A description of Florida's Gulf Coast recreational fishery and release mortality estimates for the central and eastern subregions (Mississippi, Alabama, and Florida) with varying levels of descender use

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A description of Florida's Gulf Coast recreational Red Snapper (*Lutjanus campechanus*) fishery and release mortality estimates with varying levels of descender use for the central and eastern subregions (Mississippi, Alabama, and Florida)

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Sampling protocol specifics for each data collection are described below. All data are divided by fleet (charter, headboat, private) and region. Florida regions throughout this document are **NWFL** [Escambia to Levy counties (Federal SAC 7-10: contained within **Central** Gulf of Mexico stock)] and **SWFL** [Citrus to Monroe Counties (Federal SAC 1-6: encompassing the entire **Eastern** Gulf of Mexico stock)]. Alabama (AL) and Mississippi (MS) are each considered individually.

This document contains data summaries describing the structure of the Florida recreational fishery (private and for-hire) along with estimates of proportional mortality by depth in each for-hire sector (headboats and charter boats) in four subregions (MS, AL, NWFL, SWFL). Projection estimates describing release mortality reductions possible in each fleet with several levels of descender device usage as a barotrauma mitigation method are also presented.

State Reef Fish Survey

Florida

The State Reef Fish Survey (SRFS) has run continuously on the Florida Gulf coast since May 2015. This survey is a directed effort to collect data from offshore private recreational anglers who target reef fish species. Anglers wishing to harvest certain reef fish species, including Red 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 MRIP sampling sites known to have offshore fishing activity to intercept fishers that target reef fish. Data collected during dockside assignments include information regarding target species, fishing depths and distances from shore while fishing, and estimated numbers of Red Snapper released during the fishing day. A subset of landed fish are measured (mm FL) during the survey. Data presented here summarize information from dockside sampling and do not estimate effort.

At-Sea Observer Sampling of for-hire vessels

Florida

For Florida's at-sea observer program, both headboats and charter boats were randomly selected weekly throughout the year (2009-2020). Data collected during fishing included vessel location and water depth. All Red Snapper caught during sampled trips were measured [midline length (ML = FL); mm]. Any Red Snapper released were assessed and treated for barotrauma as appropriate (all observed fish were vented. No observations were made of anglers using descenders during for-hire trips) and coded for release condition. 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 recorded on a hotline.

Overnight or multiple-day headboat trips are relatively uncommon in the fleet, but make up a substantial proportion of trips on which Red Snapper are encountered in the SWFL region. Because these trips are over-sampled with respect to their total contribution to for-hire fishing effort, we treated these trips as separate from single-day headboat trips when producing data summaries. When calculating mortality estimates (below) the single-day and multi-day headboat trips were recombined using weighting factors to more accurately reflect contributions to the overall fleet.

Alabama

Alabama's At-sea observations aboard for-hire vessels is a component of several projects undertaken by the Alabama Department of Conservation and Natural Resources, Marine Resources Division (MRD) as part of a recreational finfish data collection effort with the purpose to describe characteristics of the recreational catch. Specifically, the At-sea observer program focused on the discards of reef fish caught and released aboard participating for-hire vessels operating out of Alabama ports. Additionally, the data could be used to evaluate the performance of circle hooks. The time period for this National Fish and Wildlife Foundation program was 2017 through 2019 during the peak reef fishing months of May through September.

For-hire vessels operating from Mobile or Baldwin counties possessing a valid NMFS reef fish permit were eligible to participate in the voluntary program. These vessel owners/captains received a letter detailing the project and were given the opportunity to register their vessel with MRD. From the list of volunteers, vessels were randomly selected and contacted for availability each week. Captains were not obligated to participate when contacted.

During the scheduled trips, MRD observers attempted to record data from all anglers in parties of less than eight. For angler parties greater than 8, observers randomly selected anglers to record data from during the fishing trip. Data fields collected during the trip included hook type, hook position, release condition, release disposition and the use of a venting tool on released fish. Alabama's program was created to compliment the program in use by the state of Florida. Types of barotrauma were not recorded. MRD staff were instructed not to interfere with the vessel's crew's handling of the fish and should ask permission to measure fish before the trip begins.

Mississippi

Mississippi Department of Marine Resources (MDMR)'s reef fish observer program began in the summer of 2016 and has continued annually during both the state and federal Red Snapper seasons through the end of the 2021 season. This program has aimed to place observers on 9 for-hire trips per month based on random selection while accounting for each vessel's availability during the season. During this time, observers recorded at-sea data such as release status, barotrauma effects, and the presence of hook injuries for all fish released during each trip. Variables such as hook location and the handling of fish by both the anglers and the vessel's crew were not recorded. Additionally, due to the shallow nature of Mississippi's Red Snapper fishery, this program did not collect information on barotrauma treatment as this practice does not occur across the observed fleet.

Release Condition and Mortality Estimates

To the extent possible, at-sea observer data from each state was used to estimate total numbers and proportions of 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 3). No observed Red Snapper were descended during the time of data collection.

We used calculated survival by condition from Sauls et al. (2017) to estimate mortality at each depth based on the proportion of fish in each release condition (Sauls 2014) within each for-hire fleet/region. We then calculated a single release mortality estimate for each fleet (NWFL Charter, NWFL Headboat, SWFL Charter, SWFL Headboat, Mississippi Charter, Mississippi Headboat, Alabama Charter). In an effort to calculate the most accurate release mortality estimate for the SWFL headboat fleet, we applied weighting factors to the catch associated with trips of varying duration stratified by year. We included four trip duration strata (Half-day, Three-quarter day, Full-day, and Multi-day) and weighted catch according to trip duration to account for over/under-sampling of the trip-duration stratum each year. In this way, the catch, and subsequent release mortality, associated with multi-day headboat trips was not substantially over-represented in the calculations for this fleet.

