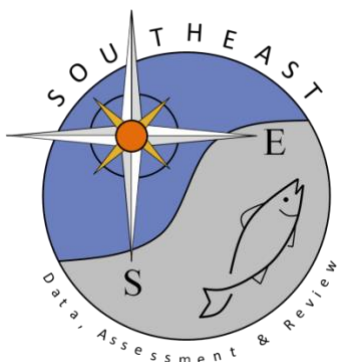


Descriptions of Florida's Mutton Snapper recreational fishery assessed  
using fishery-dependent survey data

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Descriptions of Florida's Mutton Snapper recreational fishery assessed using fishery-dependent survey data

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FDM-FWRI

The following analysis is intended to characterize the interactions between the for-hire /private recreational fishing fleets and Mutton Snapper in Florida waters. The data summaries presented include numbers of landed and released fish, typical fishing depth, size distribution (fork lengths in mm) of harvested and discarded fish, and release conditions of discarded fish in each region of the state. Additionally, we used fishery observer data (At-Sea) to estimate proportional mortality by depth in each for-hire sector within the two regions with the most observed catch of Mutton Snapper (southeast Florida and the Florida Keys). Finally, we included information on depredation, post-release predation, and the prevalence of predators observed at fishing stations with Mutton Snapper as opposed to those without Mutton Snapper.

All analyses presented here are derived from two sources, long-term monitoring data collected by at-sea observers (At-Sea: 2009-2020) aboard randomly selected for-hire fishing vessels (smaller charter boats and large headboats) and dockside sampling of the private fleet (State Reef Fish Survey – SRFS: 2015-2020). All data are aggregated by fleet (charter, headboat, private) and region. Regions of Florida are northwest Florida (NWFL – Escambia to Dixie counties, statistical zones 7-10), southwest Florida (SWFL – Levy to Collier Counties, statistical zones 3-6), Florida Keys (KEYS – Monroe County, statistical zones 1, 2, 748), southeast Florida (SEFL – Indian River to Miami-Dade counties, statistical zones 736-744), and northeast Florida (NEFL – Nassau to Brevard counties, statistical zones SAC 722-732).

#### State Reef Fish Survey

The State Reef Fish Survey has run continuously on the Florida Gulf coast since May 2015 (covering NWFL & SWFL regions). The survey was expanded state-wide in 2020 (extending coverage to include NEFL, SEFL, KEYS). This survey is an effort to collect data from private recreational anglers who target reef fish species. Anglers wishing to harvest certain reef fish species, including Mutton Snapper, on the Gulf or Atlantic coasts of Florida are required to have a State Reef Fish Angler designation on their fishing license. The State Reef Fish Survey is

composed of two survey components: a mail survey of State Reef Fish anglers, which collects data on angler effort, and a dockside intercept survey, which collects data on angler catches and fishing practices. Interview assignments are drawn from a subset of sampling sites known to have offshore fishing activity to intercept fishers that target reef fish. Data collected during dockside assignments include information regarding fishing depths and distances from shore while fishing for offshore species, number of harvested Mutton Snapper, and self-reported estimates of Mutton Snapper released during the fishing day. A subset of landed fish are measured (fork length in mm) and weighed (in kilograms) during the survey. Data presented here summarize information from dockside sampling and do not estimate effort.

#### At-Sea Sampling of for-hire vessels

At-sea data are collected on both headboats and charter boats that were randomly selected weekly, throughout the year. Sampling coverage varied by region and fleet. No sampling occurred between April 2020 and May 2021 due to the COVID-19 pandemic.

#### *Gulf Coast of Florida (NWFL, SWFL)*

Headboat observer surveys were conducted on the Gulf coast of Florida from 2005 to 2007, funded by the Gulf Fisheries Information Network (GulfFIN). In June 2009, the state of Florida secured alternative funds to continue at-sea observer coverage in the northwest panhandle and central peninsula, and expanded coverage to include the charter fleet. In the year 2014, data from headboats and charter vessels in NWFL and SWFL were a small subset of the sampled for-hire fleet and may not be representative of the fleet as a whole in that year.

#### *Florida Keys (KEYS)*

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.

#### *South Atlantic coast of Florida (NEFL, SEFL)*

On the South Atlantic coast, at-sea headboat sampling has been conducted continuously since 2004 funded by the Atlantic Coast Cooperative Statistic Program (ACCSP), with this report

including data collected between 2005 and 2020. At-sea sampling on Atlantic coast charter boats was funded with a 3-year MARFIN grant from 2013-2015.

Data collected included vessel location and fishing depth at each fishing station. Mutton Snapper caught (including both retained and released individuals) during sampled trips were measured [midline length (ML = FL); mm]. The final disposition of Mutton Snapper was observed by biologists, including barotrauma treatment and the condition of discarded fish post-release. Observers did not dictate to anglers whether barotrauma mitigation should occur. They merely recorded the barotrauma mitigation measures taken by the anglers. Many fish were tagged with conventional plastic-tipped dart tags, and angler recaptures were reported on a hotline.

### Release Condition and Mortality Estimates

We used at-sea observer data to estimate total numbers and proportions of live fish released in each of four conditions during monitored for-hire trips. The four release conditions were, in short: **good**: no barotrauma treatment, fish swam strongly down, **vent**: fish vented and swam strongly down, **impaired**: one of several visually obvious impairments at the surface, **deep-hooked**: fish hooked in damaging location or released with the hook in the body (more detail in Table 1). A few additional fish were released dead, observed preyed upon by a predator at the surface, or were recompressed using a descending device. These were not included in survival estimates.

