Estimated Discard Mortality of South Atlantic Red Snapper (*Lutjanus campechanus*) for the Florida recreational fleet, using Fisheries-Dependent Surveys

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Background

The first stock assessment conducted through SEDAR for South Atlantic Red Snapper (*Lutjanus campechanus*) found the stock had been overfished since 1960 and was currently undergoing overfishing (SEDAR 15, 2008). Management strategies aimed at recovering the fishery have primarily centered around reducing the number of harvested fish through private fleet seasonal closures for most of or all of the year, but the stock remained overfished and overfishing was occurring (SEDAR 73, 2021). While a vast majority of Red Snapper in this fishery are now released rather than harvested (NMFS Fisheries Statistical Division, 2024; Nuttall, 2025), released fish can also experience mortality. Additionally, as the population of Red Snapper in the South Atlantic rebuilds, the number of caught and released fish increases. The number of dead, discarded fish has regularly surpassed the ACL for this species, stunting the rebuilding process while also not allowing anglers to harvest fish (NMFS, 2025). Accurately assessing the number of dead discards from the recreational fishery requires accurate estimates of the number of releases and the likelihood that those fish will experience mortality. Both variables are hard to estimate in recreational fisheries, due to a reliance on angler recall, large variation in the private recreational angler fishing behavior, and size of the recreational fishing population making some data collection methods impractical.

Common factors that can cause release mortality include hooking injuries, physiological stress from long fight times or long handling times, fish length, and predation (Bartholomew & Bohnsack, 2005; Burns & Froeschke, 2012; Curtis et al., 2015; Muoneke & Childress, 1994; Rummer & Bennett, 2005). Red Snapper is a demersal (i.e., bottom dwelling) and physoclistous (i.e., have a self-contained swim bladder that does not allow for rapid changes in bladder capacity) species. Therefore, Red Snapper also experience barotrauma, decreasing the likelihood of survival for fish caught at deeper depths (Rummer & Bennett, 2005). Venting tools or descending devices are used to reduce some of the negative effects of barotrauma (Scyphers et al., 2013; Wilde, 2009). Additionally, studies have found that warmer surface temperatures can increase release mortality, likely due to physiological stress from large changes in temperature as the fish are brought to the surface (Bartholomew & Bohnsack, 2005; Curtis et al., 2015; Diamond & Campbell, 2009).

Accurately assessing release mortality can be challenging. Data collected while fishing can only directly assess immediate mortality. Delayed mortality from fishing can also occur due to the physiological stresses placed on the fish causing cellular and tissue damage, reduced immunity, and increased probably of predation due to chemical cues which can attract predators (Dallas et al., 2010; Davis, 2002; Jenkins et al., 2004; Mohan et al., 2020; Rummer, 2007; Wood et al., 1983). Additionally, physiological stress can cause changes in fish behavior which can reduce normal foraging behavior or make fish more vulnerable to predation (Campbell, 2008; Parsons & Eggleston, 2005). Recent research has estimated both immediate and delayed release mortality of Red Snapper through the use of tagging (Bohaboy et al., 2020; Curtis et al., 2015; Runde et al., 2021; Sauls et al., 2017; Stunz et al., 2017; Tompkins, 2017). Acoustic tagging allows scientists to track individual fish and assess their post-release survival. Passive tagging allows scientists to identify recaptured fish, allowing for estimates of post-release survival, when recapture rates are high enough (e.g. Boyle et al., 2022; Sauls et al., 2017; Trumble et al., 2000). While acoustic tagging more accurately assesses the post-release behavior and survival of individual fish, it is expensive and time consuming (Neilson et al., 2011; Skomal, 2007). Passive tagging requires a fish to be recaptured for data information on post-release survival to be collected but can be done with much larger sample sizes and spatial scales.

Objectives

This work aims to better understand the release mortality of Red Snapper (*Lutjanus campechanus*) in the South Atlantic. Observers, as part of the Florida For-hire Observer program, collect accurate and real-time data on the number of fish released, their release condition, barotrauma symptoms, fish length, release method (e.g. vented, descended, both, or neither), and fishing depth. Observers also tag fish. The recapture rate of these fish and various release conditions can be used to estimate release mortality for the for-hire fleet and determine which factors drive higher or lower release mortality rates. Additionally, data from private recreational dockside surveys can be used to quantify the depth at which private recreational anglers are releasing Red Snapper and the proportion of these fish that are released using descending devices or venting tools. Data on how the private recreational fleet releases Red Snapper can be input into the for-hire release mortality model to also generate Red Snapper release mortality estimates for the private recreational fleet in the South Atlantic.

Methods

For-Hire Observer Program:

On the South Atlantic coast, at-sea headboat sampling has been conducted continuously since 2005 funded by the Atlantic Coast Cooperative Statistic Program (ACCSP), with this report including data collected between 2005 and 2024. At-sea sampling on Atlantic coast charter boats was funded with a 3-year MARFIN grant from 2013-2015, and there was a gap in funding from January 2016-May 2020. In July 2020, the state of Florida secured funds through the State Reef Fish Survey to expand coverage to east Florida, but trips were not observed through this funding until April 2021 due to the COVID-19 pandemic. There has been consistent coverage of charter boats since sampling coverage was re-initiated in April 2021.

Headboat observer surveys were conducted in the Florida Keys from 2005 to 2007, funded by the Gulf Fisheries Information Network (GulfFIN) along with the Gulf coast. In 2010, headboat sampling coverage in the Florida Keys was re-initiated, along with the initiation of charter boat sampling. In 2014, representative at-sea observer data was only collected from charter vessels in the Florida Keys. Since 2015, there has been consistent coverage of both charter and headboats in the Florida Keys.