Discard mortality (M) within each 10-m depth-interval was expressed as a proportion using the equation:

$$M = 1 - \frac{\left(N_1 S_1 + N_2 X_1 \widehat{D}_2 + N_2 (1 - X_1) \hat{S}_2 + N_3 X_1 \widehat{D}_2 + N_3 (1 - X_1) \hat{S}_3 + N_4 \hat{S}_3\right)}{N_1 + N_2 + N_3 + N_4}$$

where N_1, N_2, N_3, and N_4 are the numbers of fish released in good, vented, impaired, and deep-hooked condition, respectively. S_1 is the absolute survival for fish released in good condition. Uncertainty around the true value of S_1 was accounted for by assigning a median value of 92.5% survival, with a confidence interval of 85─100%, based on a meta-analysis that estimated total Red Snapper discard mortality in the recreational fishery (Campbell et al. 2014). The estimated survival for 40 m (85%) was chosen from Campbell et al. (2014) as a conservative lower limit to survival of fish in good condition because the majority (> 85%) of fish in the current study were caught in shallower than 40 m and fish with any form of impairment were excluded from this group. S_2 and S_3 are estimated survival proportions for vented and impaired/deep-hooked fish, respectively, derived from the proportional hazards model. Each survival estimate included a variable (D_2) that allowed for the quantification of potential decreases in discard mortality by including descender devices as a barotrauma mitigation method (Table 4). Estimates were generated under varied descender device use (X_1: 0, 25, 50, 75 and 100%) to measure the degree

of reduction in discard mortality at several degrees of angler behavior change. We assumed that the survival of fish in both the good and deep-hooked conditions would not be impacted by potential increases in descender use. These methods are similar to those described in Vecchio et al. (2020), which was used as a post-release mortality estimate in SEDAR 73.

Results

Florida: fishery description in NWFL and SWFL

Between 2015 and 2020, anglers intercepted by the State Reef Fish Survey were asked about whether they had targeted Red Snapper or caught any Red Snapper during their trip. Of 46,632 interviews along the Gulf coast of Florida, 2,866 anglers reported targeting Red Snapper or catching at least one Red Snapper during their trip (Table 1). In NWFL, approximately 18.85% of interviewed private anglers indicated that they either targeted or caught Red Snapper during their trip. In contrast, only 1.37% of interviewees in SWFL identified Red Snapper as a targeted or captured species (Table 1). At-sea observers recorded data on the capture of a total of 26,330 Red Snapper (including both retained and released individuals) on for-hire vessels in the Gulf of Mexico off the Florida coast from 2009 to 2019. The largest proportion, 12,454 (43.7%) were encountered in the NWFL charter fleet (Table 2).

At-sea samplers recorded the depth of each fishing station. To estimate the fishing depth of private anglers, the maximum reported depth was used and converted from ft to m. Over 80% of Red Snapper captured in the NWFL region were captured in < 40m in each of the three fleets. SWFL headboats caught ~ 60% of their fish in 30-49 m of water, while a relatively even distribution occurred in the SWFL charter fleet from 20-59 m, suggesting a broader distribution and deeper concentration of these fish in SWFL (Figures 1 & 2). In SWFL private anglers fished in < 40m 77% of the time (Table 2, Figure 3). Depth distribution of released fish (Figure 2) closely mirrored depth distribution of all fish caught in the for-hire fleet. Red Snapper observed in the for-hire fleet were captured at 3,430 locations with multiple individuals captured at many of the locations.

To investigate whether a Red Snapper range expansion could be detected in our data over the past decade, we plotted the mean numbers of Red Snapper caught by latitude (0.1 degrees) and year by fleet (Figure 4-7). Although most at-sea sampling occurred in NWFL during the first few

years of the survey, there is an indication that Red Snapper being captured further south over the past few years. This trend is especially evident in the at-sea data. Numbers of Red Snapper encountered south of 28º have increased since 2009, with substantially higher numbers after 2016 (Figure 4). A southward distribution expansion does not appear in the private angler data. However, the survey did not begin across the full region until 2016, so any major expansion may have occurred prior to the initiation of sampling (Figures 5-7).

We investigated the relationship between Red Snapper FL and depth of capture in each fleet. We found that fish above the minimum legal size were found in all depth deeper than 10 m. Mean FL did increase slightly with depth, but this seems to be a function of smaller fish not being found in deep water rather than larger fish being found there more frequently. Red Snapper up to 800 mm FL were routinely captured in 20-29 m (Figures 8-10).

Florida Release Condition and Mortality Estimates: NWFL and SWFL

We summarized the numbers of fish released in each of four impairment conditions (release conditions listed in Table 3) at 10 m depth intervals for each fleet. The majority of fish in both the NWFL Charter and NWFL Headboat fleet were caught in 20-39 m of water and released in good condition (Table 5; Figure 11). Fish were encountered slightly deeper in the SWFL fleets and were, therefore, more likely to be vented before release (Figure 11). Less than 10% of fish in either region were deep-hooked or considered impaired upon release (Table 5).

In each of the four Florida for-hire fleets (NWFL Charter, NWFL Headboat, SWFL Charter, SWFL Headboat), estimated mortality increased with depth (Figure 12). As depth increases, proportions of fish released in vented or impaired conditions also increases, resulting in higher proportional mortality. Overall release mortality was estimated to be lowest in the NWFL Charter fleet and highest in the SWLF Headboat fleet (Table 6, Figure 13). However, numbers of fish observed in the SWFL fleets were much lower than numbers observed in the NW fleets, potentially driving some of this difference.

When exploring the impact of increased descender use on mortality by depth, we estimated that mortality would decrease with each proportional increase in descender use as the barotrauma mitigation measure of choice (Figures 13). The largest estimated decrease in overall mortality

by fleet was in the NWFL Headboat fleet with an estimated 8.1% decrease in overall mortality when transferring 100% of "vent" and "impaired" fish to "descended." However, recent meetings including for-hire industry representatives indicate that such methodological changes will be especially rare in the headboat fleet due to logistical concerns. We suggest that the estimates produced for charter fleets in each region may be applicable to the private fleets due to similarities in fishing depths and numbers of anglers per vessel in these fleets.

