Florida East Coast Red Snapper (ECRS) Mini-Season Sampling

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SEDAR90-DW-18

April 2025

Please cite this document as:

Ramsay, Chloe and Ellie Corbett. 2025. Florida East Coast Red Snapper (ECRS) Mini-Season Sampling. SEDAR90-DW-18. SEDAR, North Charleston, SC. 18 pp.

Florida East Coast Red Snapper (ECRS) Mini-Season Sampling

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In preparation for

SEDAR 90 South Atlantic Red Snapper

11 April 2025

Background

Since 2012, the state of Florida has conducted a specialized East Coast Red Snapper (ECRS) survey to provide more precise and timely estimates of Red Snapper effort and catch during the recreational mini-seasons in the South Atlantic. The South Atlantic Red Snapper season has ranged between zero and nine days since 2012. Surveys used for longer seasons, such as Florida's State Reef Fish Survey, generate estimates at monthly time scales and are not designed to provide accurate catch estimates when the season is shorter than a month. This specialized ECRS survey is used to estimate landings and releases for the private recreational and charter fleets during the South Atlantic Red Snapper mini-seasons. Estimates from this mini-season sampling were used as estimated landings for the wave when this fishery was open in the previous red snapper stock assessment (SEDAR 73; SEDAR73-WP10).

To access Atlantic federal waters and harvest red snapper from Florida during the mini season, recreational boaters must pass through one of nine distinct inlets (Fig. 1). These inlets provide a unique opportunity for a limited number of samplers to accurately assess total boat traffic from Florida into the Atlantic Ocean. Following Hurricanes Matthew in 2016 and Irma in 2017, Matanzas Inlet became increasingly difficult to navigate, particularly during low tide. As a result, sampling at Matanzas was stopped in 2020 and proportional effort collected in previous years between this inlet and the nearby St. Augustine inlet have since been used to estimate effort at Matanzas Inlet.

In 2017, the dual mail / phone survey was implemented to generate charter fleet catch estimates. In 2018, the monitoring protocol was modified to identify charter vessels in both inlet monitoring and dockside surveys, ensuring the accurate representation of charter fishing activity. Prior to 2018, charter vessels were not specifically distinguished during these monitoring efforts. The reported data from the charter fleet in 2017 was the result of enhanced sampling under a MARFIN award (NA16NMF4330163), which aimed to test methods for collecting biological data that accurately represent the recreational fishery along Florida's East Coast. Since 2018, charter fleet data from the recreational mini-season have been independently collected and estimated.

In 2020, due to the COVID-19 pandemic, private dockside sampling occurred but was severely truncated to ensure the safety of our staff and fishermen. High pressure sites in the draw were dropped to reduce public interaction and biological sampling was de-emphasized as part of sampling protocol. The dockside survey questionnaire was shortened, dropping questions about hours fished, number of Red Snapper discarded, and methods used to release Red Snapper (surface, venting, descended).

Objectives

Landing and releases estimates from the private recreational fleet from this targeted mini-season sampling effort are provided for all seasons from 2012-2024 when a recreational fishing season occurred in the South Atlantic (i.e., 2012-2014, & 2017-2024). Charter fleet landings, releases, and effort estimates are provided for all seasons from 2017-2024.

Methods

To generate estimates for the private recreational fleet, this survey consists of two portions. Data from samplers stationed at inlets count private recreational boats entering and exiting inlets is used to assess effort. Data from samplers interviewing anglers at dockside boat ramps is used to calculate catch-per-unit-effort (CPUE). The CPUE and effort estimates are combined to estimate landings and releases. All ECRS surveys are voluntary. Sampling occurred from 2012-2024 except in 2015 and 2016, as the recreational fishery was entirely closed for those two years.

For the inlet effort sampling of the private recreational fleet, all inlets from Cumberland Sound (FL/GA border) to Saint Lucie Inlet are monitored (Fig. 1). In 2012, the private recreational estimates were generated by sampling Saint Augustine Inlet continuously in daylight hours as a reference inlet. In the remaining inlets, boat traffic was monitored on randomly selected days and shift times (0700-1359h or 1400-1900h). A ratio method was used to expand the estimated landings, releases, and effort from the reference inlet to encompass the whole sampling range (Sauls et al. 2017). This was done by calculating a ratio estimator ($\hat{R}$) to apply to the number of boats observed entering the Atlantic Ocean; where h is the inlet, i is the sampling period, y is the number of boats observed at non-reference inlets, and x is the number of boats observed in the reference inlet during the non-reference inlet sampling time [1].

$$\hat{R}_h = \sum_{i=1}^{n} y_{h,i} \div \sum_{i=1}^{n} x_{h,i} \quad [1]$$

This was then used to calculate an estimate of the number of trips taken from each inlet ($\hat{Y}$) where X is the total number of boats observed at the reference inlet between 0700h and sunset across all days of the season [2].

$$\hat{Y}_h = \hat{R}_h X \quad [2]$$

Variance was calculated separately for each sampled inlet where N in the total number of possible sampling shifts in a season (i.e., all day/shift combinations) and n is the number of shifts [3].

$$\mathrm{var}(\hat{Y}_h) = \left[N^2 \left(1 - \frac{n_h}{N}\right) \frac{n_h}{(n_h - 1)}\right] \times \sum_{i=1}^{n} \left(y_{h,i} - R x_{h,i}\right)^2 \quad [3]$$

These trip and variance estimates across inlets were summed to estimate the total trips and associated variance for the mini-season. We assumed random error around the estimates from each inlet.