During a sampled trip, the captain was asked to provide the bottom depth and locational coordinates to the observer each time their vessel moved to a new fishing location. Biologists either observed fishing activity for all anglers on the vessel or monitored a sub-set of anglers if the party was too large to observe 100% of fishing activity. At each stop or station, observers record fishing depth, the presence of predators, number of observed anglers, along with their rod and rig information. As anglers fished with recreational hook-and-line gear, observers recorded for each fish caught the species, fork length (mm), and whether the fish was harvested, predated while being reeled to the surface, or discarded. In 2009, fishery observers on the west coast of

Florida began collecting additional data from managed species, including Red Snapper, and these methods were expanded in later years to include the east coast. For each Red Snapper caught, observers recorded hook location and barotrauma symptoms. If a Red Snapper was discarded, the venting method and release condition at the surface was also recorded. Prior to release, each discard was marked with a Hallprint plastic-tipped dart tag with an external monofilament streamer that was labeled with a unique tag number, a toll-free phone number for a central tag return hotline, and the word "REWARD". Anglers who captured and reported tagged fish received a t-shirt with an artist's image of various reef fish (art courtesy of the artist Diane Rome Peebles). Additional Red Snapper were also tagged during directed research and citizen science initiatives. Additional Red Snapper were also tagged on the Atlantic coast of Florida through a cooperative research project (Brodie et al. 2014).

State Reef Fish Survey (SRFS):

Florida's State Reef Fish Survey (SRFS) expanded to include the whole state of Florida in mid-2020. This survey interviews anglers who fish for a suite of reef fish. Questions about released fish are collected through angler recall at the dock. Information is collected such as which species were released, how many fish were released, whether those fish were released alive, dead, or used for bait, and the average depth fished. In May 2022 additional questions were added to the survey to ask if anglers had a venting tool or descending device aboard their boat and also for each released fish, if a venting tool or descending device was used for that release. SRFS dockside sampling is supplemental to MRIP-APAIS sampling and public access sites deemed to be offshore are drawn as supplemental assignments through the MRIP-APAIS sample draw process.

East Coast Red Snapper (ECRS):

Since 2012, FWRI has enhanced fishery-dependent monitoring efforts to collect private recreational fishing data during short recreational harvest seasons in the South Atlantic for Red Snapper. This survey aims to provide more precise catch estimates for private boat mode during Red Snapper recreational mini-seasons, which also provides an opportunity to collect additional data on angler fishing behaviors. Dockside sampling occurs at randomly selected angler intercept sites adjacent to major inlets from Cumberland Sound to Port St. Lucie. These inlets serve as egress points to Red Snapper fishing grounds in the Atlantic Ocean. Very few Red Snapper are landed south of this region along the east coast of Florida. Private anglers returning from offshore recreational boat-based fishing trips are intercepted and anglers are interviewed to determine depth fished and the number of Red Snapper released. In 2018, the survey started asking how Red Snapper were released, allowing anglers to report surface released, vented, descended, or any combination of these three options for their trip as a whole. In 2020, due to the COVID-19 pandemic, the dockside intercept survey was shortened for the safety of samplers and anglers and questions on discards were omitted.

Data Analysis

To estimate latent discard mortality from catch-and-release data from Florida's For-Hire Observer program, a proportional hazards model was developed to assess potential drivers of discard morality. The response variable was the number of days at large. Fish reported as recaptures were censored (1), while those not recaptured were uncensored (0). Tested predictor variables were hook position, venting, barotrauma, release condition, fork length, and depth fished. A second condition variable, "overall condition" was also a tested predictor in a continuity model based on the methodology used by Sauls et al., 2017 to produce a model for Red Snapper provided for SEDAR 73 (Sauls et al., 2017). All tested models were stratified by year to control for differences in recapture rates across time. Hook position was categorized as good hook position (mouth, lip, or external hook) or a bad hook position (hooked in the eye, gut, throat or gill). Venting was categorized as vented properly (belly vent with venting tool or syringe), improperly vented (vented in another location or with another tool), or not vented. Barotrauma was categorized as either low/no barotrauma or medium/high barotrauma. These categories were grouped because 98.1% of all Red Snapper released were categorized as low or medium barotrauma condition. Therefore, there was not enough data for 'no' and 'high' barotrauma categories to be analyzed separately. Release condition was grouped as either good (swam to depth rapidly or recompressed), fair (swam down slowly), bad (float off, excessive bleeding, poor swimming, or swim just under the surface within sight), or presumed dead (observed predation or unresponsive upon release). There were only 14 tagged, descended fish in the at-sea observer program for the whole provided time series and only 9 included in the model due to missing fields. Therefore, descending device use could not be modeled separately. Fish fork length (as 100mm bins) and depth (as 5m bins) were included in the model as categorical variables. The overall condition variable used in the continuity model was grouped as good (swam away strong, unvented, and low barotrauma), vented (swam away strong, vented, good hooking, and low barotrauma), impaired (struggled to swim away, improper vent, bad hook position, chased by a predator, and barotrauma present; Table 1). Descriptions and sample sizes of all tested predictor variables are included in Tables 1 & 2. Not all fish are tagged, and at-sea observers do not always collect data on all tested factors for all fish. Only tagged fish with complete cases were used in the model. Four separate models were tested: a continuity model that just included overall condition, a model with all variables, a model that drops barotrauma and venting but keeps depth, and a simple model with only depth and venting. None of the predictor variables were correlated using the *vif* function and car package (Fox et al., 2024). Headboat and charter trips were not modeled separately as, among the tagged fish available for the model, chi-squared tests found no differences between the predictor variables across these two fleets. Models were run using the survival package and *coxph* function (Therneau et al., 2024). Model fits were tested using the *cox.zph* function and the *ggcoxdiagnostics* function and survminer package for plotting fits (Kassambara et al., 2024). The best model was selected using AICs. Analyses were run in R (R Core Team, 2023).

In order to characterize recreational releases in Florida we summarized all available predictors of mortality from FWC-FWRI surveys. Depth fished and release methods used by the private, recreational fishery are available from SRFS and ECRS dockside sampling efforts. For ECRS, depth fished and release method were collected for the trip as a whole rather than for each individual fish. The number of trips taken at each depth in each sampled year were calculated. Then, we calculated a proportion of the total number of trips in a given year where at least one fish was vented, descended, both, or where no barotrauma mitigation was used on any fish in the trip. This step was repeated by depth category to calculate the proportion of trips that used each release method for each depth bin. Depth data from 2012-2024 and release method data from 2018-2024, with the exception of 2020, were available for this analysis. For SRFS, release method data is collected for each individual released fish. Therefore, the total number of released Red Snapper in the South Atlantic were summed and the proportion of fish released per year in each release method was calculated. This process was also repeated for each depth bin. Data from the entire 2022-2024 years were available for this analysis. For the for-hire fishery, depth fish and release method were quantified from the at-sea observer program. For the Observer program, release method is collected for each fish. The total number of fish were summed and the proportion of fish released with each release method calculated. This was repeated for each depth bin. Data from continuous sampling from 2011-2024, with the exception of July 2020-April 2021, were available for this analysis (Table 4).

