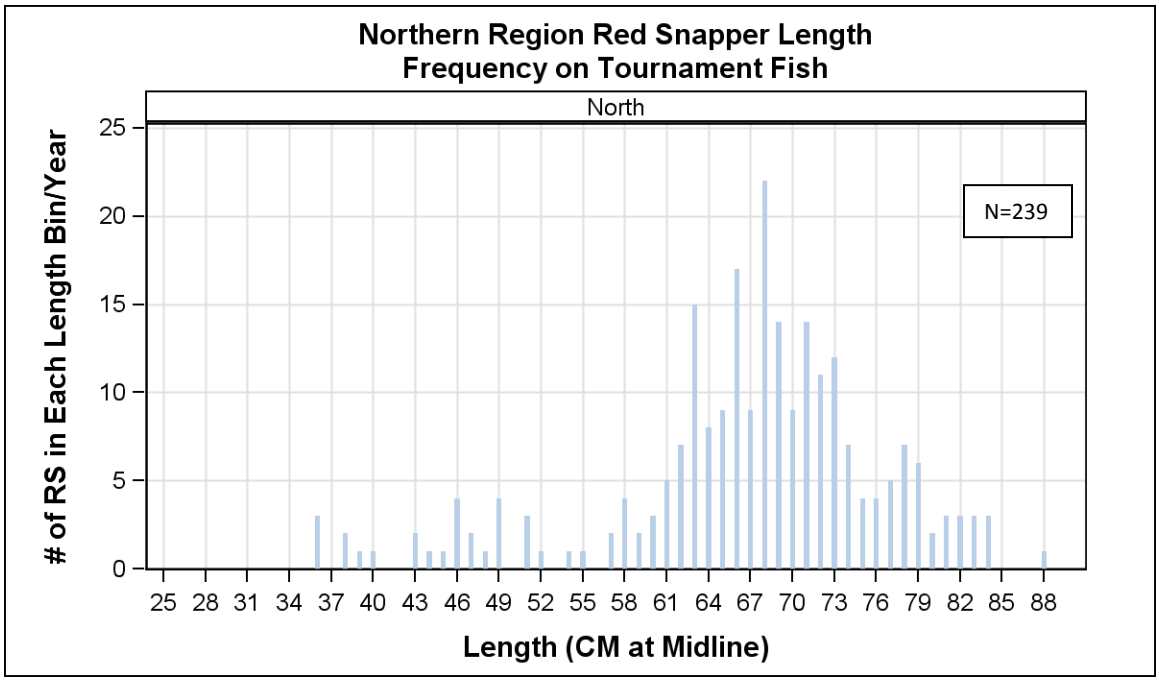


Figure 27. Length frequencies of red snapper from tournament samples (Northern Region). N = Number of observations, Percent = Number expressed as a percentage of overall totals for all inlets in the region. No Tournaments occurred in the Southern Region. Most samples were from Ponce Inlet (236 out of 239 total).