In all other sampled years, all inlet sampling shifts were selected through random sampling. In 2013 the shift times were the same as in 2012, two per day. From 2014 on there were three potential sampling shifts each day between dawn and dusk. Sample weighting techniques were used to expand the mean values (y_i) to unsampled periods (Sauls et al. 2017, 2019; Sauls and Lazarre 2018, 2019, 2021; Vecchio et al. 2021; Sauls and Corbett 2023; Corbett and Sauls 2023; Corbett 2024). The primary sampling weight (P) for each sampling shift (s) was the inverse proportion of the number of days sampled out of the entire season length. If sampling could not

be conducted for the entire sampling shift (i.e., due to lightning) then a secondary sampling weight (S), the inverse proportion of time sampled over total shift time, was applied to account of this missed sampling period. Finally, a constant of the total number of potential shift times in the season (N) was applied to the mean and variance. The mean weighted number ($\bar{y}$) of boats observed at each inlet (h) was calculated using this weighting scheme [4].

$$\bar{y}_h = \left(\frac{\sum_{s=1}^{t} \sum_{i=1}^{n} P_{h,s} S_{h,s,i} y_{h,s,i}}{\sum_{s=1}^{t} \sum_{i=1}^{n} P_{h,s} S_{h,s,i}} \right) N \text{ [4]}$$

The associated variances for the weighted number of boats observed were also calculated using this weighting scheme [5].

$$v(\bar{y}_h) = \text{ var} \left(\frac{\sum_{s=1}^{t} \sum_{i=1}^{n} P_{h,s} S_{h,s,i} (y_{h,s,i} - \bar{y}_{h,s})^2}{\sum_{s=1}^{t} \sum_{i=1}^{n} P_{h,s} S_{h,s,i}} \right) N \text{ [5]}$$

To determine what proportion of these boats that exited the inlet were targeting Red Snapper (p_h), the proportion [6] and the associated variance of intercepted private boat trips that were targeting or caught Red Snapper (t_h) out of the total intercepted private boat trips (n_h) were calculated [7].

$$p_h = \frac{t_h}{n_h} \text{ [6]}$$

$$var(p_h) = \frac{\hat{Y}_h - n_h}{(n_h - 1)\hat{Y}_h} p_h (1 - p_h) \text{ [7]}$$

This proportion was then multiplied by the total number of trips ($\hat{Y}_h$) to calculate the total number of trips targeting Red Snapper ($\hat{T}_h$). An associated error was also calculated. [8]

$$\sigma(\hat{T}_h) = \hat{T}_h \sqrt{\left[\frac{\sigma(\hat{Y}_h)}{\hat{Y}_h} \right]^2 + \left[\frac{\sigma(p_h)}{p_h} \right]^2} \text{ [8]}$$

For reference inlets in 2012, as they were sampled the entire season, the error was calculated slightly differently. [9]

$$\sigma(\hat{T}_h) = Y_h \sigma(p_h) \qquad \text{[9]}$$

Finally, to adjust the effort estimates to account for boats that left the inlet before sampling began (sunrise), the total number of intercepted trips targeting Red Snapper ($\hat{T}_h$) was divided by the proportion of intercepted trips targeting Red Snapper that were interviewed out of the total number of intercepted trips (p_h) [10].

$$\hat{T}_{h,\text{adj}} = {\hat{T}_h}/{p_h} \quad [10]$$

The error was propagated [11].

$$\sigma(\hat{T}_{h,adj}) = \hat{T}_{h,adj}\sqrt{\left[\frac{\sigma(\hat{T}_h)}{\hat{T}_h}\right]^2 + \left[\frac{\sigma(p_h)}{p_h}\right]^2} \quad [11]$$

The above steps generate an adjusted effort estimate for the Red Snapper mini-season ($\hat{T}_{h,adj}$). To generate the estimates of catch, the number of Red Snapper caught per angler ($\hat{c}_h$) from the inlet interviews were calculated, where $F_{h,i}$ is the number of Red Snapper either harvested or discarded at each inlet (h). $a_{h,i}$ is the number of anglers per boat for each interview (i) [12].

$$\hat{C}_h = \frac{\sum_{i=1}^{n} f_{h,i}}{\sum_{i=1}^{n} a_{h,i}} \quad [12]$$

The variance around the Red Snapper caught per angler was calculated slightly differently in 2012 due to the reference inlet method [13]

$$\text{var}(\hat{c}_h) = \left[\frac{1}{\sqrt{t_h a_h}}\sqrt{\frac{\sum_{i=1}^{n} f_{h,i}^2 - 2\hat{R}_h\left(\sum_{i=1}^{n} f_{h,i}a_{h,i}\right) + \hat{R}_h^2\left(\sum_{i=1}^{n} a_{h,i}^2\right)}{t_h - 1}}\right]^2 \quad [13]$$

than in all other sampled years [14]. t_h is the number of intercepted boats targeting Red Snapper.

$$\text{var}(\hat{c}_h) = \left[\frac{1}{\sqrt{t_h a_h}}\sqrt{\frac{\sum_{i=1}^{n} f_{h,i}^2 - 2\hat{c}_h\left(\sum_{i=1}^{n} f_{h,i}a_{h,i}\right) + \hat{c}_h^2\left(\sum_{i=1}^{n} a_{h,i}^2\right)}{t_h - 1}}\right]^2 \quad [14]$$

Catch is calculated as per angler rather than as per boat due to the variability of the number of anglers per boat. The number of anglers per trip ($\hat{e}_h$) [15] and associated variance [16] were calculated.

$$\hat{e}_h = \frac{\sum_{i=1}^{n} a_{h,i}}{t_h} \quad [15]$$

$$\mathrm{var}(\hat{e}_h) = \frac{\sum_{i=1}^{n} a_{h,i}^2 - \left[\left(\sum_{i=1}^{n} a_{h,i} \right)^2 \Big/ t_h \right]}{t_h(t_h - 1)} \qquad [16]$$