Because the biology of Red Snapper and Mutton Snapper are quite similar, we used calculated survival by condition of Red Snapper from Sauls et al. (2017) to estimate mortality at each depth interval based on the proportion of Mutton Snapper in each release condition (Sauls 2014) within each for-hire fleet.

### Predator observations

At-sea observers recorded the presence of marine mammal, bird, and fish predators at all fishing stations. Fish (shark, barracuda, or goliath grouper primarily) predators were recorded if one of these species was caught by any anglers on the boat, or if the species was observed interacting with fish in the proximity of the boat at each fishing station. For this analysis, we selected only

trips that caught Mutton Snapper. We then divided the fishing stations into those at which Mutton Snapper were caught and those at which Mutton Snapper were not caught. We used a Chi-squared test to determine whether predators were observed more frequently at stations with Mutton Snapper.

## **Results and Discussion**

State reef fish survey biologists intercepted 83 fishing trips that reported catching Mutton Snapper. In total, these anglers kept a total of 33 fish and released 122 fish across the state (Table 2). However, important to note is that sampling in the Florida Keys, southeast Florida, and northeast Florida began in 2020, so only a partial year of data is included for these regions (sampling was suspended between March and mid-May of 2020 due to the COVID-19 pandemic). Mean numbers of Mutton Snapper encountered per angler that caught or released Mutton Snapper statewide was 1.86. Most of the private anglers catching Mutton Snapper were fishing in shallow water, and the majority of fish encountered by private anglers were released (Figure 1).

Capture depth in the for-hire fleets varied by region. In the Florida Keys, Mutton Snapper were caught in the shallowest water, with up to 76.53% caught in < 10-meter depth. Fish were encountered in deeper water in other areas. Anglers in southeast Florida caught fish in the deepest waters with up to 90% of fish being encountered in 20–39-meter depth (Table 3, Figure 2). While numerous larger fish were encountered, many of the Mutton Snapper encountered on for-hire fleets were smaller than the current legal size (18" total length) regardless of depth (Figure 3). However, it is important to note that minimum legal size was 16" total length from 1994 to 2018.

Because many of the fish encountered are not legal to keep, depredation, release condition, and post-release predation are important factors to understand. Approximately 47% of fish were released in good condition without being vented, 22% were vented but swam down strongly, and 1% of fish were descended in the for-hire fishery during the decade of sampling presented in this analysis. Approximately 19% of fish were impaired upon release, 8% of fish were deep-hooked, and 1.3% were released dead or eaten by a predator (Table 5). Very high proportions of fish released in the Florida Keys were released in good condition with no barotrauma intervention, likely due to the shallow water in which Mutton Snapper are targeted in

the region. In southeast Florida, a much higher proportion of fish were vented, in line with deeper fishing depths in the region (Figure 4).

Depredation on hooked fish and post-release predation are both important factors to consider regarding total survival of released fish. Less than one percent of fish were observed eaten by a predator at the surface upon release (Table 5). However, a higher percentage of stations with Mutton Snapper also had observed predators than stations without Mutton Snapper ( $\chi^2 = 28.24$ ,  $p < 0.01$ ; Figure 5). In several of the region/fleet combinations, the proportion of stations at which Mutton Snapper were recorded and predators were present were higher than expected, including both charter and headboat fleets in the Florida Keys and the Headboat fleet in southwest Florida and southeast Florida (Figure 5). Although these data do not specifically indicate that released fish were preyed upon, they do indicate a high prevalence of predators in areas where Mutton Snapper are caught and released.

We estimated total release mortality for Mutton Snapper in the Florida Keys and southeast Florida based on capture depth and the proportional survival of Red Snapper in similar depths (Sauls et al. 2017), in the combined for-hire fleets. Estimated mortality increased with depth, commensurate with increases in proportions of fish in more impaired release categories (Vent or Impaired as compared to Good) in each region (Figure 6). Total estimated mortality was higher in southeast Florida and the Florida Keys (Table 6, Figure 7), reflecting the high proportion of fish caught in shallow water in the Florida Keys. This difference was significant ( $Z = 1.72$ ,  $p = 0.07$ ), suggesting that the regions should not be combined for analysis. However, the pooled mortality estimate for all regions (NEFL, SEFL, KEYS, SWFL) combined was  $0.249 \pm 0.066$ , if a pooled release mortality estimate is desired.

#### Literature Cited

- Campbell MD, Driggers WB, Sauls B, Walter JF (2014) Release mortality in the red snapper (*Lutjanus campechanus*) fishery: a meta-analysis of 3 decades of research. *Fishery Bulletin* 112(4):283-296 doi:10.7755/fb.112.4.5
- Sauls B (2014) Relative survival of gags *Mycteroperca microlepis* released within a recreational hook-and-line fishery: Application of the Cox Regression Model to control for heterogeneity in a large-scale mark-recapture study. *Fisheries Research* 150:18-27
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Table 1. Description of release condition categories for Mutton Snapper observed on for-hire vessels (modified from Sauls 2014). In the mortality model, Impaired and Deep-Hooked fish were pooled for analysis. Fish that were descended, released dead, or preyed upon at the surface once released were not included in survival analyses.