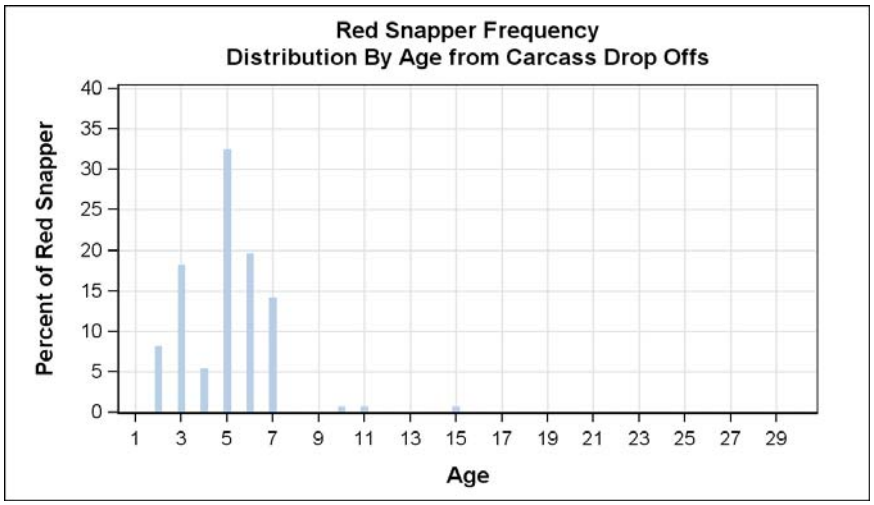
Age Analysis

Results for the age analysis represent a brief summary. Otoliths were processed at the FWC Fish and Wildlife Research Institute's (FWRI) Age and Growth Lab. The group used standard methods for determining red snapper ages that included assessment of marginal increments in addition to annuli counts. The group works closely with NOAA Beaufort and Panama City Age labs and otoliths were read using both NMFS and FIN margin codes. Data from age analysis will be made available in most requested file formats for stock assessment purposes. Multiple readers were used for 12% of the samples. A total of 2,465 otoliths were read, of which only one (a commercial sample) was collected outside of the initial commercial and recreational opening in September. Lengths for commercial samples are reported in the NMFS Trip Interview Program. Age distribution data are summarized in terms of size distribution in table 14. The overall mean age for red snapper samples was 4.78 years with a range of 27 years (2-29) but with most fish less than eight years old. However, tournament and commercial samples had higher means than charter, private angler samples and those classified as unknown. The oldest fish was determined to be 29 years. State samplers assist with collection of commercial age samples but normally NMFS port samplers obtain ototliths for age analysis. Those samples are not included with FWC samples reported herein. Fish caught from headboats tended to be younger than those caught in other modes. " Unknown" samples have incomplete information on mode fished but have been assigned to the recreational sector based on date. Samples categorized as carcass were also assigned to the recreational sector based on date received. Although data cards were provided at carcass drop off locations for anglers to record mode fished, most carcasses were unlabeled. Histograms for mode-specific age distributions are shown in figure 28 A-G. More detailed information on size at age is shown in Appendix D.

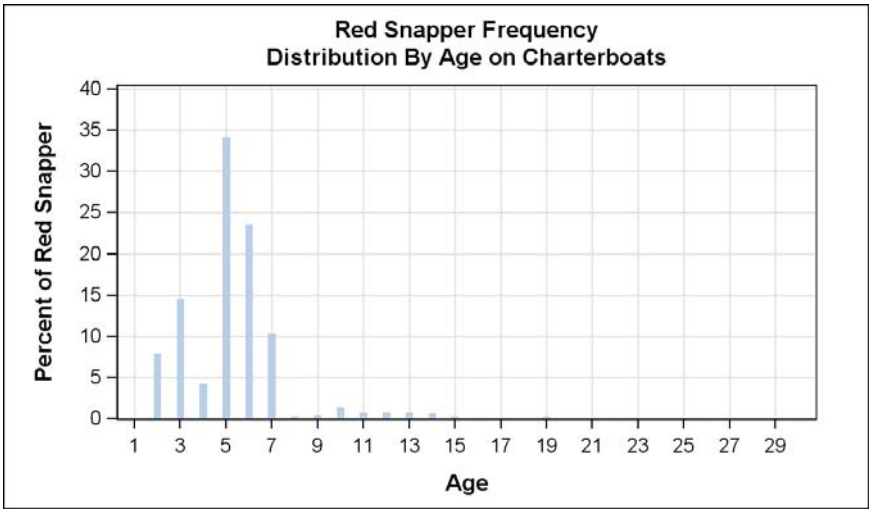
Table 14. Summary of South Atlantic red snapper age information by mode fished. *Only a low number of commercial samples are represented. Additional ages will be available from NMFS. ** Samples categorized as "Unknown" are hook and line recreational samples not assigned to a mode because of incomplete information.

Sample Type	N Obs	Label	Mean	Maximum	Minimum
Carcass	**148**	**FL**	599.97	789	349.0
		Age	4.96	15	2.00
Charter	**683**	**FL**	609.85	870	300.00
		Age	5.24	19	2.00
Commercial	**22**	**FL**	627	828	450.00
		Age	5.91	21	2.00
Headboat	**496**	**FL**	452.87	863	291.00
		Age	3.17	20	2.00
Private	**648**	**FL**	589.42	866	255.00
		Age	4.94	20	0.00
Tournament	**234**	**FL**	664.69	875	358.00
		Age	6.03	29	2.00
Unknown	**232**	**FL**	583.78	890	265.00
		Age	4.97	23	2.00