The estimated number of trips for Red Snapper ($\hat{T}_{h,adj}$) was then multiplied by the number of anglers per trip ($\hat{e}_h$) to get the number of angler trips for Red Snapper ($\hat{E}_h$). The variance around the estimated number of angler trips was also calculated [17].

$$\mathrm{var}\left(\hat{E}_h\right) = \hat{T}_{h,\mathrm{adj}}^2 \mathrm{var}(\hat{e}_h) + \hat{e}_h^2 \mathrm{var}\left(\hat{T}_{h,\mathrm{adj}}\right) - \mathrm{var}(\hat{e}_h)\mathrm{var}\left(\hat{T}_{h,\mathrm{adj}}\right) \quad [17]$$

Finally, the total catch ($\hat{C}$) across all the inlets [18] and associated variance were calculated [19].

$$\hat{C} = \sum_{h=1}^{9} \hat{E}_h \hat{c}_h \qquad [18]$$

$$\mathrm{var}\left(\hat{C}\right) = \sum_{h=1}^{9} \left[\hat{E}_h^2 \mathrm{var}(\hat{c}_h) + \hat{c}_h^2 \mathrm{var}\left(\hat{E}_h\right) \mathrm{var}(\hat{c}_h) \right] \qquad [19]$$

To calculate landings in pounds ($\hat{L}$) for the private recreational fleet, an average weight in pounds (l) was calculated from all fish sampled during dockside intercepts from the private recreational fleet and multiplied by the estimated landings in numbers ($\hat{C}$). The variance for landings in pounds was also calculated [20].

$$\mathrm{var}\left(\hat{L}\right) = \hat{C}^2 \mathrm{var}(l) + l^2 \mathrm{var}\left(\hat{C}\right) - \mathrm{var}(l)\mathrm{var}\left(\hat{C}\right) \quad [20]$$

For the charter fleet, landings, releases, and effort estimates are calculated using data from a mail/telephone survey. Federally permitted charter vessels with a snapper-grouper permit, who are not already sampled by the MRIP For-Hire Survey in the fishing season wave, are sampled by FWRI for the Red Snapper season. Charter captains are provided with a log sheet prior to the fishing season that they can mail back once the season is complete. If the sheet is not returned, FWRI follows up by telephone. Data is collected on the number of trips taken and the number of Red Snapper harvested and released on each trip.

To estimate the number of charter trips and angler trips targeting Red Snapper, as well as the number of harvested and discarded Red Snapper by the charter fleet, the number of trips or fish reported ($Y_{h,i}$) by respondent i in region h during the open season was summed. Then a sampling weight (W_h) was calculated as an inverse proportion of responses to the charter mail survey, where N_h is the total number of federally permitted charter vessels in a given region and n_h is the number of vessels that responded to the survey [21].

$$w_h = {}^{N_h}\!/_{n_h} \qquad [21]$$

These two values were then multiplied and summed across regions and respondents to calculate a total number of trips ($\hat{Y}$) [22].

$$\hat{Y} = \sum_{i=1}^{n} w_h Y_{h,i} \qquad [22]$$

Variance was calculated using the Taylor Series method using SAS (SAS Enterprise Guide, 2020).

To estimate landings in pounds for the charter fleet, the landings in numbers estimated from the mail survey were multiplied by a mean weight obtained from biological sampling at randomly selected charter sites. Charter vessels without a snapper grouper permit that were encountered during dockside intercept surveys were included in private effort calculations as they are not legally allowed to harvest Red Snapper as a charter boat. Estimate calculations for both the private and charter fleet were primarily conducted in SAS (SAS Enterprise Guide, 2020).

Findings and Conclusions

The South Atlantic Red Snapper mini-season length ranged from 0-9 days between 2012-2024. For years with open seasons, the average season length was 4 days. FWC-FWRI sampled an average of 947 (± 527 SE) private trips and 304 (±88) charter trips in each of the years sampling occurred (Table 1). Peaks in the number of private recreational trips intercepts occurred in 2014, 2018, and 2023. In 2014, the increased sample size was likely due to the open season increase from the previous year by 5 days. The increased sample size in 2018 was likely due to the late summer season with calm conditions generating an overall increase in fishing pressure. FWC-FWRI could not identify anything unique about 2023. For the charter trips, a low number of respondents in 2022 was attributed to an incorrectly provided charter list. This meant that only 30% of federally permitted charter captains received the survey, compared to the normal 90%.

The Florida South Atlantic private recreational fleet has landed 20,866 (± 4,361 SE) fish and 204,620 (± 19,947 SE) pounds of Red Snapper and released on average 26,790 (± 6,904) Red Snapper per 2012-2024 mini-season (Table 2; Fig. 2-5). The Florida South Atlantic charter fleet landed 2,287 (± 176) and released 3,623 (± 545) Red Snapper per 2017-2024 mini-season (Table 3; Fig. 2-4 & Fig. 6). While landings for both fleets show general fluctuations, both fleets have a sustained high period of catch in numbers and pounds from 2018-2021 (Fig. 2-4), as well as recent declines of catch in numbers and pounds from 2022-2024 (Fig. 2-4).

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Table 1: Metadata for the supplied ECRS estimates

Field Name	**Description**
NEW_COM	Species common name – “Red Snapper”.
YEAR	Year the estimate was produced.
MONTH	Month the estimate was produced.
WAVE	Wave the estimate was produced.
SUB_REG	Subregion that the estimate is generated for. All 6 for the South Atlantic.
ST	State FIPS code for the estimate generated. All 12 for Florida.
NEW_MODEN	Mode of fishing as text. ‘Priv’ for private boat and ‘Cbt’ for charter.