Condition category	Description
Good (not vented/not impaired)	Fish immediately submerged without the assistance or venting, and did not exhibit any impairments
Vented (not impaired)	Fish immediately submerged after the swim bladder was vented, and did not exhibit any impairments
Impaired (vented or unvented: displaying distress)	Any fish that exhibited one or more of the following impairments: <ol style="list-style-type: none"> <li>1) chased by a predator near the surface</li> <li>2) disoriented or unresponsive at the surface before submerging</li> <li>3) buoyant at the surface and unable to submerge</li> <li>4) improperly vented by puncturing the stomach or anus</li> <li>5) bleeding from the gills</li> <li>6) exophthalmia (pop-eye), indicative of severe barotrauma</li> </ol>
Deep Hooked (hook embedded in deep tissue)	Any fish for which either of the following was true: <ol style="list-style-type: none"> <li>1) hook embedded in gill, eye, esophagus, or gut</li> <li>2) released with hook still embedded</li> </ol>
Dead	Any fish that was observed to float away making no movements
Preyed Upon	Any fish that was observed to be eaten by a marine predator once released. Most predators were dolphins, sharks, barracuda, and goliath grouper
Recompressed	Fish that were descended toward the bottom using a weighted device.



Table 2. **Dockside Private Fleet Interviews (SRFS)** Mutton Snapper total catch, kept fish, and released fish by Florida region. Total numbers of anglers reporting catching and keeping or catching and releasing Mutton Snapper, numbers of fish reported kept, numbers of fish reported released, and mean numbers of fish per trip for fishers reporting catching Mutton Snapper.

\*Dockside sampling intercepts occurred in northwest and southwest Florida from 2016-2020, but only occurred in the Florida Keys, southeast Florida and northeast Florida in 2020.

<b>Region</b>	<b>Number of trips</b>	<b>Number kept</b>	<b>Number Released</b>	<b>Mean Fish/Trip</b>
SWFL	32	14	41	1.72
KEYS*	29	10	43	1.83
SEFL*	18	9	16	1.39
NEFL*	4	0	22	5.50
<i>STATE-WIDE</i>	<i>83</i>	<i>33</i>	<i>122</i>	<i>1.86</i>

Table 3. **At-Sea Observations of for-hire fleets (at-sea)** Numbers and percentage of Mutton Snapper released in each fleet by depth. Data are measured values (vessel exact fishing depth and counts of released fish) taken by observers deployed on for-hire fishing trips. Data represent 2009-2020.

<b>Depth (m)</b>	<b>% Released Fish</b>							
	<b>SWFL</b>		<b>KEYS</b>		<b>SEFL</b>		<b>NEFL</b>	
	<i>Charter (n=42)</i>	<i>Headboat (n=36)</i>	<i>Charter (n=213)</i>	<i>Headboat (n=497)</i>	<i>Charter (n=220)</i>	<i>Headboat (n=1021)</i>	<i>Charter (n=2)</i>	<i>Headboat (n=52)</i>
0-9	11.90	0.00	76.53	54.53	2.73	1.67	0.00	0.00
10-19	59.52	41.67	8.92	26.56	0.00	10.38	0.00	0.00
20-29	7.14	8.33	2.35	9.26	40.45	37.61	100.00	90.38
30-39	16.67	27.78	3.76	4.23	51.36	26.64	0.00	9.62
40-49	0.00	19.44	4.69	2.21	3.18	17.43	0.00	0.00
50-59	0.00	0.00	0.00	2.41	1.36	4.51	0.00	0.00
60-69	0.00	2.78	3.76	0.80	0.00	1.57	0.00	0.00
70-79	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
80+	4.76	0.00	0.00	0.00	0.91	0.00	0.00	0.00

Table 4. **Dockside interviews of private fleet (SRFS)**. Statewide private fleet. Data are self-reported values collected dockside by samplers interviewing private anglers at the end of their fishing day. These values include recalled numbers of released fish and estimated maximum fishing depth for the day. Maximum fishing depth was chosen to represent the most conservative (worst case) scenario. Fishers were intercepted from 2016-2020 in SWFL & NWFL. \*Fishers were intercepted in all other regions of the state in **2020 only**. Total number of interviewed anglers-trips reporting catching Mutton Snapper = **121**.

<b>Depth (m)</b>	<b>% Released Fish</b>
0-9	35.54
10-19	9.09
20-29	34.71
30-39	8.26
40-49	3.31
50-59	3.31
60-69	3.31
70-79	0.00
80+	2.00

Table 5. **At-Sea Observations of for-hire fleets (at-sea)** Numbers of Mutton Snapper released by release category across all at-sea for-hire recreational fishery data 2009-2020. \*Fish observed preyed upon at the surface by marine predator (dolphin, shark, barracuda, or Goliath Grouper).

Release Condition	SWFL		KEYS		SEFL		NEFL		Total
	Charter	Headboat	Charter	Headboat	Charter	Headboat	Charter	Headboat	
1-Good	27	31	136	387	109	347	0	28	1065
2-Vent	7	8	11	37	75	356	2	10	506
3-Impaired	6	4	34	90	37	253	0	8	432
4-Deep-hooked	2	0	35	92	1	59	0	8	197
5-Dead	0	0	4	2	1	10	0	0	17
6-Preyed upon*	0	1	0	1	0	10	0	0	12
7-Recompressed	0	0	2	0	3	17	0	0	22
<i>Grand Total</i>	<i>42</i>	<i>44</i>	<i>222</i>	<i>609</i>	<i>226</i>	<i>1052</i>	<i>2</i>	<i>54</i>	<i>2251</i>

Table 6. Total estimated proportional mortality within the Mutton Snapper primary capture regions in the for-hire fleet. Observations included venting as the primary means of barotrauma mitigation. Because only 1% of fish were reported descended, these fish were excluded from mortality calculations. Calculations are based on estimated survival of Red Snapper from a large conventional tagging study (Sauls et al. 2017), proportion of fish released in each impairment condition (Table 1) at each depth (Table 4) and calculated proportional mortality of fish released in each of the conditions.