Alabama and Mississippi: Release Condition and Mortality Estimates

We summarized the numbers of fish released in each of four impairment conditions (conditions described in Table 3) at 10 m depth intervals for each fleet. The majority of fish in the Alabama Charter fleet were caught in less than 19 m of water, while depth distributions within the Mississippi fleets were more evenly divided between 0-19 and 20-29 m. No fish were recorded in >30 m depth. In all cases, the vast majority of released fish were considered in Good condition upon release (Table 5; Figure 11).

In each of the three fleets (Alabama Charter, Mississippi Charter, Mississippi Headboat), estimated mortality increased with depth (Figure 12). Because fish were never caught deeper than 29 m in any of these fleets, overall release mortality was quite low and descenders may not have a large impact on mortality (Figures 12 & 13). Among these fleets, the Mississippi headboat fleet was estimated to have the lowest total mortality (11.4%), due, in part, to the high proportion of the fishery operating in water shallower than 20 m where barotrauma is rare (Table 6, Figure 13). In the event of increasing descending device usage within these fleets, the largest decrease in mortality would be in the Mississippi Charter fleet with an estimated 6.25% decrease in mortality with the inclusion of descenders (Table 6, Figure 13).

Table 1. **Florida dockside interviews of private anglers (SRFS).** Numbers of dockside interviews conducted. Percentage of anglers targeting, harvesting, or releasing Red Snapper. These data are summarized from the Florida State Reef Fish Survey (SRFS).

Region	Total Interviews	Target/Release RS	% target RS
NWFL	12,716	2,398	18.85
SWFL	33,916	468	1.37

Table 2. **Florida dockside interviews (SRFS) + At-Sea Observations (at-sea)**. Percentage of Red Snapper released in each fleet by depth. Charter and Headboat depth are measured values (vessel exact fishing depth and counts of released fish) taken by observers deployed on for-hire fishing trips. SWFL Headboat trips are broken into single-day and multi-day segments. 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.

Depth (m)	NWFL			SWFL			
	Charter	Headboat	Private	Charter	Single-day Headboat	Multi-day Headboat	Private
0-19	0.76	0.00	24.22	10.30	16.02	0.05	5.43
20-29	34.38	32.93	37.85	25.20	13.86	2.99	27.70
30-39	50.99	52.16	26.18	23.59	36.66	31.34	44.57
40-49	8.48	10.62	2.56	16.73	33.30	33.77	14.62
50-59	3.44	3.11	2.05	19.72	0.25	22.78	6.13
60-69	1.03	0.68	1.93	4.46	0.13	5.55	1.12
70-79	0.41	0.38	1.18	0.00	0.00	1.67	0.00
80+	0.36	0.12	1.73	0.00	0.00	1.82	0.24
Total #	**8,893**	**6,603**	**14,989**	**1,430**	**772**	**1,975**	**3,296**

Table 3. Description of release condition categories for Red Snapper observed on for-hire vessels (modified from Sauls 2014). In the mortality model, Impaired and Deep-Hooked fish were pooled for analysis.

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: 1) chased by a predator near the surface 2) disoriented or unresponsive at the surface before submerging 3) buoyant at the surface and unable to submerge 4) improperly vented by puncturing the stomach or anus 5) bleeding from the gills 6) exophthalmia (pop-eye), indicative of severe barotrauma
Deep Hooked (hook embedded in deep tissue)	Any fish for which either of the following was true: 1) hook embedded in gill, eye, esophagus, or gut 2) released with hook still embedded

Table 4. Estimated survival of Red Snapper after recompression from six research studies (Bohaboy et al. 2020; Curtis et al. 2015; Drumhiller et al. 2014; Runde et al. 2021; Stunz et al. 2017; Tomkins 2017).

Study	Depth (m)	n	n survived	% survival
Bohaboy et al (2020)	30	30	22	73.33
Curtis et al (2015)	30-50	25	20	80.00
Drumhiller et al (2014)	30	6	6	100.00
Runde et al (2021)	37	36	33	91.67
Stunz et al (2017)	40	15	14	93.33
Tompkins (2017)	30-50	40	30	75.00
Grand Mean (± SD)	**30-50**	**97**	**83**	**82.26 ± 10.93**

Table 5. **Florida At-Sea sampling of the For-hire fleet**. Total numbers of fish for which release was observed and percent of observed fish released in each of four impairment categories 1: Good, 2: vented, 3: Impaired 4: Deep-hooked (described in table 3) in the charter and headboat fleets of the NWFL and SWFL regions. Note that in the SWFL region, single-day and multi-day headboat trips are separated. Multi-day trips are able to travel farther (to deeper water) than those that leave and return within a single day.

NWFL-Charter						NWFL-Headboat				
Depth	**Total #**	% Good	% Vent	% Impaired	% Deep-hooked	**Total #**	% Good	% Vent	% Impaired	% Deep-hooked
0-19	**80**	75	13.75	7.5	3.75	**0**	.	.	.	.
20-29	**3,075**	59.74	31.53	4.48	4.25	**2,181**	30.11	56.43	9.72	3.74
30-39	**4,512**	44.39	44.3	6.78	4.54	**3,406**	23.88	62.75	10.15	3.22
40-49	**749**	37.12	45.66	11.75	5.47	**731**	26.16	61.19	10.03	2.62
50-59	**304**	29.93	56.58	9.54	3.95	**206**	16.34	62.38	18.81	2.48
60-69	**99**	21.98	45.05	21.98	10.99	**44**	9.09	63.64	27.27	0
70-79	**38**	36.11	50	11.11	2.78	**25**	16	68	16	0
80+	**25**	12	56	32	0	**8**	0	37.5	62.5	0

SWFL-Charter						SWFL-Single-day Headboat				
Depth	**Total #**	% Good	% Vent	% Impaired	% Deep-hooked	**Total #**	% Good	% Vent	% Impaired	% Deep-hooked
0-19	**142**	75.18	15.6	2.84	6.38	**124**	53.22	20.16	4.03	22.58
20-29	**347**	32.17	49.57	3.48	14.78	**107**	34.58	41.12	8.41	15.89
30-39	**356**	8.36	68.11	7.43	16.1	**283**	17.66	66.07	8.48	7.77
40-49	**251**	9.61	69.87	7.86	12.66	**255**	8.23	71.37	9.41	10.98
50-59	**273**	16.67	60.74	7.04	15.56	**2**	0	50.00	50.00	0
60-69	**61**	3.28	73.77	6.56	16.39	**1**	0	100	0	0
70-79	**0**	.	.	.	.	**0**	.	.	.	.
80+	**0**	.	.	.	.	**0**	.	.	.	.