N	Sample size that the estimate is generated for: “landings_lbs” N in the private fleet is the number of boat trips intercepted “landings_lbs” N in the charter fleet is the number of survey responses received “landings_num” N in the private fleet is the number of boat trips intercepted “landings_num” N in the charter fleet is the number of survey responses received “release” N in the private fleet is the number of boat trips intercepted “release” N in the charter fleet is the number of survey responses received “mean_wgt_lbs” N in the private fleet is the number of fish weighed in dockside intercepts “mean_wgt_lbs” N in the charter fleet is the number of fish weighed in dockside intercepts
VARNAME	Written description of the estimate type: “landings_lbs” is the total estimated landings in pounds, “landings_num” is the total estimated number of fish landed, “mean_wgt_lbs” is the mean weight (lbs) per fish, and “release” is the estimated number of fish released.
VARNAME2	Codes for different estimate types: “lbest_wwt” is the total estimated landings in pounds, “AB1” is the total estimated number of fish landed, “avgwgt” is the mean weight (lbs) per fish, and “B2” is the estimated number of fish released.
ESTIMATE	Estimated value from the East Coast Red Snapper mini-season FWC sampling effort.
SE	The standard error around the estimates.
PSE	The percent standard error about the estimates.
DS	Data source: “ECRS” are estimates directly generated the East Coast Red Snapper mini-season sampling effort. “ECRS_num” are for estimates of numbers of fish generated by the ECRS sampling effort. “ECRS_wgt” is for estimates of weights of fish estimated from the ECRS sampling effort.

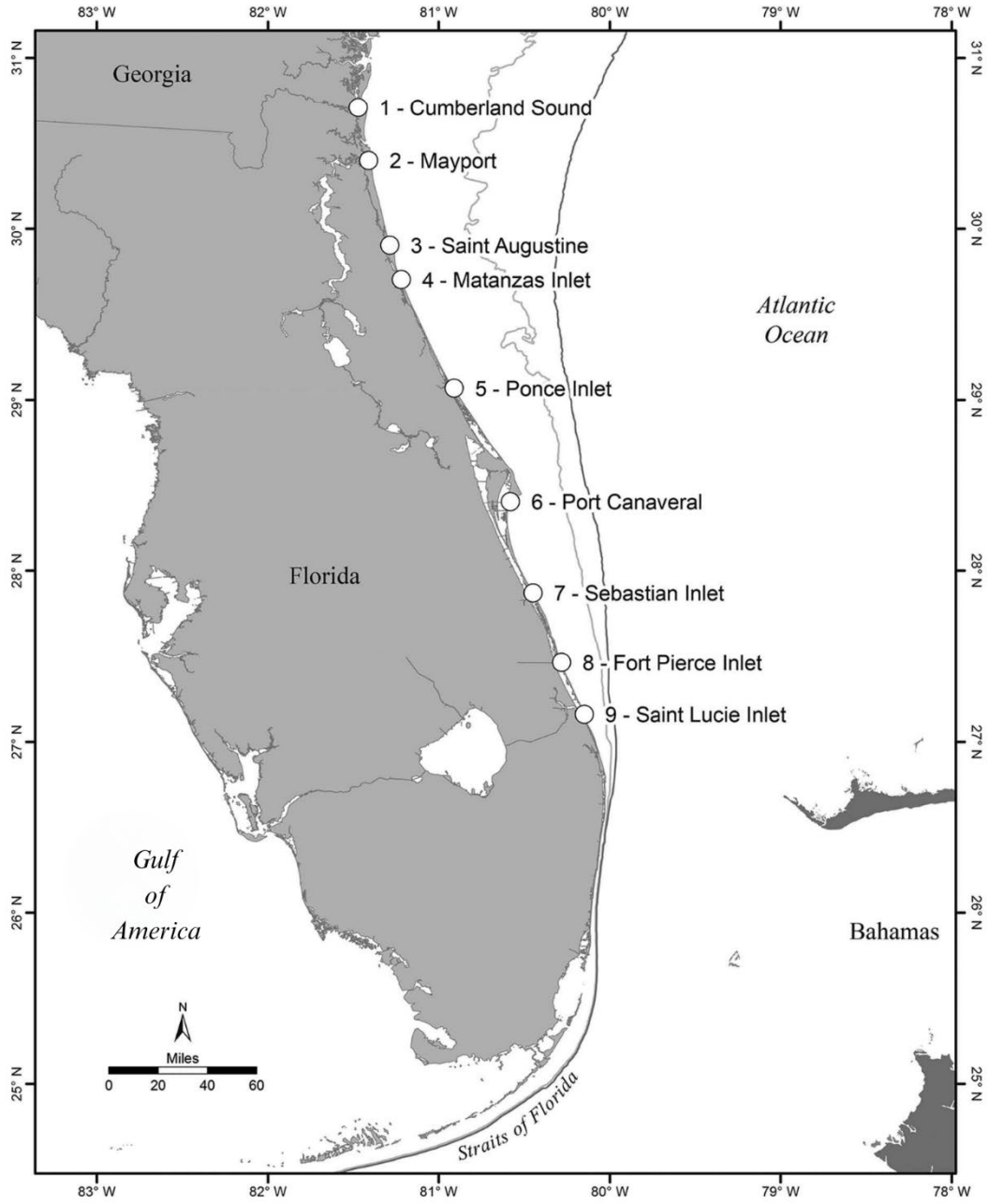

Figure 1. Inlets 1-9 are the sampling sites for the Fish and Wildlife Research Institute's East Coast Red Snapper Survey (FWRI - ECRS). Monitoring for Matanzas inlet (inlet 4) ended in 2020. This inlet experiences extremely low effort and is not navigable in low tide. A sampling weight generated from previous years' monitoring efforts is used to account for trips taken from this inlet.