Region	Total Mortality
SEFL	0.27 ± 0.06
KEYS	0.23 ± 0.07

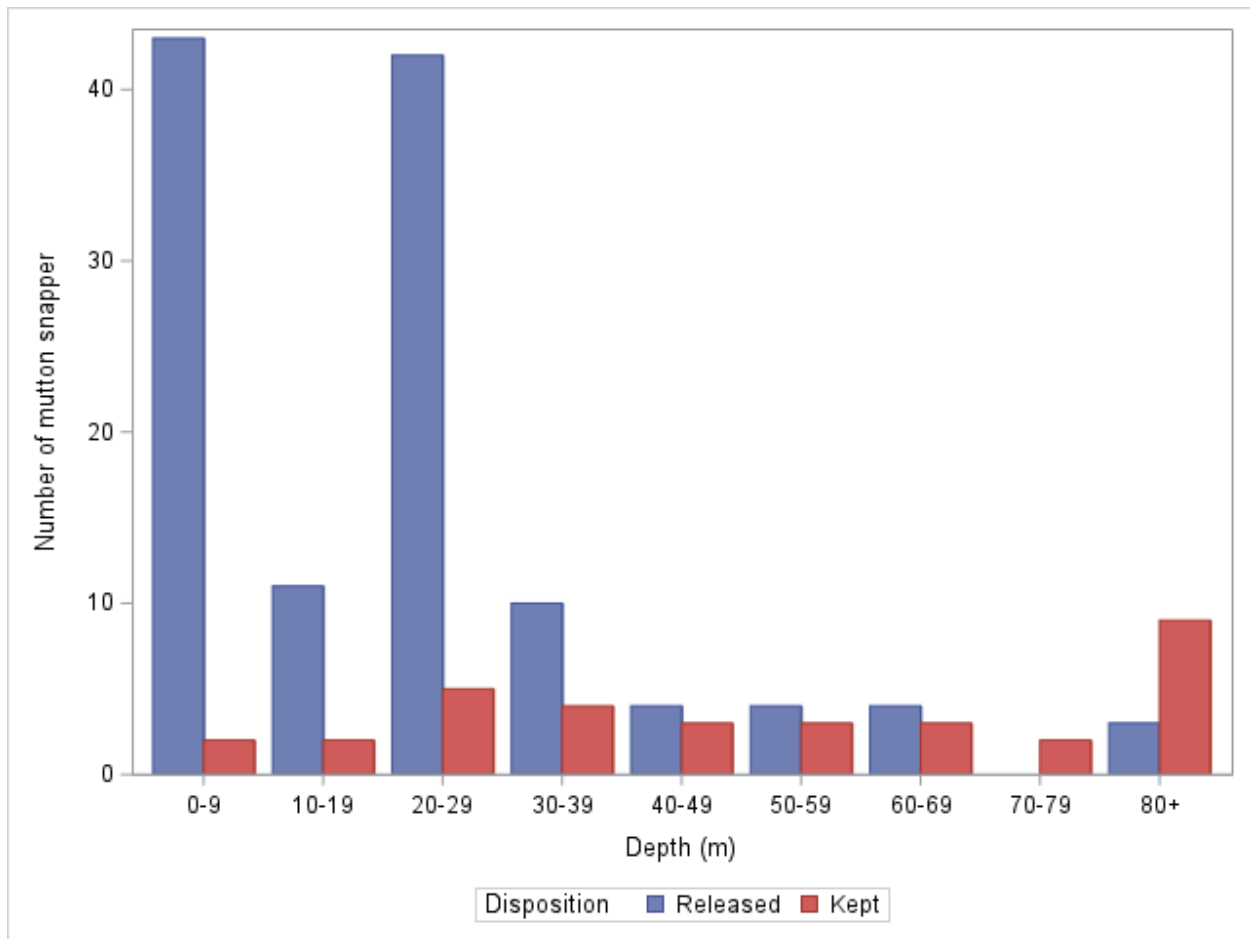


Figure 1. **Dockside Private Fleet Interviews (SRFS)**. Angler reported maximum fishing depth on trips for which Mutton Snapper were encountered (retained and released). Maximum fishing depth was chosen to represent the most conservative (worst case) scenario. Data are found in Tables 2 & 4.