A



B



C

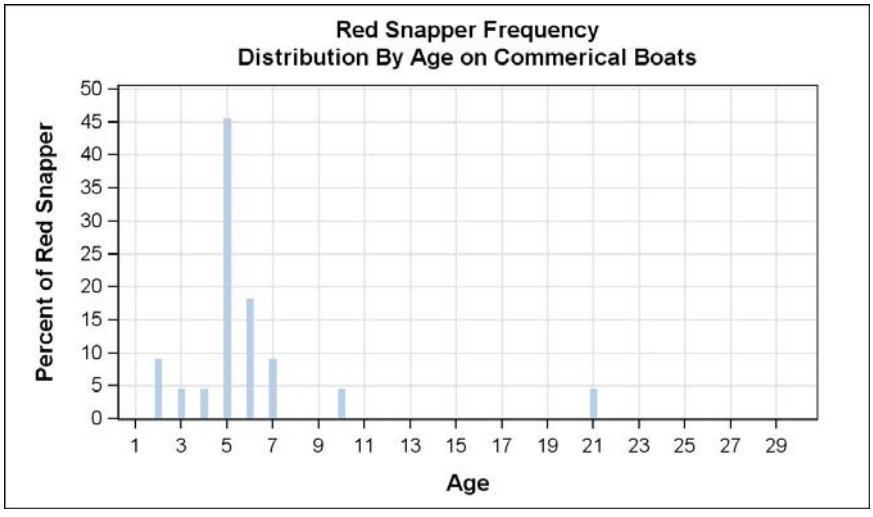
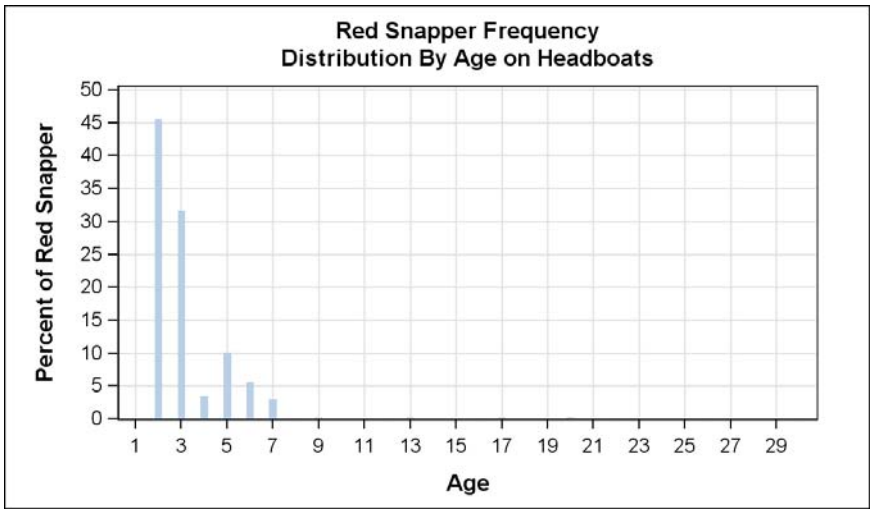
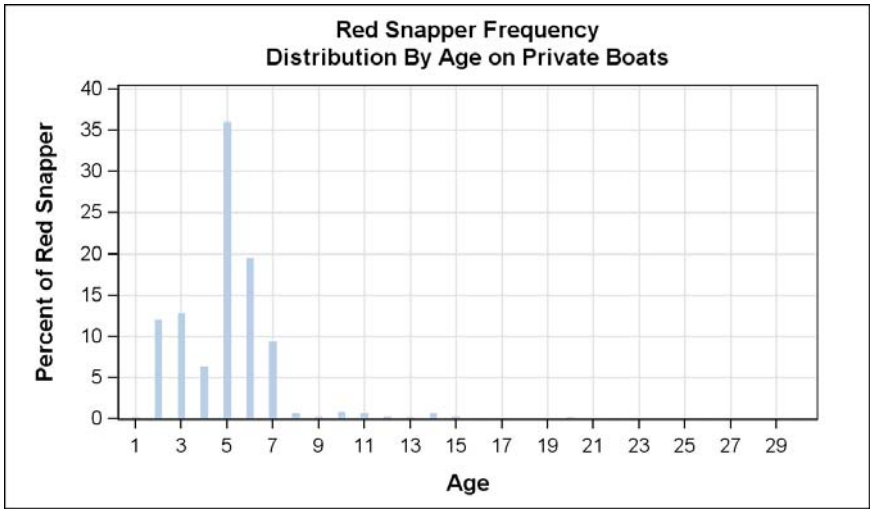


Figure 28 A-C. Age distributions of ages by sample type categories. Samples categorized as "Unidentified" and "Carcass" are recreationally caught samples but have not been assigned to a fishing mode.