Table 1. Wave of season and season length (in days) for the recreational red snapper season along Florida's East Coast, including the total number of private and charter recreational trips sampled for Red Snapper (*Lutjanus campechanus*) throughout the season. All open recreational seasons were monitored from 2012 to 2024. Sample sizes below for the private recreational trips were number of dockside interviews conducted. Sample sizes for charter trips are the number of completed mail/telephone surveys.

Year	Wave of Sampling	Season Length (Days)	Private Trips Sampled	Charter Trips Sampled
2012	5	6	508	.
2013	4	3	803	.
2014	4	8	2,303	.
2017	6	9	259	436
2018	4	6	1,225	309
2019	4	5	990	307
2020	4	4	826	284
2021	4	3	990	332
2022	4	2	883	118
2023	4	2	1,057	320
2024	4	1	576	324

Table 2. Total catch estimates for Red Snapper (*Lutjanus campechanus*) expressed in numbers and pounds of fish with their error (SE) from the private fishing fleet during recreational season openings. All open recreational seasons were monitored from 2012-2024. Discards were not estimated in 2020 due to a shortened questionnaire for the COVID-19 pandemic.

Year	Landings (no. fish)	S.E	Releases (no. fish)	S.E	Landings (lbs)	S.E
2012	11,136	1,734	17,587	9,031	.	.
2013	6,999	1,321	5,033	1,512	.	.
2014	22,013	2,782	9,755	1,741	.	.
2017	5,390	475	4,331	561	37,966	1,637
2018	30,050	6,256	41,660	10,057	263,110	24,900
2019	37,750	6,292	56,648	10,163	347,047	26,398
2020	30,921	5,820	.	.	254,953	21,767
2021	30,206	3,159	54,685	5,541	252,147	14,954
2022	16,324	4,549	24,273	7,142	138,955	17,610
2023	26,915	6,843	34,864	9,143	237,114	27,388
2024	11,822	2,527	19,064	4,436	105,667	10,296

Table 3. Total catch estimates for Red Snapper (*Lutjanus campechanus*) expressed in numbers and pounds of fish with their error (SE) from the charter fishing fleet during recreational season openings. All open recreational seasons were monitored from 2017-2024. Landings in pounds from the charter fishing fleet are only for the NE region (Nassau-Martin Counties) of Florida in 2022.

Year	Landings (no. fish)	S.E	Releases (no. fish)	S.E	Landings (lbs)	S.E
2017	898	82	1,622	253	.	.
2018	3,184	212	3,192	410	.	.
2019	3,227	218	4,908	589	.	.
2020	2,900	216	4,907	613	.	.
2021	4,196	172	8,713	931	.	.
2022	1,582	246	2,053	565	13,439	317
2023	1,547	91	2,155	375	15,739	452
2024	763	65	1,436	307	6,616	268