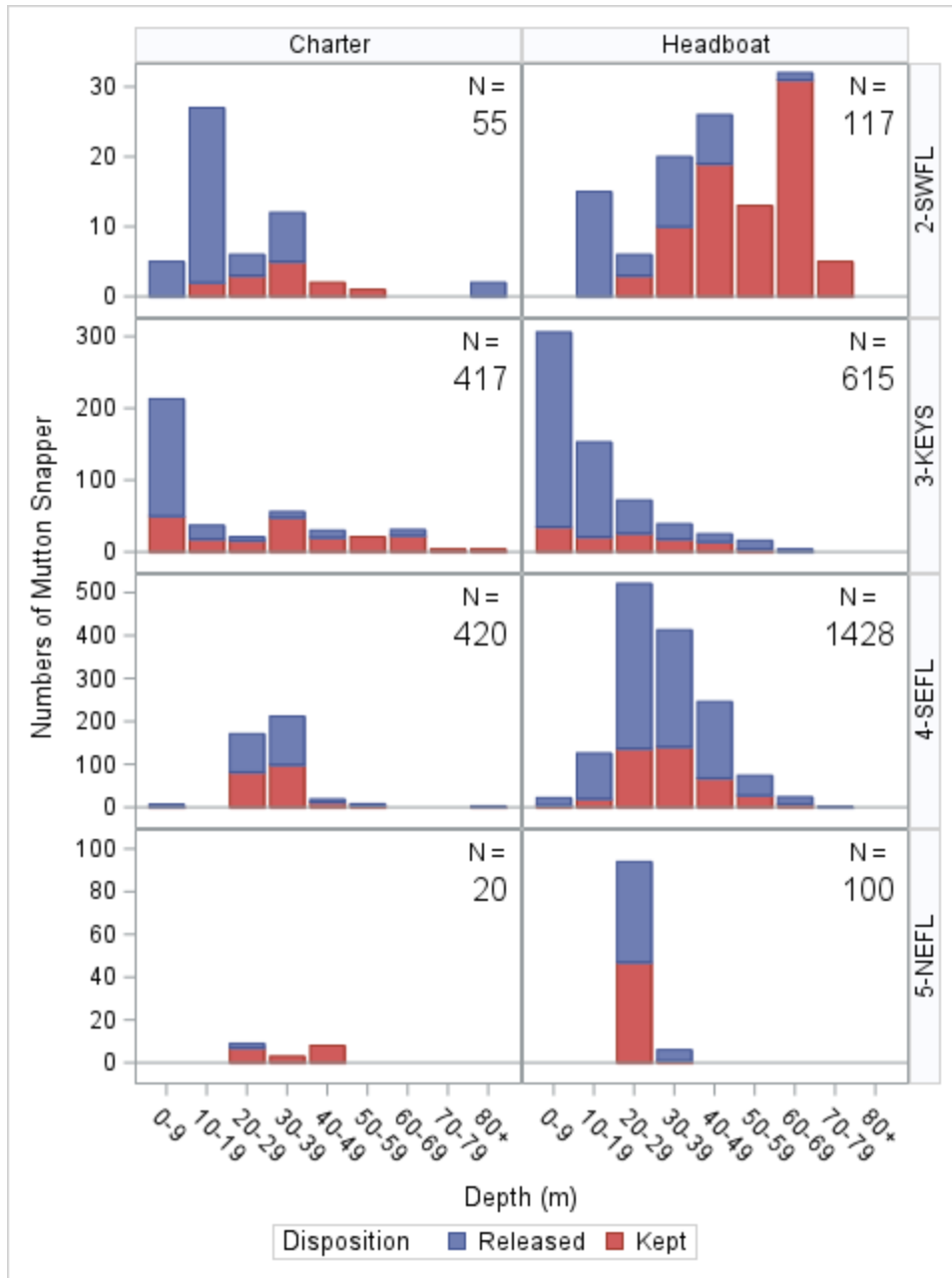


Figure 2. **At-Sea sampling of the For-hire fleet.** Numbers of Mutton Snapper kept, and numbers released in each depth bin 2009-2020. Total numbers of fish observed in each fleet/region are listed in each panel.