In order to estimate total discard mortality for each fleet, the fish that were released were grouped into each combination of predictor variables available for that fleet. For example, for the for-hire fleet, all predictors were available and therefore released fish could be grouped into all significantly different combinations available in the model (i.e. by depth bin, fork length bin, release condition, and hook position) for both charters and headboats (Fig. 1-4). For the private recreational fleet, only depth was available, and therefore all released Red Snapper across both SRFS and ECRS were assigned to a depth bin (Fig. 5). The probability of mortality (*M*) [1] for each depth (*d*), fork length (*fl*), release condition (*r*), and hook position (*h*) were calculated using the hazards ratios (*H*) from the proportional hazards model and the proportion of fish not recaptured from the good category (*P*=0.88; Runde et al., 2019 correction; Sutradhar & Austin, 2018). Different probabilities of mortality were calculated separately for each depth and fork length categories.

$$M_{d,fl,r,h} = \left(1 - \frac{(1 - P^{H_{d,fl,r,h}})}{1 - P}\right) * 100 \quad [1]$$

The probability of mortality was then assigned to each released fish with those predictor variables. For the for-hire fleets, if released fish were in multiple non-reference categories (e.g., both poorly hooked and caught at a deeper depth) the hazard ratios across categories were multiplied to calculate the percent reduction in mortality for these groups. For example, if a fish had a hooking injury and was released in fair condition, then the hazard ratios for each of these categories were multiplied before calculating overall mortality [2].

$$M_{r*h} = \left(1 - \frac{(1 - P^{H_{,r}*H_h})}{1 - P}\right) * 100 \quad [2]$$

Once each fish was assigned a mortality likelihood, these values were averaged across the whole fleet to generate an overall release mortality. Error around each hazard ratio from the model was also used to calculate 95% confidence intervals around the discard mortality estimates.

Mortalities for each fleet were calculated with three assumed percent mortalities for the base condition fish (i.e., caught in <25m, released in good condition, properly hooked, and between 301-500mm in length) of 100%, 92.5% and 85% (Sauls et al., 2017).

Findings and Conclusions

Model Results

Tag-recapture data used in the model included a total of 10,930 Red Snapper were caught, tagged by at-sea observers, and released on the Atlantic coast from 2011-2024. Overall reported recaptures occurred predominately in the Northeast region (Nassau, Duval, St. Johns, Flagler, and Volusia) with a recapture rate of 7.7%.

Of the models tested in the analysis the best fitting model included predictors of season, depth, release condition, hook position, and fish length based on AIC values (Table 3). The results from the best fitting model are summarized in Table 3. Fish caught at deeper depths generated higher release mortalities ($\chi^2_6 = 57.71$, $p<0.001$). Fish caught at shallower depths then the median depth of 21-25m had no significant difference in release mortality (p=0.89), but fish caught at 26-30m saw an increase of 24% (p=0.001), fish caught at 31-35m saw an increase of 62% (p<0.001), fish caught between 36-45m saw an increase of about 75% (p<0.01), and fish caught at deeper than 46m saw an increase in morality of 70% ($p<0.05$) release mortality compared to fish caught at the median depth of 21-25m. Fish with a hooking injury (i.e., hooked in the gills, throat, or other internal organ) had a 52% increase in release mortality compared to fish with a good hooked position ($\chi^2_1 = 20.98$, $p<0.001$). Average sized fish faired best ($\chi^2_4=11.99$, $p<0.02$), with no significant difference between the 301-400mm and the 401-500mm fork length fish (p=0.91). Smaller fish (<300mm) saw a 19% increase in release mortality ($p=0.04$) and larger fish had an increase in release mortality of 27% (p=0.03) and 28% (p=0.03) for 501-600mm and 601+mm fish, respectively. Poorer release conditions significantly increased release mortality ($\chi^2_3=18.66$, $p<0.001$). Fish released in a fair condition (i.e., swam down slowly) had a 53% increased release mortality (p<0.002) and fish released in poor condition (i.e. floated off or swam poorly) had a 61% increased release mortality (p<0.002) compared to fish that swam off strong. Fish that were released in the presumed dead category were not significantly different (p=0.99). However, this is because no fish released presumed dead were recaptured and the model estimates 100% mortality for this group. Season was not a significant predictor of release mortality (χ^2_1=1.46, p=0.23).

Summaries of Predictor Variables by Survey

Number of observed or reported, released Red Snapper varied by fleet. There were 29,523 Red Snapper released in the private recreational fleet, 2,792 in the charter fleet, and 9,972 in the headboat fleet.

Venting rates differed between FDM surveys (Table 4). The For-hire At-sea Observer program observed venting on 71.5% of the fish, whereas ~34% of fish were reported vented by SRFS and for ECRS ~45% of trips anglers reported venting some or all of their released fish. Use of descender devices is much lower in the for-hire sector with less than 1% for strictly descending or both venting and descending fish observed by the For Hire Observer Program. Compared to ECRS and SRFS that sees ~26% trips where some descending occurred and ~13% fish descended, respectively. SRFS reports the highest rate of no venting or descending methods with >53% of Red Snapper, followed by ECRS at 28.8% no venting or descending usage for any released Red Snapper during trips, and lastly for-hire observing 28.4% of released Red Snapper.

Depth of releases varied by FDM survey. At-sea observers reported more than 90% of the Red Snapper released on headboats were released at 21-30m (Fig. 1). Charter vessels released Red Snapper in deeper waters than headboats. Approximately 34% of Red Snapper were released in 31m or deeper waters. SRFS reported most of their discards occurring in 21-25m (Figure 5). Most of the ECRS trips with reported releases occurred between 0-30m. Both SRFS and ECRS reported deep release depths, reporting ~30% of recalled fishing depths at 36+ m.