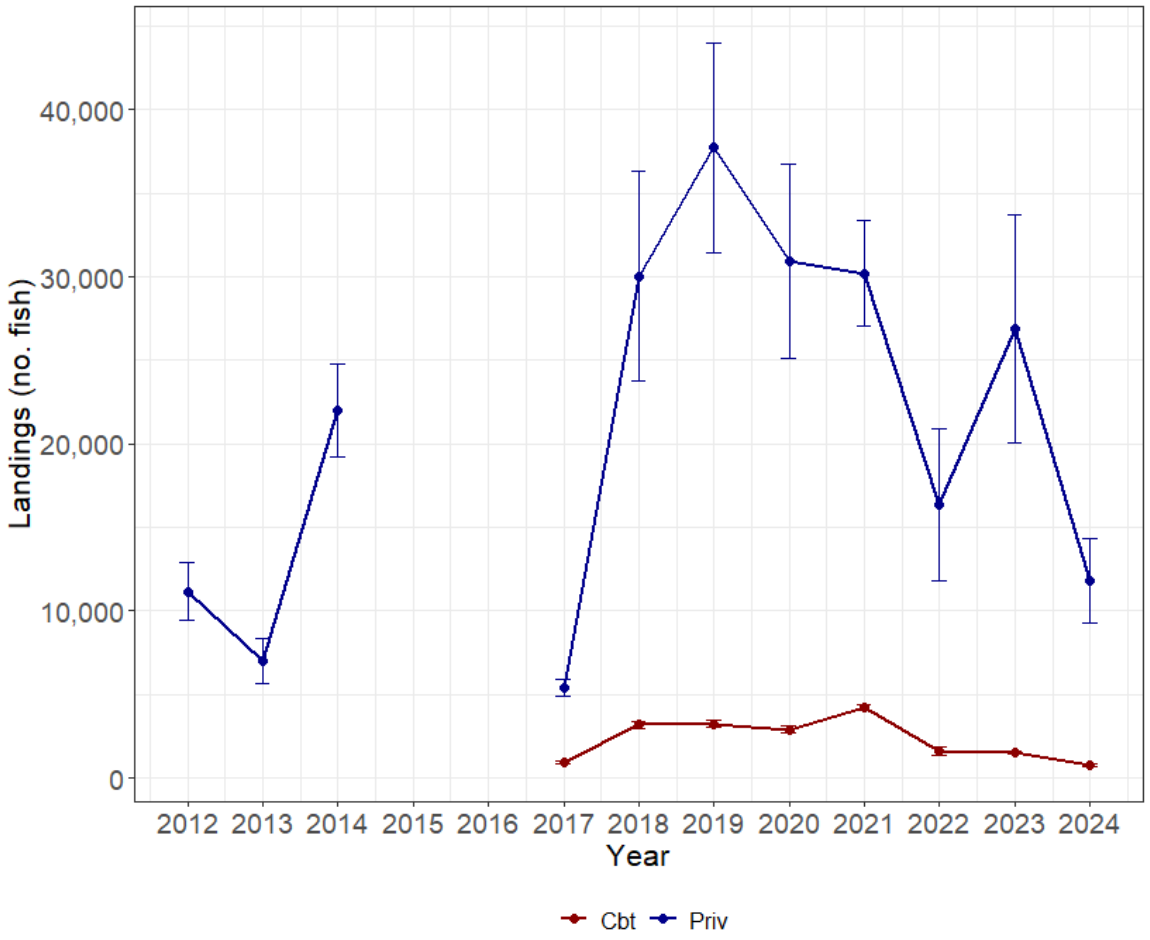

Figure 2. Red Snapper (*Lutjanus campechanus*) estimates of landings (numbers of fish) with their error (SE) during recreational season openings from 2012-2024 for the private and charter fishing fleets. The fishery was entirely closed to recreational fishing for all of 2015 and 2016.

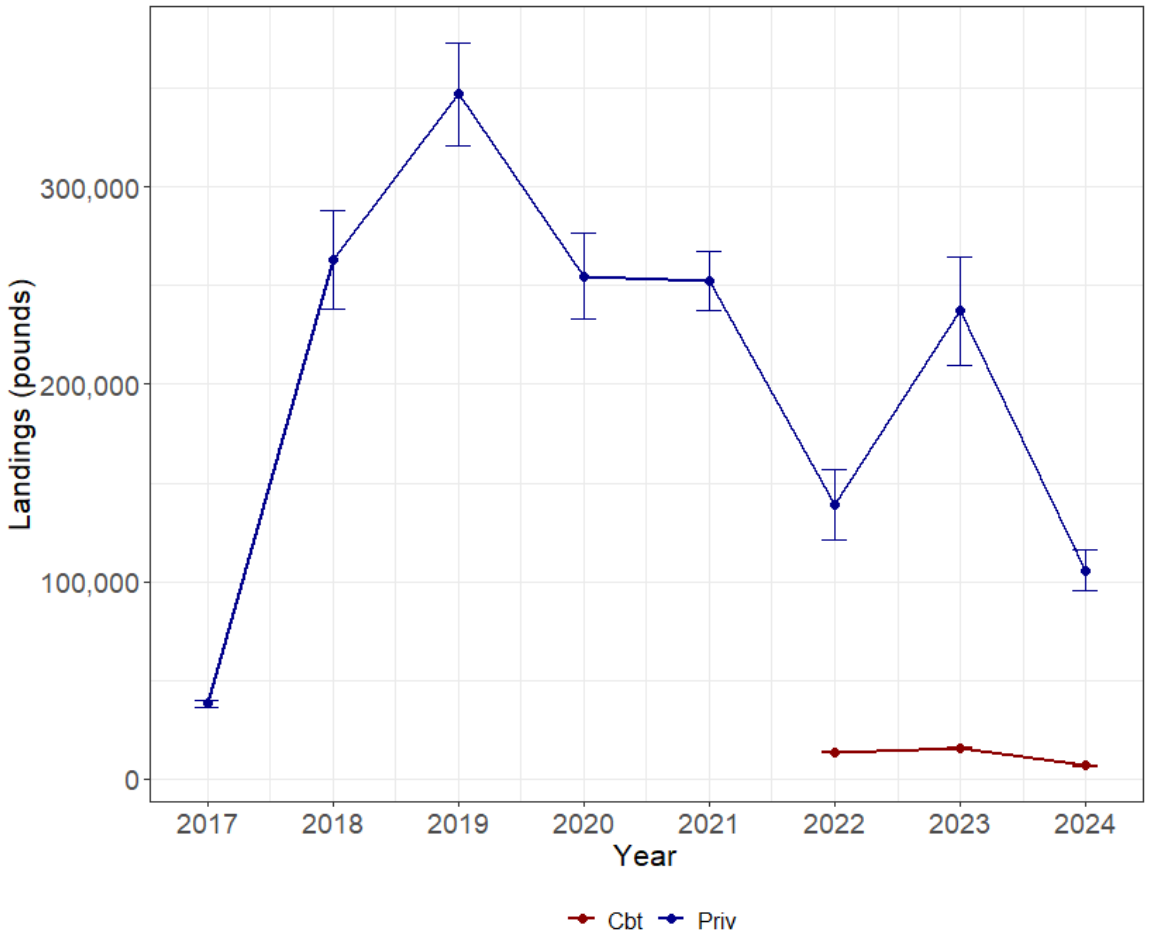

Figure 3. Red Snapper (*Lutjanus campechanus*) estimates of landings (pounds of fish) with their error (SE) during recreational season openings from 2017-2024 for the private and charter fishing fleets. Landings in pounds from the charter fishing fleet are only for the NE region (Nassau-Martin Counties) of Florida in 2022.