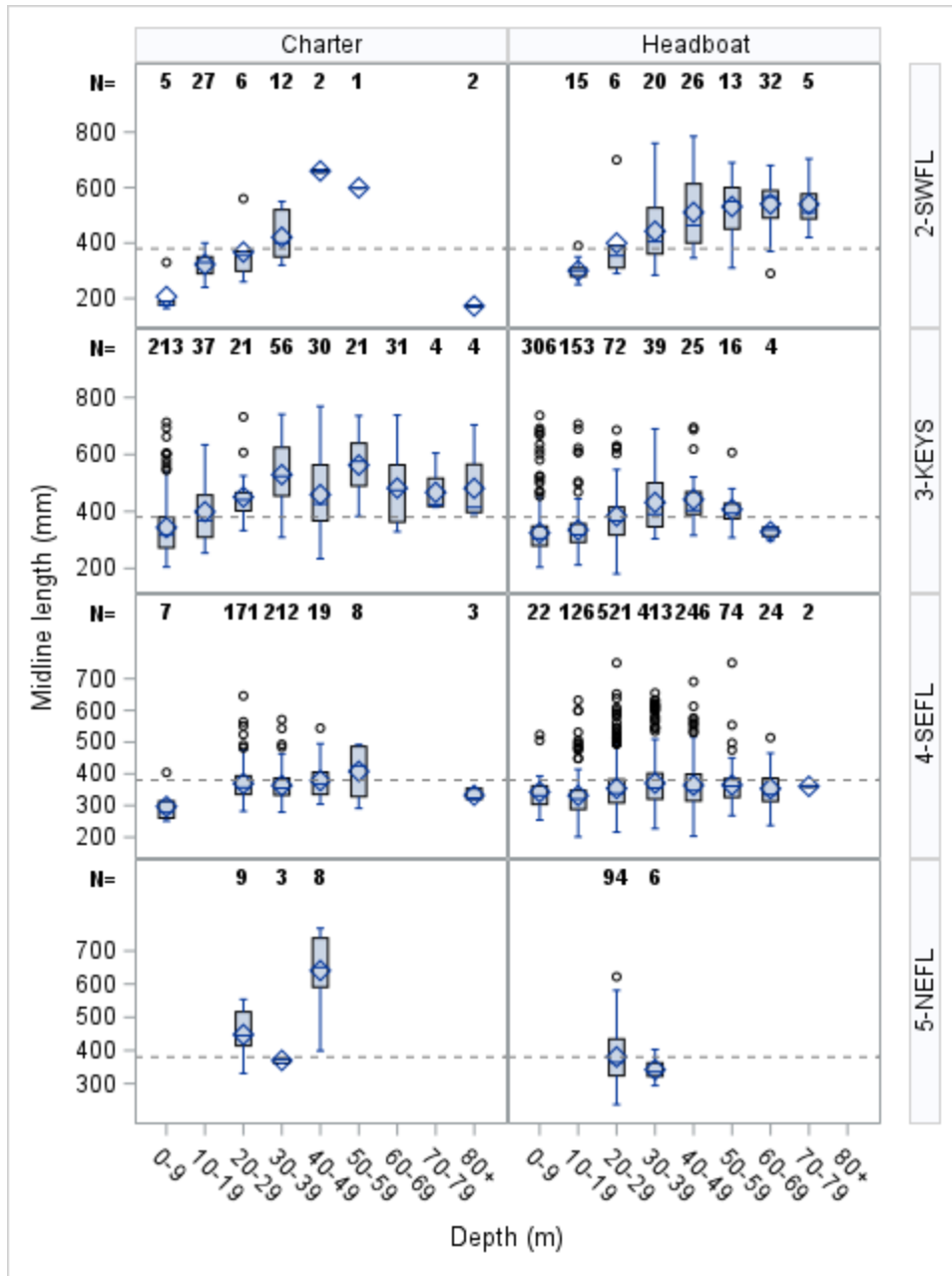


Figure 3. **At-Sea sampling of the For-hire fleet.** Numbers of Mutton Snapper **ENCOUNTERED (RETAINED + RELEASED)** by length and depth strata 2009-2020. Total numbers of fish in each depth interval are listed above each box. The dashed line represents the current minimum legal size (18" total length).