The presence of predators and depredation rates observed at-sea changed over time (Table 5). Total depredation (both occurring during fishing and observed after release) was less than 1% from 2011-2022, however, in 2023 and 2024 it increased to 1.27% and 2.01% respectively. Of the stations where anglers were catching Red Snapper, observers saw a predator (i.e. sharks or dolphins) at over 50% of them from 2022-2024 (Table 5).

Overall Discard Mortality by Fleet

We found that the private recreational fleet had the lowest estimated release mortality. If it is assumed that one hundred percent of fish released in the best possible condition survive then the model predicts 24% (95CI: 11-30%) mortality for released fish. Predicted mortality for the private recreational fleet is 31% (95CI: 19-38%) and 39% (95CI: 26-45%) for the assumptions that 92.5% or 85% of fish released in good condition survive, respectively. The headboat fleet has an estimated release mortality of 28% (95CI: 26-35%), 36% (95CI: 34-42%), and 43% (95CI: 41-50%), assuming 100%, 92.5%, and 85% of the fish released in good condition survive respectively. The charter fleet had the highest estimate release mortality of 42% (95CI: 40-43%), 49% (95CI: 47-51%), and 56% (95CI: 55-58%) across the range of assumptions (Table 6).

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Table 1. Definitions of all variables used as categorical predictor variables for the proportional hazards model. All data for the model came from the At-Sea Observer program (2011-2024).

Season:	**Not Summer:** October-June (1,2,3,4,5,6,10,11,12). -*Base condition* **Summer:** July-September (7,8,9).
Depth:	Depth in 5-meter depth bins. The first depth bin is 0-20 and increases by 5m until the last length bin of 46+. 21-25m – *Base condition (median depth fished)*
Vent:	**Properly Vented:** Belly vent with a proper venting tool or syringe. **Improperly Vented:** Incorrectly vented via stomach, anus, or belly OR vented with incorrect tools (knife, hook, poker, dehooker/pliers, or other). **Not Vented:** No venting occurred. -*Base condition*
Release:	**Good:** Swam rapidly back down to depth or recompressed. -*Base condition* **Fair:** Swam down slowly but eventually descend out of sight. **Bad:** Float off (even if they eventually go back down), are bleeding profusely and swim poorly, or remain just under the surface within sight. **Presumed Dead:** Observed depredation or unresponsive upon release.
Barotrauma:	**L:** No barotrauma to little symptoms (extended belly). -*Base condition* **B:** Fair to severe barotrauma symptoms (stomach everted, intestines visible, popped eyes, or bubbles under the scales).
Hook Position:	**Good:** Inside mouth, Lip, Foul. -*Base condition* **Injury:** Eye, Gut, Throat, Gill.
Fork Length:	100mm fork length bins starting 100-200mm and ending with 800+ mm. 201-300mm – *Base condition (median fish length)*
Overall Condition:	**Good:** Good release condition, not vented, a good hook position, and little to no barotrauma symptoms -*Base condition* **Vented:** Fish was able to descend back down to depth, vented, good hook position, and little to fair barotrauma symptoms (Extended belly or stomach everted) **Poor:** Bad release condition, bad venting methods, bad hook position, extreme barotrauma symptoms (intestines visible, popped eyes, or bubbles under the scales), or chased by a predator at the surface.

Table 2. Sample size of tagged fish in each category in all tested predictor variables. Sample sizes presented here are only for tagged fish and will not match the total sample sizes provided in the figures below.

Variable	**Category**	**Sample Size**
Season	Summer	2,671
	Not Summer	8,259
Release Condition	Good	9,934
	Fair	531
	Bad	441
	Presumed Dead	24
Barotrauma	None or Low	8,675
	Medium or High	2,245
Vent	Not Vented	2,283
	Properly Vented	8,396
	Improperly Vented	251
Overall Condition	Good	26
	Fair	9327
	Poor	1542
	Presumed Dead	25

Variable	**Category**	**Sample Size**
Depth Bin	<20m	1,125
	21-25m	4,992
	26-30m	3,270
	31-35m	747
	36-40m	483
	41-45m	184
	46+m	127
FL Bin	<300 mm	1,869
	301-400 mm	4,450
	401-500 mm	2,624
	501-600 mm	998
	600+ mm	938
Hook Position	Good	9,764
	Injury	1,160

Table 3. Model results from the survival analysis on tagged and recaptured South Atlantic Red Snapper (*Lutjanus campechanus*). Reported percent changes in mortality for significant predictors are increases in release mortality (unless the value is negative) compared to the base conditions of a 201-300mm fish, caught with a good hook position in a season other than summer at a 21-25m depth and released in good condition. Base conditions for depth and length are the median value seen in the At-Sea data.

Variable	Estimate	Standard Error	Hazard Ratio	Z Statistic	P value	Sig	% Change in Mortality
Summer	-0.106	0.088	0.899	-1.207	0.227		9.68%
<20m Depth	-0.015	0.114	0.985	-0.134	0.893		1.44%
26-30m Depth	-0.274	0.084	0.760	-3.274	0.001	**	23.04%
31-35m Depth	-0.968	0.200	0.380	-4.838	<0.001	***	60.83%
36-40m Depth	-1.384	0.307	0.251	-4.515	<0.001	***	73.99%
41-45m Depth	-1.397	0.504	0.247	-2.771	0.006	**	74.32%
46+m Depth	-1.188	0.583	0.305	-2.039	0.041	*	68.44%
Fair Release	-0.765	0.254	0.465	-3.006	0.003	**	52.39%
Bad Release	-0.929	0.292	0.395	-3.178	0.001	**	59.48%
Presumed Dead	-13.716	740.369	0.000	-0.019	0.985		100.00%
Hook Injury	-0.740	0.162	0.477	-4.581	<0.001	***	51.23%
<300m FL	-0.208	0.101	0.812	-2.055	0.040	*	18.09%
401-500mm FL	-0.010	0.087	0.990	-0.113	0.910		0.93%
501-600mm FL	-0.318	0.143	0.728	-2.229	0.026	*	26.35%
601+mm FL	-0.330	0.149	0.719	-2.216	0.027	*	27.19%

Table 4. The proportion of trips (ECRS) or total released fish (SRFS or At-Sea) that were vented, descended, both methods were used, or neither method was used (i.e. surface released with no barotrauma mitigation) for each year. Proportions are expressed as percents. The 'ALL' row is the proportion across all years that each survey was functioning (i.e. 2011-2024 for At-Sea).