SWFL Multi-day Headboat					
Depth	**Total #**	% Good	%Vent	% Impaired	% Deep-hooked
0-19	**1**	0	100	0	0
20-29	**59**	22.03	62.71	11.86	3.38
30-39	**617**	17.50	57.54	10.21	14.78
40-49	**667**	10.19	65.07	12.74	11.99
50-59	**450**	12.66	62.00	9.11	16.22
60-60	**110**	1.82	71.82	7.28	19.09
70-79	**33**	6.06	60.60	12.12	21.21
80+	**36**	0	69.44	19.44	11.11

Table 5 (cont). **Mississippi and Alabama At-Sea sampling of the For-hire fleet**. Total numbers of fish for which release was observed and percent of observed fish released in each of four impairment categories 1: Good, 2: vented, 3: Impaired 4: Deep-hooked (described in table 3) in the charter and headboat fleets of Alabama and Mississippi.

Mississippi Charter						Mississippi Headboat				
Depth	**Total #**	% Good	% Vent	% Impaired	% Deep-hooked	**Total #**	% Good	% Vent	% Impaired	% Deep-hooked
0-19	**162**	84.57	0	15.43	0	**306**	92.81	0	7.19	0
20-29	**308**	81.21	0	17.85	0	**280**	90.56	0	9.64	0
30-39	**0**	.	.	.	.	**0**	.	.	.	.
40-49	**0**	.	.	.	.	**0**	.	.	.	.
50-59	**0**	.	.	.	.	**0**	.	.	.	.
60-69	**0**	.	.	.	.	**0**	.	.	.	.
70-79	**0**	.	.	.	.	**0**	.	.	.	.
80+	**0**	.	.	.	.	**0**	.	.	.	.

Alabama Charter					
Depth	**Total #**	% Good	% Vent	% Impaired	% Deep-hooked
0-19	**388**	77.85	10.83	6.44	4.90
20-29	**40**	22.50	62.50	2.50	12.50
30-39	**0**	.	.	.	.
40-49	**0**	.	.	.	.
50-59	**0**	.	.	.	.
60-69	**0**	.	.	.	.
70-79	**0**	.	.	.	.
80+	**0**	.	.	.	.

Table 6. Total estimated percent mortality within each for-hire fleet/region. Original observations included venting as the only means of barotrauma mitigation (0% descend). 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 at each depth (Table 5), and calculated proportional mortality of fish released in each of the conditions listed above (Table 3). All gray columns are calculated by estimating percent survival of descended fish (Table 4), and mathematically transferring a proportion of vented or impaired fish to an additional descended category. Note that the values estimated in the NWFL and SWFL headboat fleets include mathematical adjustments to account for over-sampling of long duration and multiple-day trips.

	0% descend	25% descend	50% descend	75% descend	100% descend
NWFL Charter	19.76 ± 6.0	18.44 ± 6.7	17.11 ± 7.4	15.79 ± 8.0	14.47 ± 8.7
NWFL Headboat	24.41 ± 5.3	22.39 ± 6.3	20.37 ± 7.3	18.36 ± 8.3	16.34 ± 9.3
SWFL Charter	26.77 ± 5.4	25.23 ± 6.3	23.69 ± 7.2	22.15 ± 8.1	20.60 ± 9.0
SWFL Headboat	27.93 ± 5.4	26.24 ± 6.3	24.54 ± 7.2	22.84 ± 8.2	21.15 ± 9.1
	0% descend	25% descend	50% descend	75% descend	100% descend
AL Charter	15.69 ± 7.0	14.86 ± 7.2	14.03 ± 7.5	13.20 ± 7.7	12.37 ± 8.0
MS Charter	15.48 ± 7.4	13.93 ± 7.6	12.37 ± 7.7	10.81 ± 7.8	9.25 ± 7.9
MS Headboat	11.42 ± 7.5	10.66 ± 7.5	9.89 ± 7.6	9.13 ± 7.7	8.36 ± 7.7