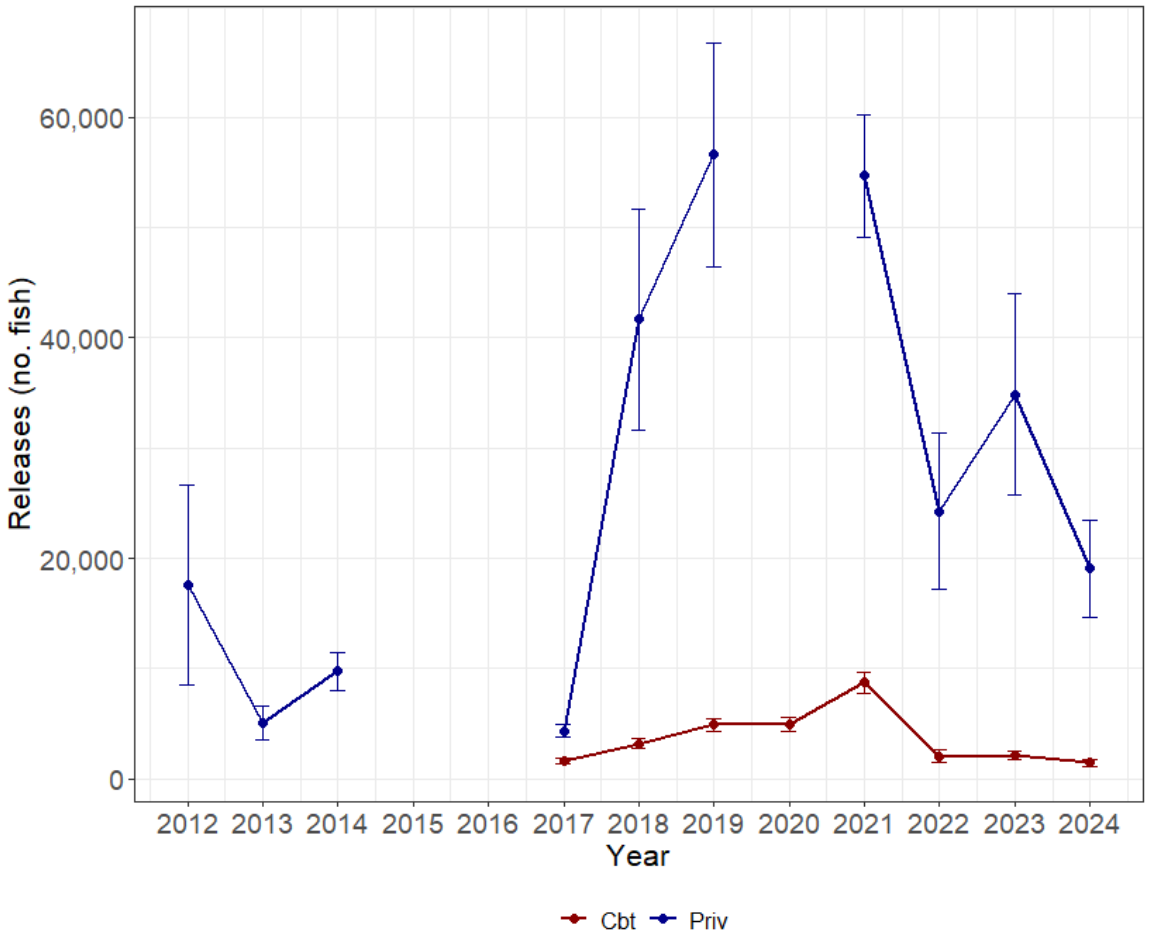

Figure 4. Red Snapper (*Lutjanus campechanus*) estimates of releases (numbers of fish) with their error (SE) during recreational season openings from 2012-2024 for the private and charter fishing fleets. The fishery was entirely closed to private recreational fishing for all of 2015 and 2016. Released fish from the private fishing fleet were not estimated in 2020 due to a shortened onsite questionnaire during the COVID-19 pandemic.