	RELEASE METHOD											
	VENT			**DESCEND**			**BOTH**			**NONE**		
YEAR	ECRS	SRFS	AT-SEA	ECRS	SRFS	AT-SEA	ECRS	SRFS	AT-SEA	ECRS	SRFS	AT-SEA
2011	.	.	79.5	.	.	0.0	.	.	0.0	.	.	20.5
2012	.	.	87.1	.	.	0.0	.	.	0.0	.	.	12.9
2013	.	.	75.4	.	.	0.0	.	.	0.0	.	.	24.6
2014	.	.	77.4	.	.	0.0	.	.	0.0	.	.	22.6
2015	.	.	76.3	.	.	0.1	.	.	0.0	.	.	23.6
2016	.	.	58.4	.	.	0.0	.	.	0.0	.	.	41.6
2017	.	.	61.7	.	.	0.5	.	.	0.0	.	.	37.9
2018	63.4	.	62.9	0.9	.	0.1	0.0	.	0.0	35.7	.	37.0
2019	69.1	.	73.1	2.0	.	0.0	0.0	.	0.0	29.0	.	26.9
2020	.	.	64.1	.	.	0.0	.	.	0.0	.	.	35.9
2021	34.5	.	79.9	31.6	.	0.0	8.8	.	0.0	25.0	.	20.1
2022	33.2	31.4	77.8	27.2	16.8	0.0	7.6	0.0	0.0	32.0	51.9	22.2
2023	38.3	32.5	69.9	26.0	14.8	0.0	8.9	0.1	0.0	26.8	52.6	30.1
2024	34.2	35.8	56.7	26.7	8.9	0.5	11.6	0.7	0.0	27.6	54.6	42.7
ALL	45.2	34.0	71.5	19.9	12.1	0.1	6.2	0.4	0.0	28.8	53.5	28.4

Table 5. Percent of predation (i.e. % Predation During Capture is the % of fish predated while being reeled in, % Predation After Release is the % of fish predated after release) and percent of predators present at each station. Total Pred % is the sum of the predation during capture and predation after release divided by the total number Red Snapper observed (2011-2024). % Stations with Obs. Predators refers to the % of stations that were positive for both a Red Snapper and predator, documenting the chance of predation at each stop on the trip (2012-2024).

Year	No. Red Snapper	No. Stations with Red Snapper	% Predation During Capture	% Predation After Release	% Total Predation	% Stations with Obs. Predators
2011	302	85	0	0	0	.
2012	611	98	0	0.33	0.33	37.76
2013	895	179	0.22	0.67	0.89	65.36
2014	989	158	0.1	0.1	0.2	41.77
2015	1013	124	0.49	0.2	0.69	56.45
2016	694	66	0.29	0.29	0.58	43.94
2017	652	68	0	0	0	41.18
2018	700	94	0.14	0	0.14	44.68
2019	913	70	0.44	0	0.44	30
2020	231	20	0.43	0.43	0.87	25
2021	1671	169	0.18	0.36	0.54	31.95
2022	1194	151	0.34	0	0.34	52.32
2023	1258	170	1.11	0.16	1.27	52.94
2024	1641	228	1.77	0.24	2.01	64.47

Table 6. Estimated discard mortality by fleet and % assumed survival of good release. 95% confidence intervals propagated from the error around the model hazard ratios are provided.

Assumed Survival of a Good Release	Fleet		
	Private	Charter	Headboat
100%	23.63 (11.39 - 30.16)	41.64 (39.83-43.32)	28.27 (26.30-34.73)
92.50%	31.13 (18.89 - 37.66)	49.00 (47.33-50.82)	35.73 (33.79-42.23)
85%	38.63 (26.39-45.16)	56.36 (54.83-58.32)	43.19 (41.29-49.73)