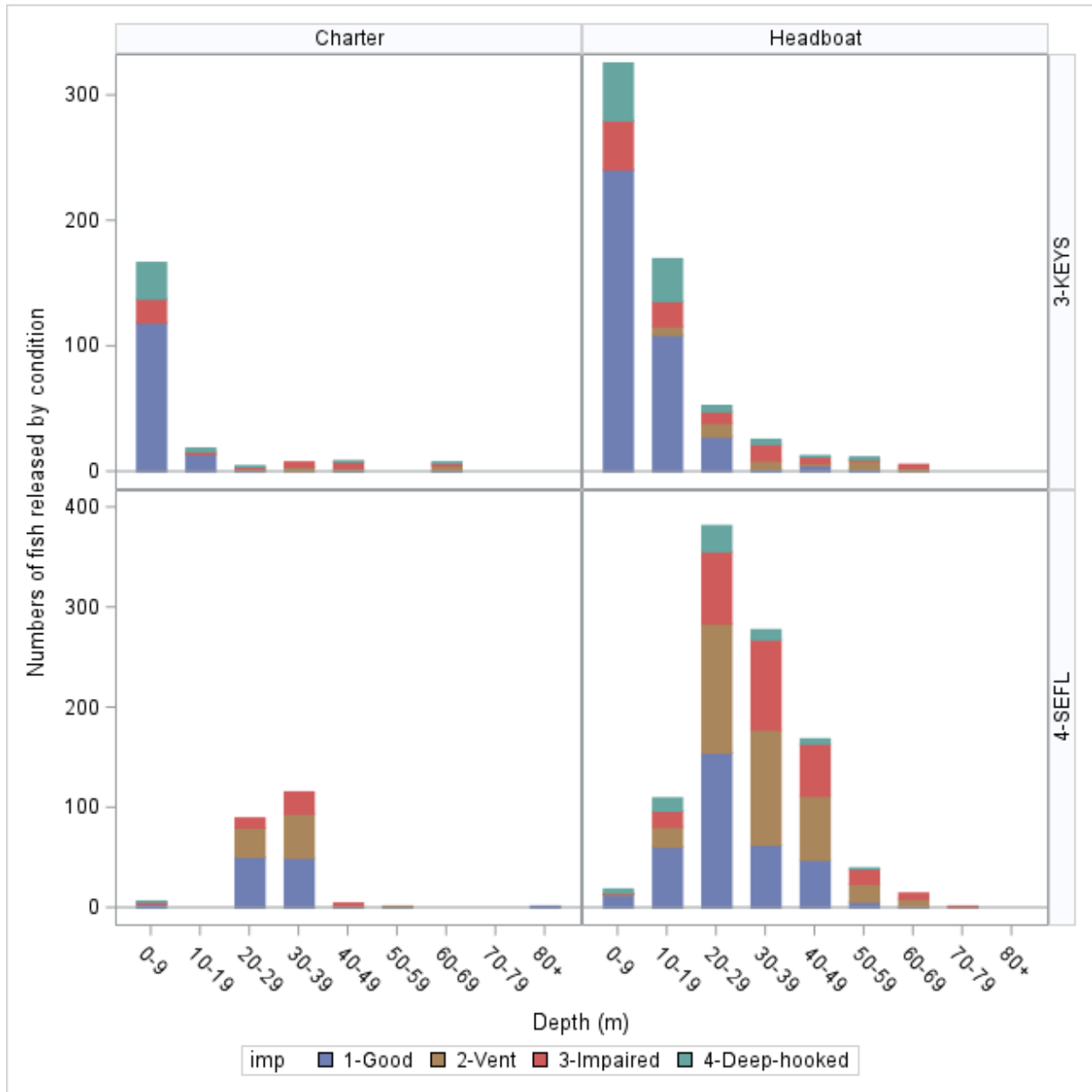


Figure 4. **At-Sea sampling of the For-hire fleet.** Numbers of Mutton Snapper released alive in each of the four release conditions (Table 1) by region/fleet and depth strata. Only regions in which Mutton Snapper are typically targeted are shown (SEFL, KEYS). Data are presented numerically in Table 5 (Release conditions 1-4).

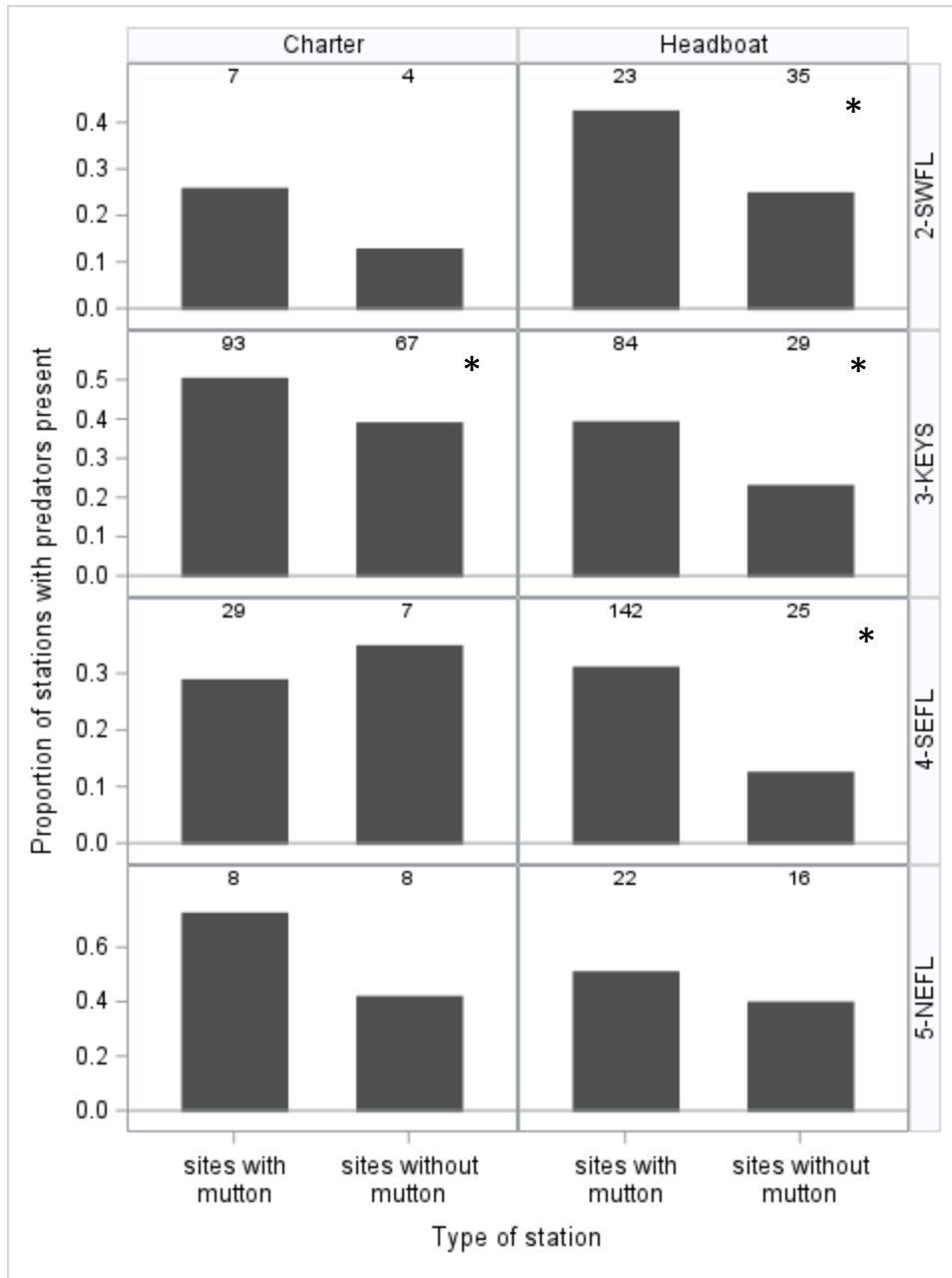


Figure 5. **At-Sea sampling of the For-hire fleet.** Data includes only trips on which Mutton Snapper were encountered. Fishing sites were divided between sites at which Mutton Snapper were observed and sites at which no Mutton Snapper were observed. Bars are proportion of sites with observed predators (dolphins, sharks, Goliath Grouper, or Barracuda). Numbers at the top of each bar represent total numbers of sites with observed predators. \* Denotes significant difference based on  $\chi^2$  (KEYS-Headboat, KEYS-Charter, SEFL-Headboat). Overall  $\chi^2 = 28.24$ ,  $p < 0.001$ .