D



E



F

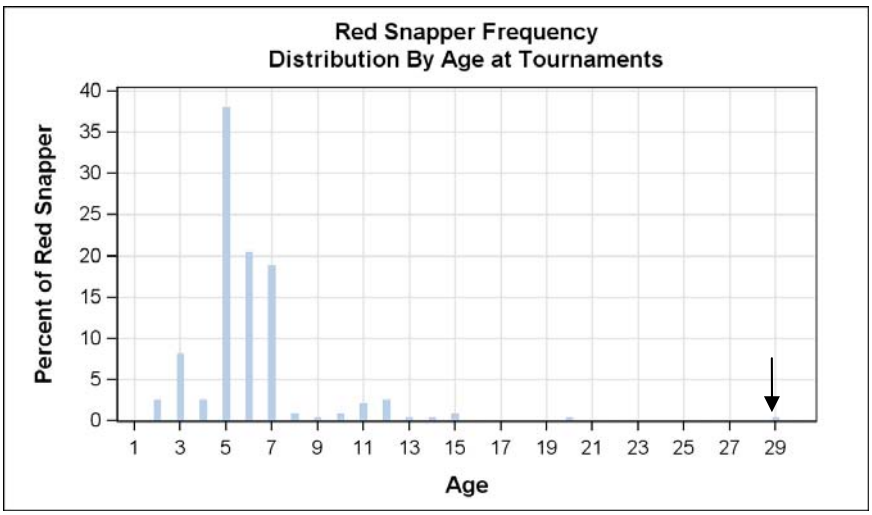


Figure 28 D-F. Age distributions of ages by sample type categories. Samples categorized as "Unidentified" and "Carcass" are recreationally caught samples but have not been assigned to a fishing mode. Arrow shows single 29 year old fish.

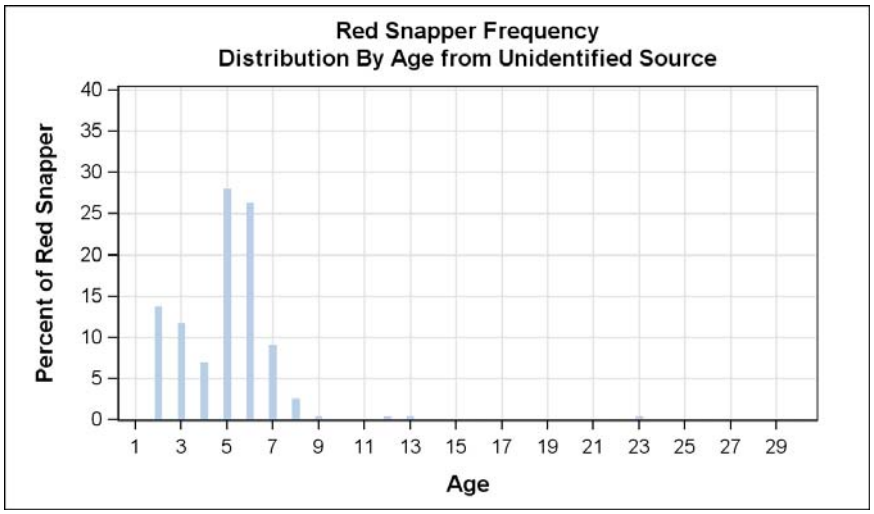
G 

Figure 28 G. Age distributions of ages by sample type categories. Samples categorized as "Unidentified" and "Carcass" are recreationally caught samples but have not been assigned to a fishing mode.

Discussion

Considering the short duration of the season, samplers were able to collect a large number of specimens from broad size distribution. The carcass drop off program was probably the least effective in terms of numbers of samples and manpower needed to collect and process those specimens. This type of program requires time to build and would probably function best for inshore species for which there is more directed effort and less of a burden on the angler to leave carcasses. However, time available to advertise locations, was limited and drop off locations were often manned by samplers which negated the need for anglers to drop off carcasses into freezers and coolers. Tournament sampling was highly effective in terms of samples per unit effort. Biological data for a large number of fish were accessed in a relatively short period. However, some questions remain on how these data can be handled in a stock assessment. For future sampling efforts, information that will help characterize angler involvement in the tournament in terms of motivation and expertise would be helpful and may provide some guidance on how these age samples should be appropriated.

The absence of a size limit resulted in a large number of smaller fish (mostly from headboats) that would not have been accessible under the previous size restrictions for South Atlantic red snapper.