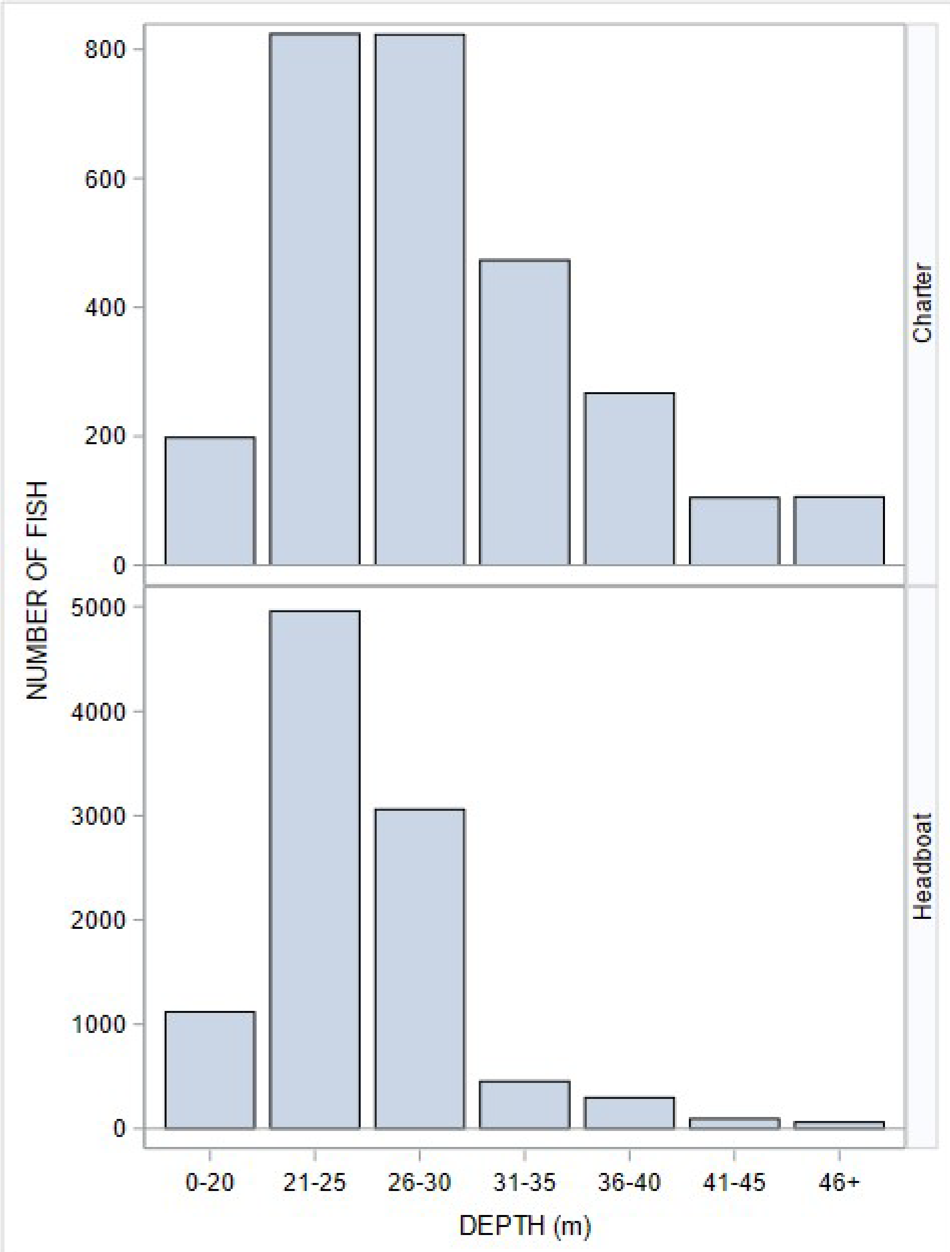

Figure 1. The total number of released Red Snapper (*Lutjanus campechanus*) by depth bin (m) and fleet from the At-Sea Observer program. Charter data was collected between 2013-2015, 2017-2019, and 2021-2024. Headboat data was collected between 2011-2024.

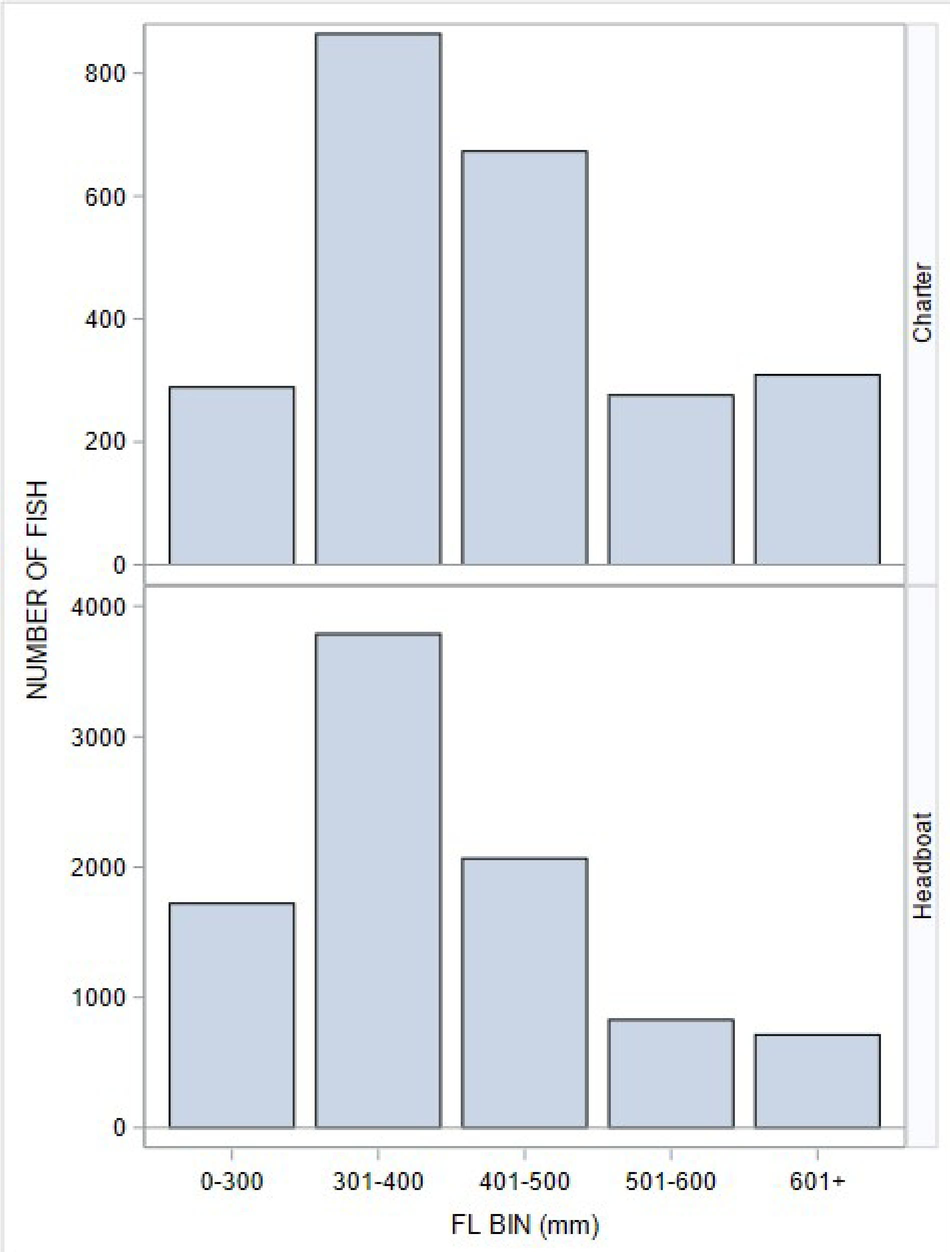

Figure 2. The total number of released Red Snapper (*Lutjanus campechanus*) by fork length bin (mm) and vessel type from the At-Sea Observer program. Charter data was collected between 2013-2015, 2017-2019, and 2021-2024. Headboat data was collected between 2011-2024.