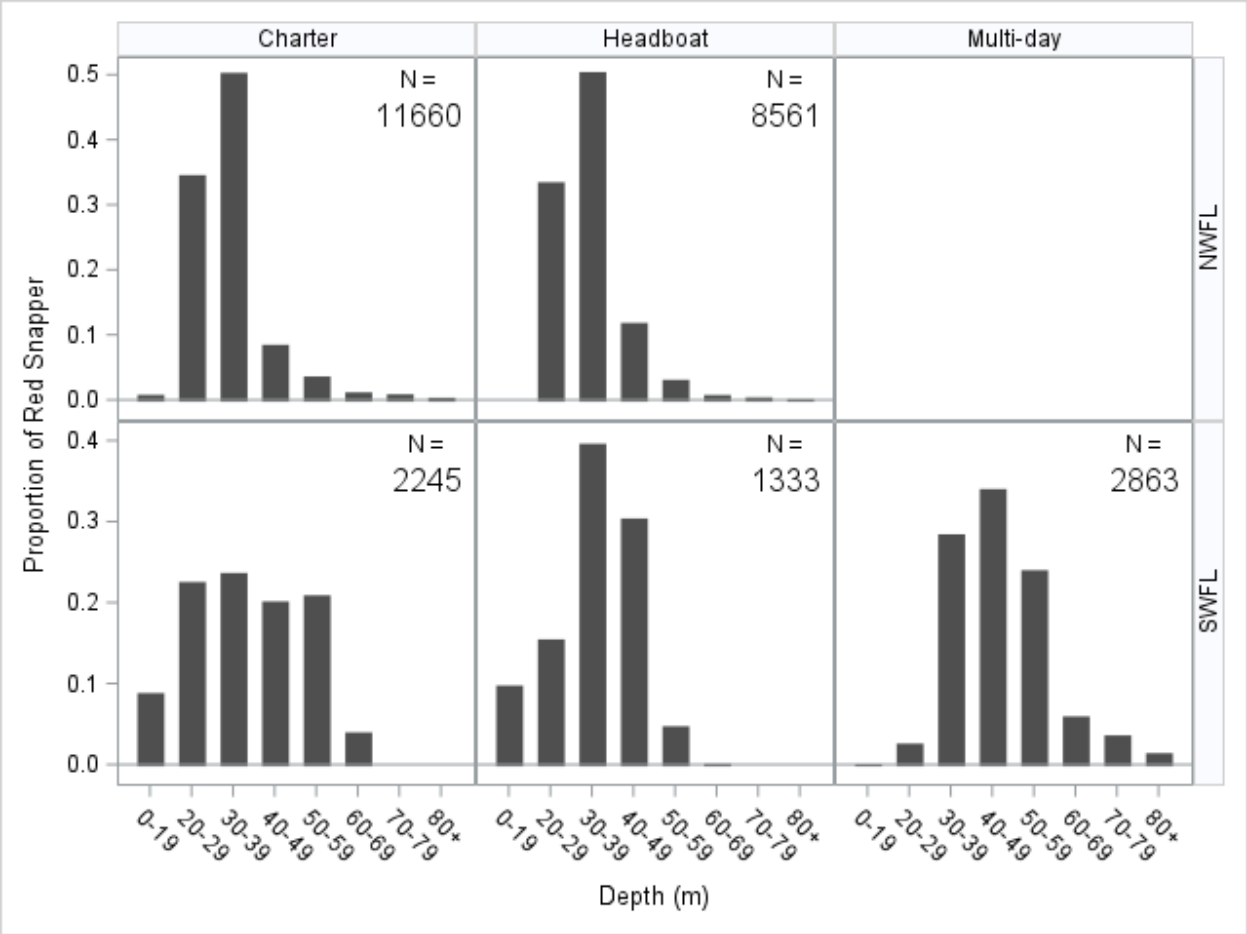


Figure 1. Florida at-Sea sampling of the For-hire fleet. Proportion of Red Snapper **ENCOUNTERED** (**RETAINED + RELEASED**)by depth 2009-2019. Total numbers of fish are listed in each panel.

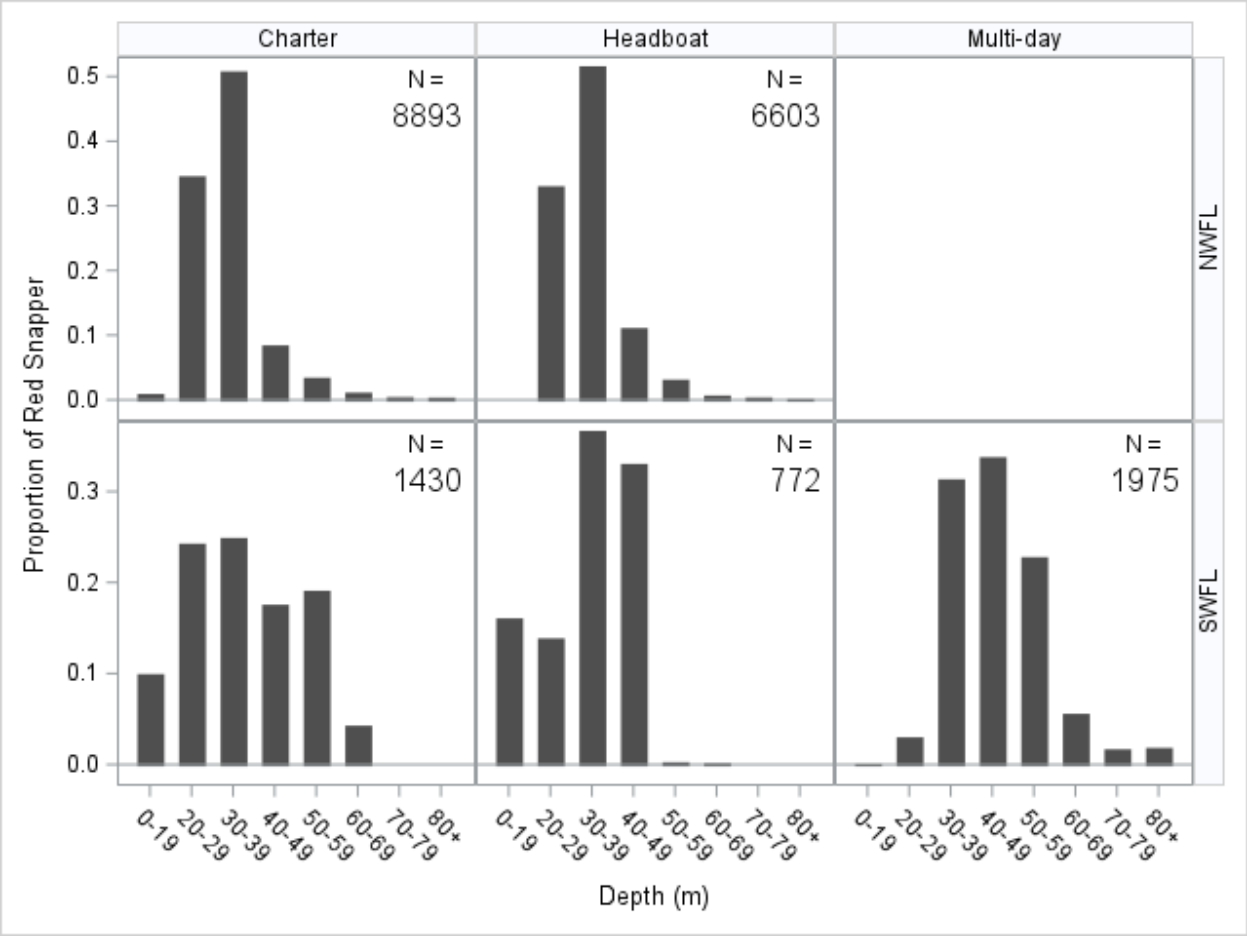


Figure 2. Florida at-Sea sampling of the For-hire fleet. Proportion of fish **RELEASED** by depth 2009-2019. Total numbers of fish released are listed in each panel.