APPENDICES

Appendix A. Front and back of survey form used to collect catch and effort information on red snapper directed trips. The form is adapted from the NOAA Fisheries MRIP For Hire Telephone Survey (FHTS) form to allow screening for vessels that target and/or catch red snapper and also for incorporation of directed catch information such as number of fish harvested and released per vessel trip reported. Only days for which red snapper were accessible to harvest are included in the report. FHTS selected vessels would be asked to complete the normal FHTS survey and then to provided additional information for those days in the call week for which red snapper harvest was allowed.

Florida – SA Red snapper Survey NEFL

***Screener**: Do you take customers into the Atlantic Ocean for recreational fishing trips? Yes No*

Sample week: 37 **Sampler Name:** _____ **Eligibility:** A, Y
(A=Active, N=Noncooperative/Y=Cooperative)

Number of Representatives Contacted for SUNDAY____ SEL FHTS: **Boat Type:**C

***Total Recreational Saltwater Finfishing Trips with Paying Passengers** _____ (C=Charter, H=Head)

***Total Vessel Trips (trips with paying passengers + other dock-to-dock trips for Week of** 9/10/2012_____

Date	Day of Week	* Trip No.	*Trip Type (Charter, Head, or Other)	* # of anglers	Origin of Trip		Access Site (see codes)	Target Species (see ITIS codes)	HMS Trip (Y or N)	*Fish Area (see codes)	*Distance from shore	Time Trip Started (24hr)	Time Trip Ended (24hr)	Time Spent Fishing (nearest half-hr)	Multi-day Trip?
					*State	Cnty									
9/14/2012	FRI	1													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/14/2012	FRI	2													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/14/2012	FRI	3													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/15/2012	SAT	1													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/15/2012	SAT	2													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/15/2012	SAT	3													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/16/2012	SUN	1													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/16/2012	SUN	2													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			
9/16/2012	SUN	3													
			Number harvested:			Number released:			Distance from shore:			Depth fished:			

Representative : HENRY K. OTTO, JR.
Vessel Registration: 953324
Vessel Name: SUNDAY
Vessel ID: 1201009
Notification Received _____
Form Used _____
Verified___ Errors Found (Y or N)___
Initials___Date_____

*KEY QUESTIONS

Fishing Areas
1=Gulf, Ocean, or Open Bay
2=Sound
3=River
4=Enclosed Bay
5=Other

Multi-Day
1=YES
2=NO

If Gulf, Ocean or Open Bay:
1= <= 3 miles from shore
2= > 3 miles from shore
3= <=10 miles from shore
4= > 10 miles from shore
8=Not applicable

Date: Time: Phone:	Date: Time: Phone:	Date: Time: Phone:	Date: Time: Phone:	Date: Time: Phone:
Call Back	Call Back	Call Back	Call Back	Call Back
1 ☐ Line Busy	1 ☐ Line Busy	1 ☐ Line Busy	1 ☐ Line Busy	1 ☐ Line Busy
2 ☐ No Answer	2 ☐ No Answer	2 ☐ No Answer	2 ☐ No Answer	2 ☐ No Answer
3 ☐ Answering Machine/Service	3 ☐ Answering Machine/Service	3 ☐ Answering Machine/Service	3 ☐ Answering Machine/Service	3 ☐ Answering Machine/Service
4 ☐ Wrong Number - new number avail.	4 ☐ Wrong Number - new number avail.	4 ☐ Wrong Number - new number avail.	4 ☐ Wrong Number - new number avail.	4 ☐ Wrong Number - new number avail.
5 ☐ Not available	5 ☐ Not available	5 ☐ Not available	5 ☐ Not available	5 ☐ Not available
11 ☐ Fax/Computer	11 ☐ Fax/Computer	11 ☐ Fax/Computer	11 ☐ Fax/Computer	11 ☐ Fax/Computer
No Call Back	No Call Back	No Call Back	No Call Back	No Call Back
6 ☐ Not in service/ Wrong number	6 ☐ Not in service/ Wrong number	6 ☐ Not in service/ Wrong number	6 ☐ Not in service/ Wrong number	6 ☐ Not in service/ Wrong number
7 ☐ Refusal	7 ☐ Refusal	7 ☐ Refusal	7 ☐ Refusal	7 ☐ Refusal
8 ☐ Communication Problem	8 ☐ Communication problem	8 ☐ Communication problem	8 ☐ Communication problem	8 ☐ Communication problem
9 ☐ Ineligible	9 ☐ Ineligible	9 ☐ Ineligible	9 ☐ Ineligible	9 ☐ Ineligible
10 ☐ Successful Contact	10 ☐ Successful Contact	10 ☐ Successful Contact	10 ☐ Successful Contact	10 ☐ Successful Contact