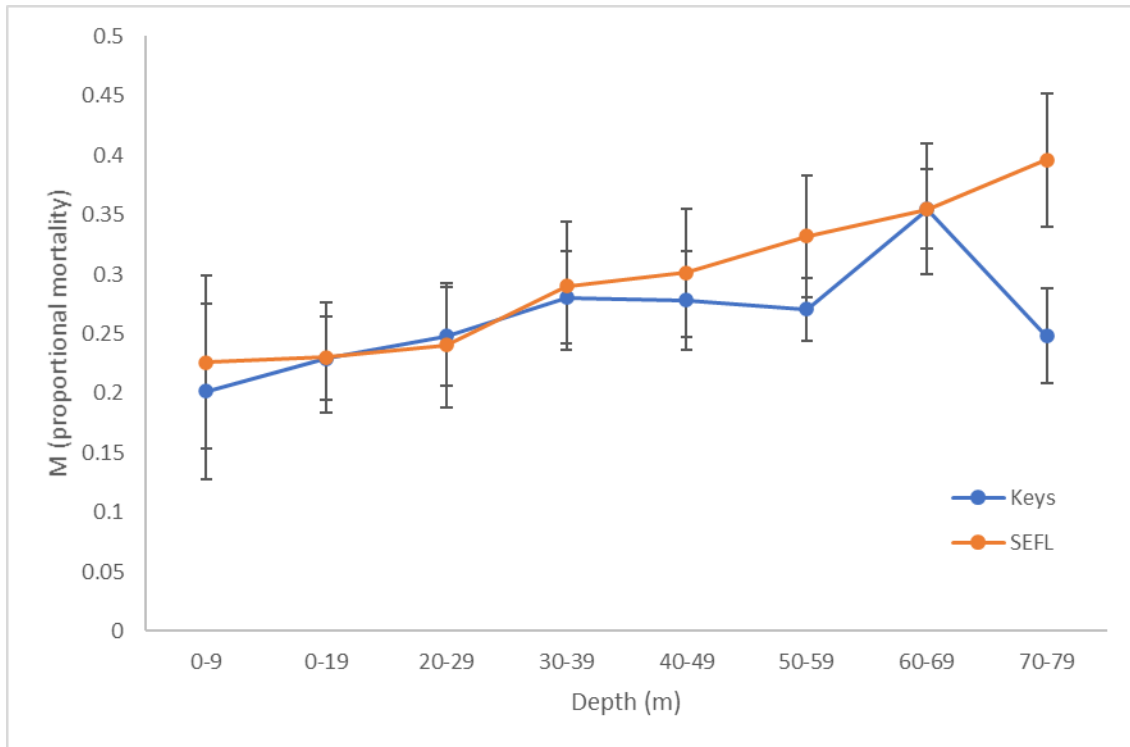


Figure 6. **For-hire fleet (Charter & Headboat combined):** Estimated mortality by depth based on survival likelihood and proportion of released fish in each of four impairment categories (Table 1).

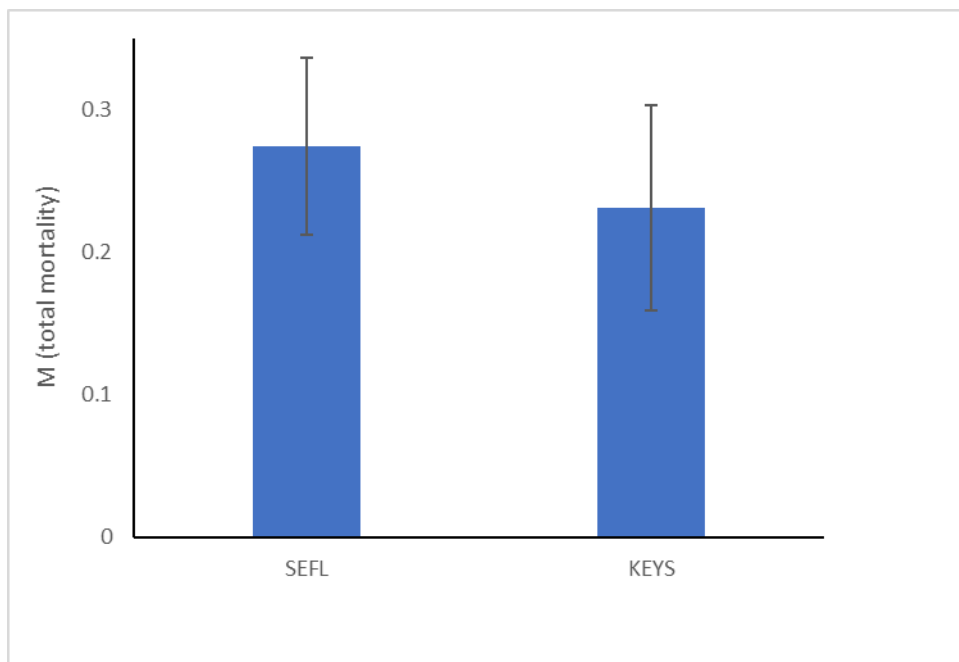


Figure 7. **For-hire fleet (charter and headboat combined by region):** Estimated total mortality within each region based on proportional mortality by depth. Proportional mortality differed significantly by region ( $Z = 1.72$ ,  $p = 0.047$ ).