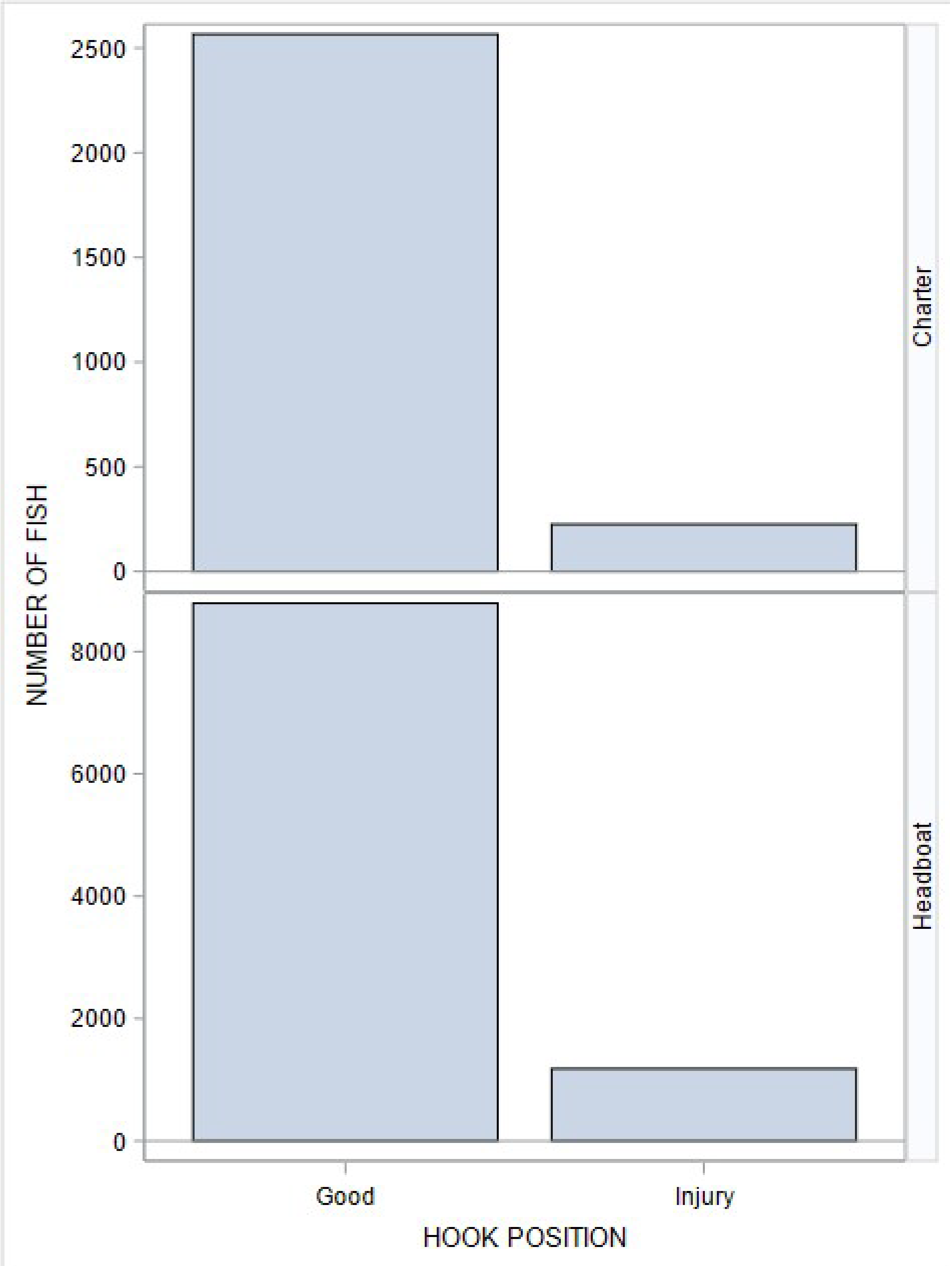

Figure 3. The total number of released Red Snapper (*Lutjanus campechanus*) by hook position and vessel type from the At-Sea Observer program. Charter data was collected between 2013-2015, 2017-2019, and 2021-2024. Headboat data was collected between 2011-2024.