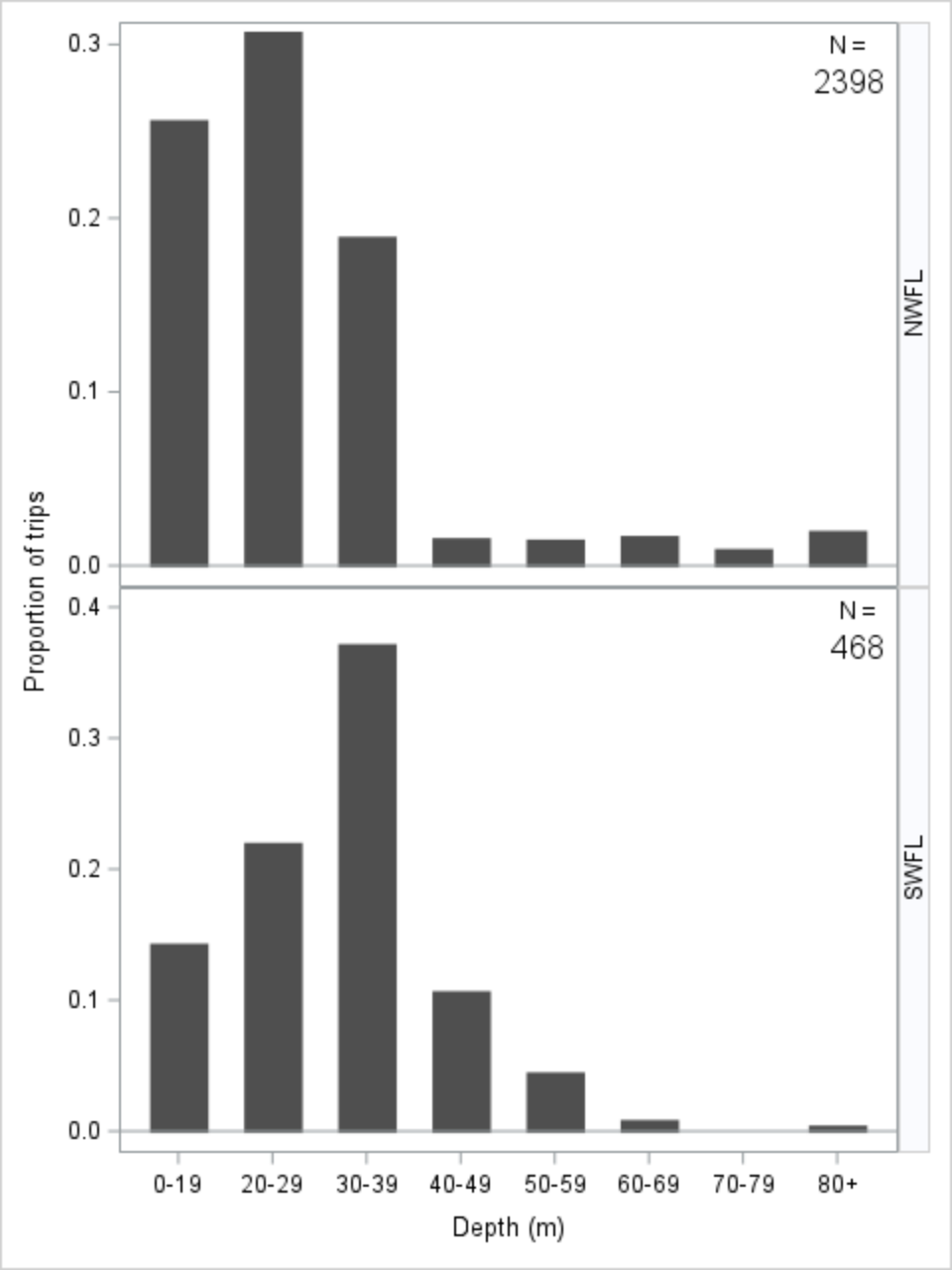


Figure 3. **Florida dockside sampling of private anglers**: Proportion of interviewed private anglers **TARGETING, CATCHING or RELEASING** Red Snapper and reported maximum fishing depth (converted to m) by region. Total numbers of anglers that indicated fishing for, catching, or releasing Red Snapper is listed in each panel.