Week No: begin 9/10/2012
Vessel ID: 1201009
Vessel Reg.: 953324
Vessel name: SUNDAY
Vessel length: 44
Year Vessel Built: 1989
Vessel Capacity: 8
Vessel loc: PIRATE'S COVE MARINA
Loc. Site Code: 0294
County: 12085

Representative (REP_ID=1):
HENRY K. OTTO, JR.
3740 OCEAN BEACH BLVD, #407
COCOA BCH, FL
32931

Best time to call:
Region: NEFL

Other Contact
Capt1 (Rep_id=2):
Capt2 (Rep_id=3):
Capt3 (Rep_id=4):
Ownr (Rep_id=5):
Other (Rep_id=6):

	Representative	Captain 1	Captain 2	Captain 3
Phone #1:	321-720-9266 C			
Phone #2:				
Phone #3:				

Comments: NEED GOOD ADDRESS; MAIL RETURNED

Interview Status (to be completed when telephone contact made):
1 ☐ Complete Interview (**Result=10**)

2 ☐ Incomplete, but all key (*) questions answered

3 ☐ Refusal (**Result=07**)

4 ☐ Language Barrier

5 ☐ Mid-interview Refusal

6 ☐ Ineligible (**Result=09**)

7 ☐ Unable to Contact

8 ☐ Inactive (**Result=10**)

Appendix B. Summary of call results by call attempt for FHTS regions 4 (SEFL) and 5 (NEFL), in weeks 1 and 2, respectively. Up to five calls per vessel were made for a given week. Some vessels provided trip information once for both weeks, hence the lower number of calls for week 1.

Week 1 NEFL

Result	Result	1		2		3		4		5		Total	
		N	%	N	%	N	%	N	%	N	%	N	%
Line Busy	**1**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
No Answer	**2**	0	0.00	0	0.00	0	0.00	0	0.00	2	8.70	2	1.94
Voicemail	**3**	6	12.00	5	33.33	3	30.00	3	60.00	17	73.91	34	33.01
Wrong Number/New available	**4**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Unavailable	**5**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
NIS/Wrong Number	**6**	1	2.00	0	0.00	1	10.00	0	0.00	0	0.00	2	1.94
Refusal	**7**	17	34.00	0	0.00	0	0.00	0	0.00	0	0.00	17	16.50
Communication Problem	**8**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Ineligible	**9**	1	2.00	0	0.00	0	0.00	0	0.00	1	4.35	2	1.94
Successful Contact	**10**	24	48.00	10	66.67	6	60.00	2	40.00	3	13.04	45	43.69
Fax/Computer	**11**	1	2.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.97
		50	100.00	15	100.00	10	100.00	5	100.00	23	100.00	103	100.00

Week 1 SEFL

Result	Result	1		2		3		4		5		Total	
		N	%	N	%	N	%	N	%	N	%	N	%
Line Busy	**1**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
No Answer	**2**	3	3.03	2	4.26	1	2.94	1	3.57	2	9.52	9	3.83
Voicemail	**3**	32	32.32	29	61.70	19	55.88	16	57.14	9	42.86	105	44.68
Wrong Number/New available	**4**	1	1.01	0	0.00	0	0.00	0	0.00	0	0.00	1	0.43
Unavailable	**5**	6	6.06	1	2.13	2	5.88	2	7.14	0	0.00	11	4.68
NIS/Wrong Number	**6**	5	5.05	4	8.51	3	8.82	0	0.00	0	0.00	12	5.11
Refusal	**7**	28	28.28	0	0.00	0	0.00	0	0.00	0	0.00	28	11.91
Communication Problem	**8**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Ineligible	**9**	0	0.00	0	0.00	0	0.00	0	0.00	1	4.76	1	0.43
Successful Contact	**10**	27	27.27	13	27.66	10	29.41	9	32.14	9	42.86	68	28.94
Fax/Computer	**11**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
		99	100.00	47	100.00	34	100.00	28	100.00	21	100.00	235	100.00