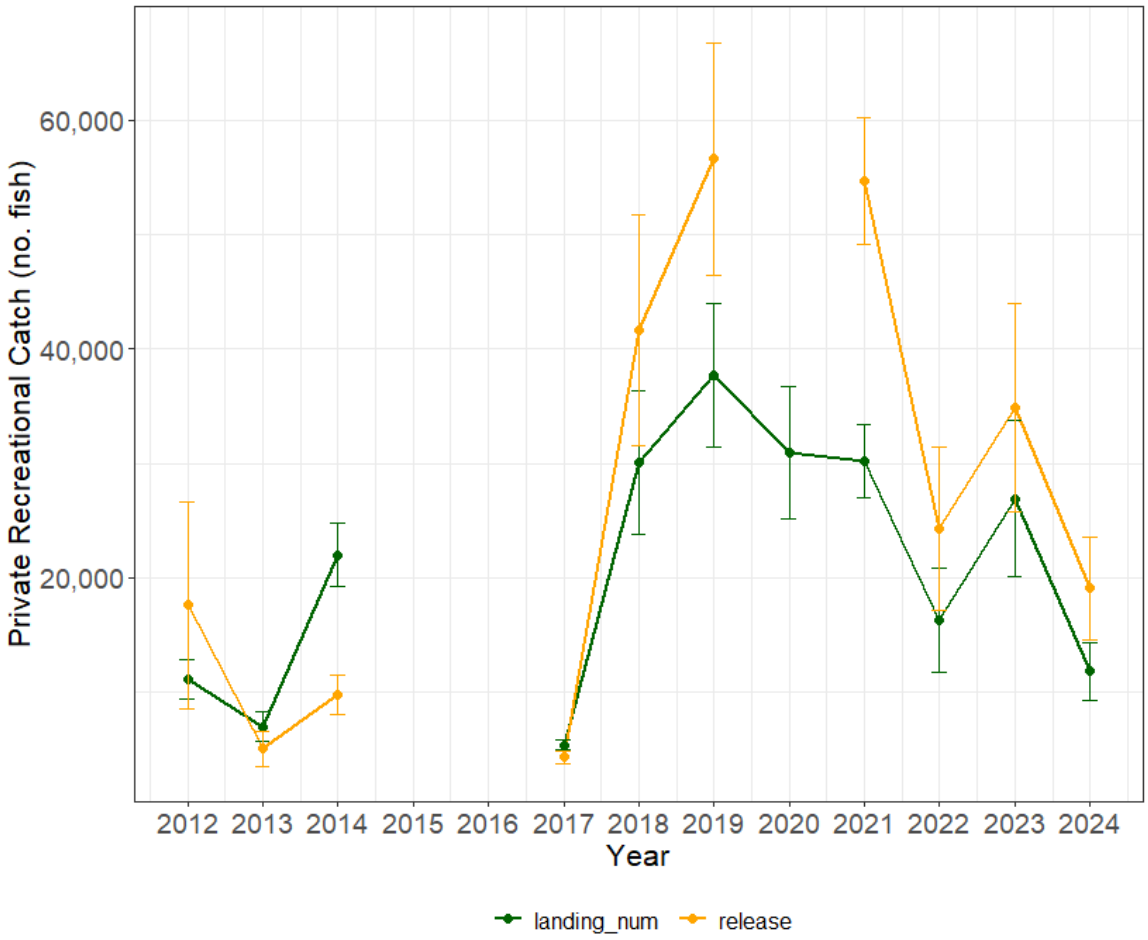

Figure 5. Red Snapper (*Lutjanus campechanus*) estimates of landings and releases (numbers of fish) with their error (SE) during recreational season openings from 2012-2024 for the private fishing fleet. The fishery was entirely closed to private recreational fishing for all of 2015 and 2016. Released fish from the private fishing fleet were not estimated in 2020 due to a shortened onsite questionnaire during the COVID-19 pandemic.

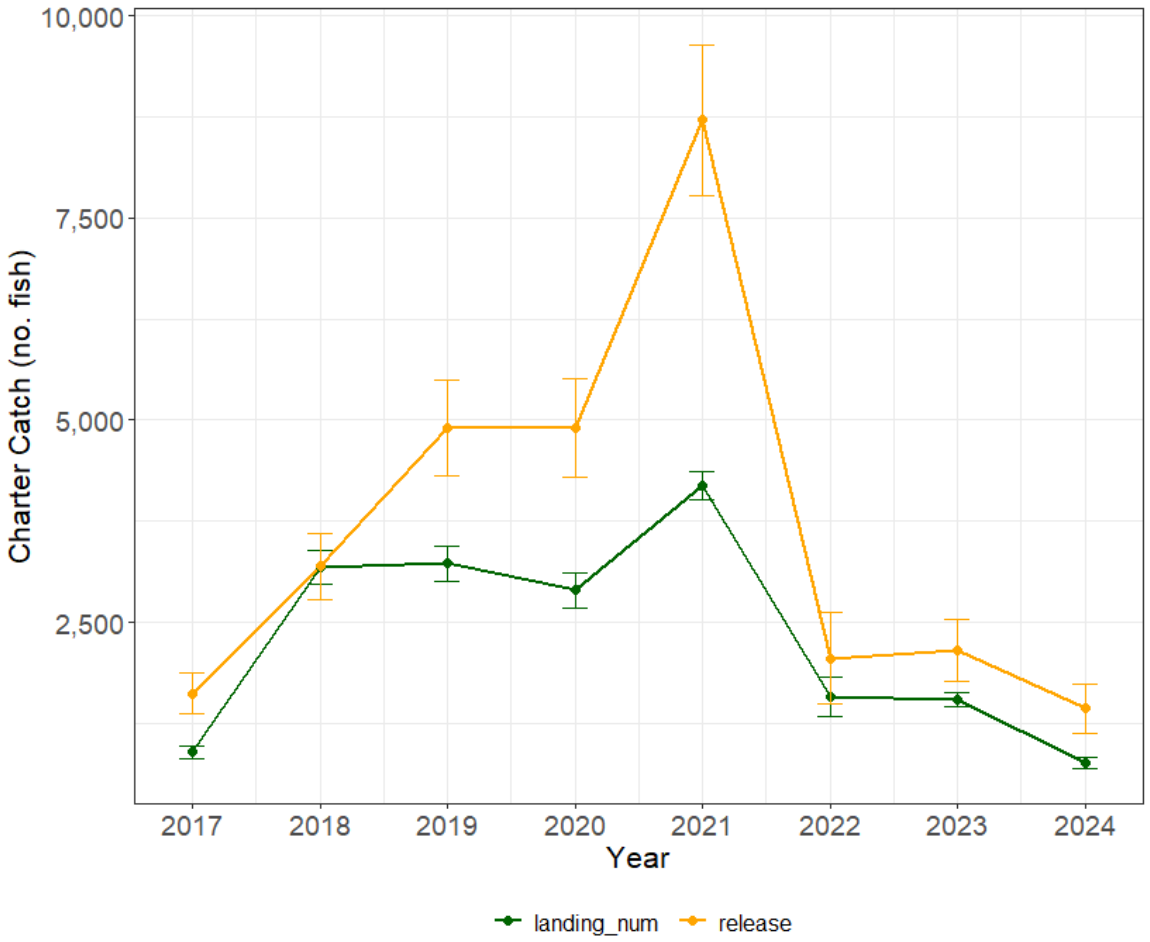

Figure 6. Red Snapper (*Lutjanus campechanus*) estimates of landings and releases (numbers of fish) with their error (SE) during recreational season openings from 2017-2024 for the charter fishing fleet. The fishery was entirely closed to recreational fishing for all of 2015 and 2016.