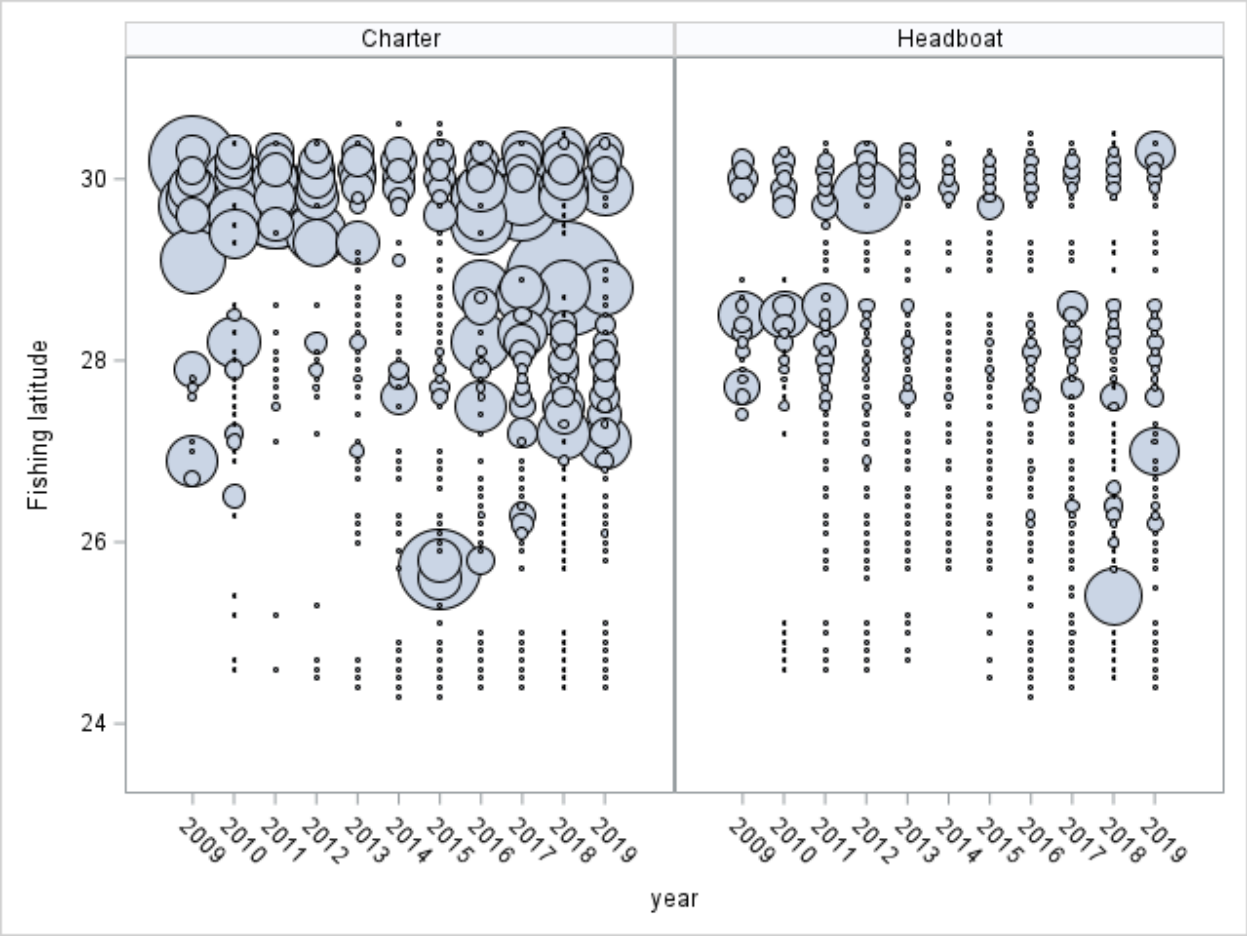


Figure 4. Florida At-Sea sampling of the for-hire fleet: Mean numbers of Red Snapper encountered (**RETAINED + RELEASED**) by latitude (0.1º increments) and year. The smallest dots represent latitudes at which sampled trips were conducted but no Red Snapper were encountered. No dot represents latitudes for which no data exists (no observed trips were made). Note that early in the time-series sampling effort was concentrated in the northern half of the geographic range.