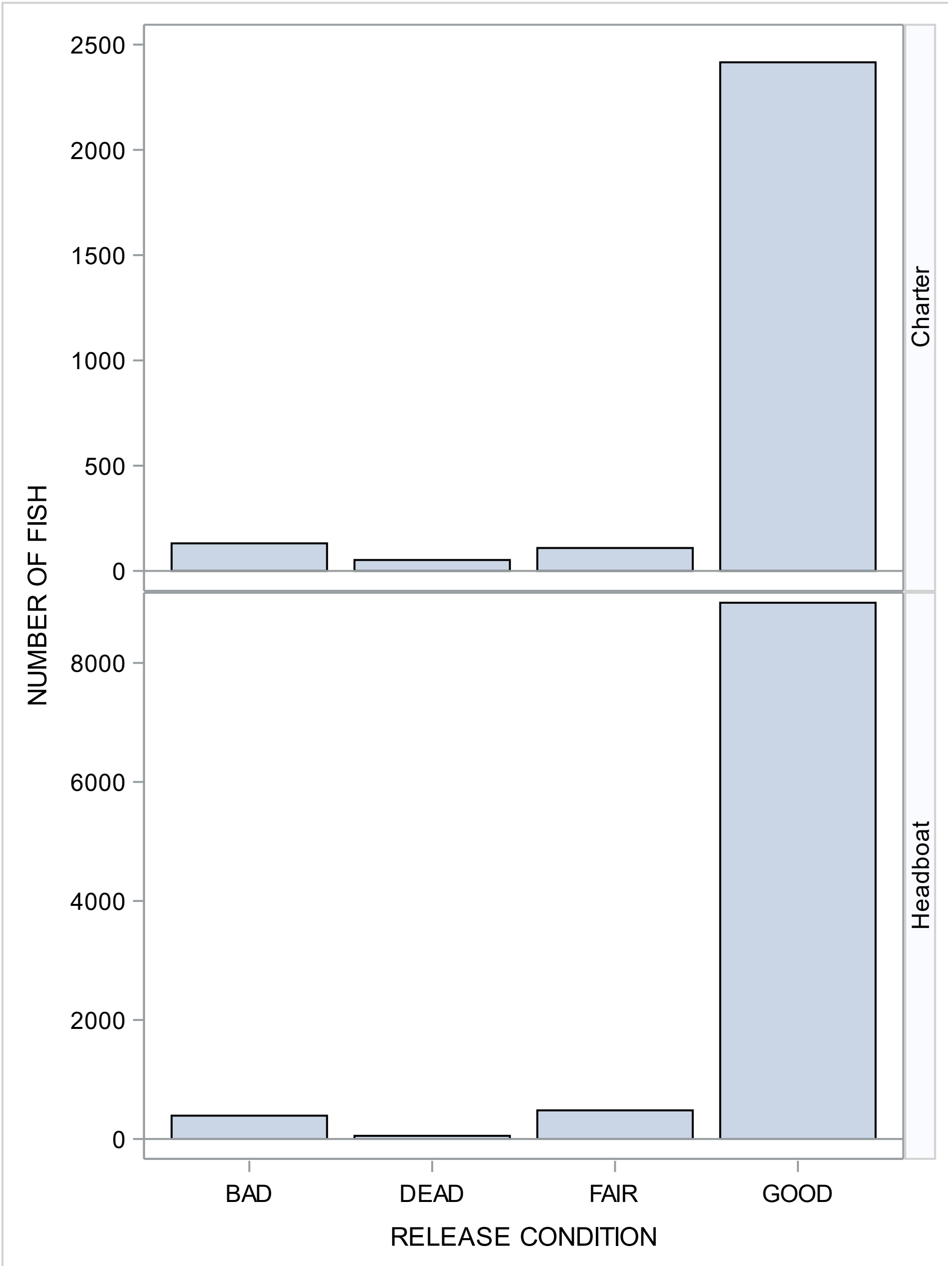

Figure 4. The total number of released Red Snapper (*Lutjanus campechanus*) by release condition and vessel type from the At-Sea Observer program. Charter data was collected between 2013-2015, 2017-2019, and 2021-2024. Headboat data was collected between 2011-2024.

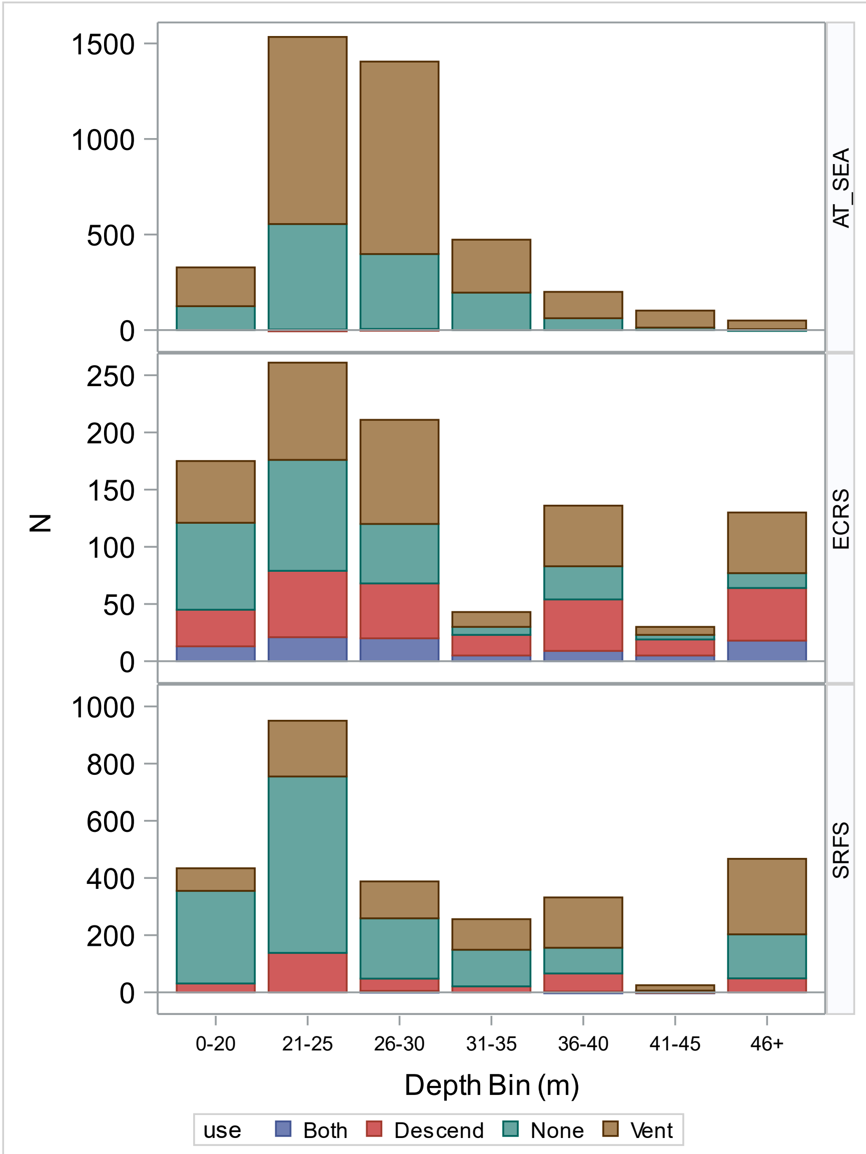

Figure 5. For At-Sea and SRFS data, the number of Red Snapper released (N) by depth bin (m) and release method (vent, descend, both or none) are shown. For ECRS data, the number of trips where at least one fish was released with each release method at each depth are shown. For example, ECRS trips in the 'Descend' column could have descended all released fish or they could have used a mix of surface release and descending categories.