Week 2 NEFL

Result	Code	1 N	1 %	2 N	2 %	3 N	3 %	4 N	4 %	5 N	5 %	Total N	Total %
Line Busy	**1**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
No Answer	**2**	3	4.00	2	5.71	2	8.70	1	5.00	1	5.26	9	5.08
Voicemail	**3**	28	37.33	21	60.00	17	73.91	16	80.00	13	68.42	95	53.67
Wrong Number/New available	**4**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Unavailable	**5**	1	1.33	2	5.71	0	0.00	1	5.00	1	5.26	5	2.82
NIS/Wrong Number	**6**	2	2.67	0	0.00	1	4.35	0	0.00	0	0.00	3	1.69
Refusal	**7**	16	21.33	0	0.00	0	0.00	0	0.00	0	0.00	16	9.04
Communication Problem	**8**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Ineligible	**9**	0	0.00	0	0.00	0	0.00	0	0.00	1	5.26	1	0.56
Successful Contact	**10**	28	37.33	9	25.71	5	21.74	2	10.00	3	15.79	47	26.55
Fax/Computer	**11**	0	0.00	1	2.86	0	0.00	0	0.00	0	0.00	1	0.56
		75	100.00	35	100.00	23	100.00	20	100.00	19	100.00	177	100.00

Week 2 SEFL

Result	Result	1 N	1 %	2 N	2 %	3 N	3 %	4 N	4 %	5 N	5 %	Total N	Total %
Line Busy	**1**	1	0.70	0	0.00	0	0.00	0	0.00	0	0.00	1	0.36
No Answer	**2**	2	1.41	1	1.89	2	6.90	2	8.00	1	4.35	8	2.91
Voicemail	**3**	39	27.46	27	50.94	20	68.97	21	84.00	18	78.26	125	45.45
Wrong Number/New available	**4**	2	1.41	1	1.89	1	3.45	0	0.00	0	0.00	4	1.45
Unavailable	**5**	5	3.52	1	1.89	1	3.45	0	0.00	0	0.00	7	2.55
NIS/Wrong Number	**6**	8	5.63	3	5.66	0	0.00	0	0.00	0	0.00	11	4.00
Refusal	**7**	36	25.35	0	0.00	0	0.00	0	0.00	0	0.00	36	13.09
Communication Problem	**8**	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Ineligible	**9**	2	1.41	1	1.89	1	3.45	0	0.00	2	8.70	6	2.18
Successful Contact	**10**	46	32.39	20	37.74	6	20.69	2	8.00	2	8.70	76	27.64
Fax/Computer	**11**	1	0.70	0	0.00	0	0.00	0	0.00	0	0.00	1	0.36
		142	100.00	53	100.00	29	100.00	25	100.00	23	100.00	275	100.00

Appendix C. Summary of trip information from for hire directed survey telephone calls. SD = standard deviation, N Obs. = total number of observations (including zero trip reports). N = number of trip reports with information on variables reported.

Week 1

REGION	N Obs	Variable	Mean	SD	Min.	Max.	N
NEFL	108	Total Trips	0.410	0.864	0	3	61
		For-hire Trips	0.377	0.799	0	3	61
		Depth fished (ft)	111.176	42.224	65	205	17
		Passengers	6.000	2.669	3	13	17
		Number harvested	5.706	3.442	0	13	17
		Number released	8.294	9.225	0	25	17
SEFL	138	Total Trips	0.563	1.052	0	5	71
		For-hire Trips	0.549	1.039	0	5	71
		Depth fished (ft)	87.500	14.434	75	100	4
		Passengers	4.286	1.604	2	6	7
		Number harvested	5.167	1.169	3	6	6
		Number released	10.167	12.497	0	26	6

Week 2

REGION	N Obs	Variable	Mean	SD	Min.	Max.	N
NEFL	116	Total Trips	0.419	0.932	0	4	43
		For-hire Trips	0.419	0.932	0	4	43
		Depth fished (ft)	115.925	43.666	47	180	40
		Passengers	5.682	1.253	3	10	44
		Number harvested	6.605	1.866	0	9	43
		Number released	13.263	11.294	0	50	38
SEFL	178	Total Trips	0.317	0.804	0	3	104
		For-hire Trips	0.314	0.776	0	3	104
		Depth fished (ft)	98.000	25.642	75	140	5
		Passengers	4.375	1.847	2	6	8
		Number harvested	4.000	2.582	0	6	7
		Number released	3.000	4.123	0	10	7

Appendix D. Biological sampling: Distribution of size at age for sample types. FL = Fork Length or midline length (MRIP). Size is shown in mm.

Sample Type	Age	N Obs	Label	Minimum	Maximum	Mean
Carcass	**2**	**12**	**FL**	349	448	393.33
	3	**27**	**FL**	350	534	456.7
	4	**8**	**FL**	458	625	564.13
	5	**48**	**FL**	497	726	635.06
	6	**29**	**FL**	610	745	680.52
	7	**21**	**FL**	636	772	699.81
	10	**1**	**FL**	750	750	750
	11	**1**	**FL**	778	778	778
	15	**1**	**FL**	789	789	789
Charter	**2**	**54**	**FL**	300	463	367.96
	3	**99**	**FL**	342	656	461.24
	4	**29**	**FL**	475	676	543.97
	5	**233**	**FL**	456	776	627.99
	6	**161**	**FL**	566	790	687.08
	7	**70**	**FL**	604	796	703.29
	8	**2**	**FL**	715	794	754.5
	9	**3**	**FL**	767	795	780.67
	10	**9**	**FL**	747	820	775.33
	11	**5**	**FL**	686	832	781
	12	**5**	**FL**	750	843	782.8
	13	**5**	**FL**	763	808	793.4
	14	**4**	**FL**	772	842	803
	15	**2**	**FL**	758	770	764
	19	**2**	**FL**	820	870	845
Commercial	**2**	**2**	**FL**	450	530	490
	3	**1**	**FL**	610	610	610
	4	**1**	**FL**	500	500	500
	5	**10**	**FL**	534	696	596.4
	6	**4**	**FL**	616	740	672
	7	**2**	**FL**	690	722	706
	10	**1**	**FL**	812	812	812
	21	**1**	**FL**	828	828	828

Headboat	**2**	**226**	**FL**	291	517	365.38
	3	**156**	**FL**	310	687	445.82
	4	**17**	**FL**	441	736	548.76
	5	**50**	**FL**	504	708	620.42
	6	**28**	**FL**	527	762	676.36
	7	**15**	**FL**	390	791	660.2
	9	**1**	**FL**	755	755	755
	13	**1**	**FL**	863	863	863
	17	**1**	**FL**	831	831	831
	20	**1**	**FL**	858	858	858
Private	**0**	**1**	**FL**	255	255	255
	1	**1**	**FL**	288	288	288
	2	**77**	**FL**	273	565	371.94
	3	**83**	**FL**	369	625	453.89
	4	**41**	**FL**	348	655	563.46
	5	**233**	**FL**	479	735	623.08
	6	**126**	**FL**	360	866	667.71
	7	**61**	**FL**	383	802	706.25
	8	**4**	**FL**	692	800	738.5
	9	**2**	**FL**	770	779	774.5
	10	**5**	**FL**	737	787	770.8
	11	**4**	**FL**	740	800	774.75
	12	**2**	**FL**	732	830	781
	13	**1**	**FL**	803	803	803
	14	**4**	**FL**	782	830	808.25
	15	**2**	**FL**	842	846	844
	20	**1**	**FL**	852	852	852
Tournament	**2**	**6**	**FL**	358	396	375
	3	**19**	**FL**	375	537	467.84
	4	**6**	**FL**	511	608	561.17
	5	**89**	**FL**	575	738	651.74
	6	**48**	**FL**	567	798	700.54
	7	**44**	**FL**	623	787	722.25
	8	**2**	**FL**	721	780	750.5
	9	**1**	**FL**	774	774	774
	10	**2**	**FL**	790	830	810
	11	**5**	**FL**	767	820	797.4
	12	**6**	**FL**	725	875	810
	13	**1**	**FL**	805	805	805
	14	**1**	**FL**	842	842	842
	15	**2**	**FL**	769	798	783.5
	20	**1**	**FL**	828	828	828
	29	**1**	**FL**	837	837	837

Unknown	**2**	**32**	**FL**	265	460	356.34
	3	**27**	**FL**	365	534	436.44
	4	**16**	**FL**	506	610	551.31
	5	**65**	**FL**	457	745	611.74
	6	**61**	**FL**	552	785	674.2
	7	**21**	**FL**	589	805	716.9
	8	**6**	**FL**	530	805	698.33
	9	**1**	**FL**	770	770	770
	12	**1**	**FL**	820	820	820
	13	**1**	**FL**	815	815	815
	23	**1**	**FL**	890	890	890