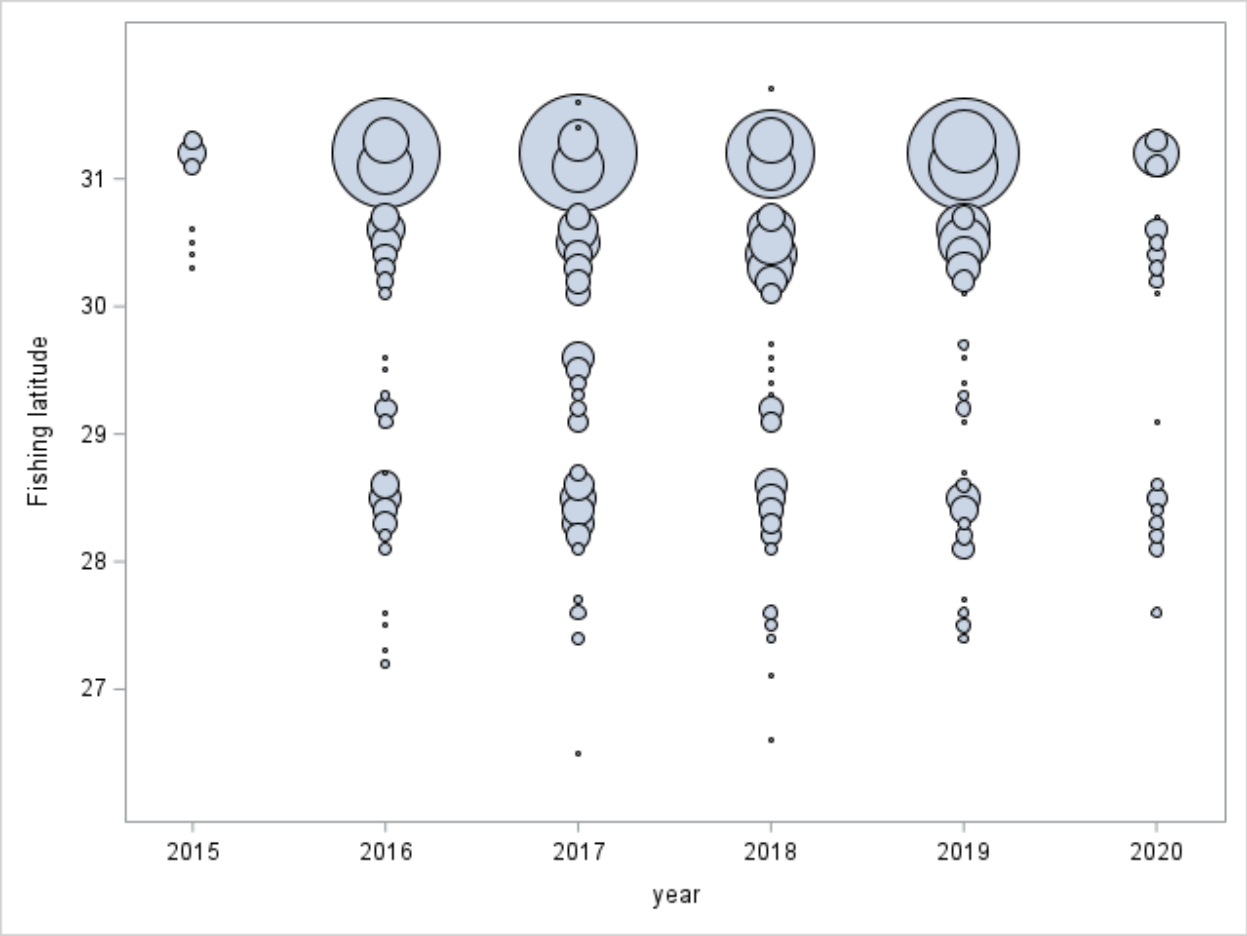


Figure 5. Florida dockside sampling of private anglers: Mean number of angler trips encountering red snapper (**RETAINED + RELEASED**) by latitude (0.1º increments) and year. Latitudes were derived from angler-reported fishing areas. The smallest dots represent latitudes at which anglers reported fishing but no anglers reported targeting or releasing Red Snapper. No dot represents latitudes for which no data exists. Note that early in the time-series sampling effort was concentrated in the northern half of the geographic range.

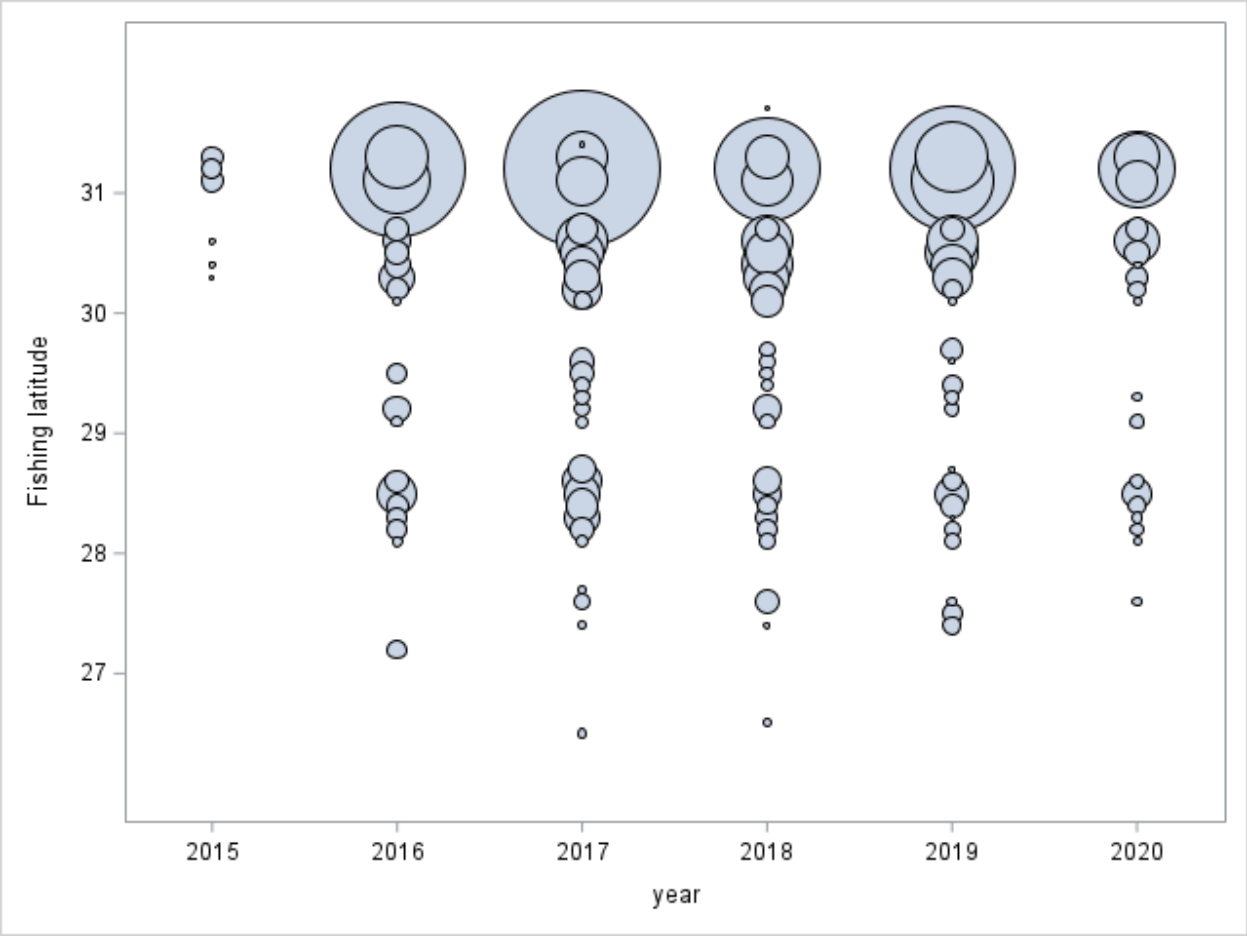


Figure 6. Florida dockside sampling of private anglers: Mean number of angler trips **RELEASING** snapper by latitude (0.1º increments) and year. Latitudes were derived from angler-reported fishing areas. The smallest dots represent latitudes at which anglers reported fishing but no anglers reported targeting or releasing Red Snapper. No dot represents latitudes for which no data exists. Note that early in the time-series sampling effort was concentrated in the northern half of the geographic range.

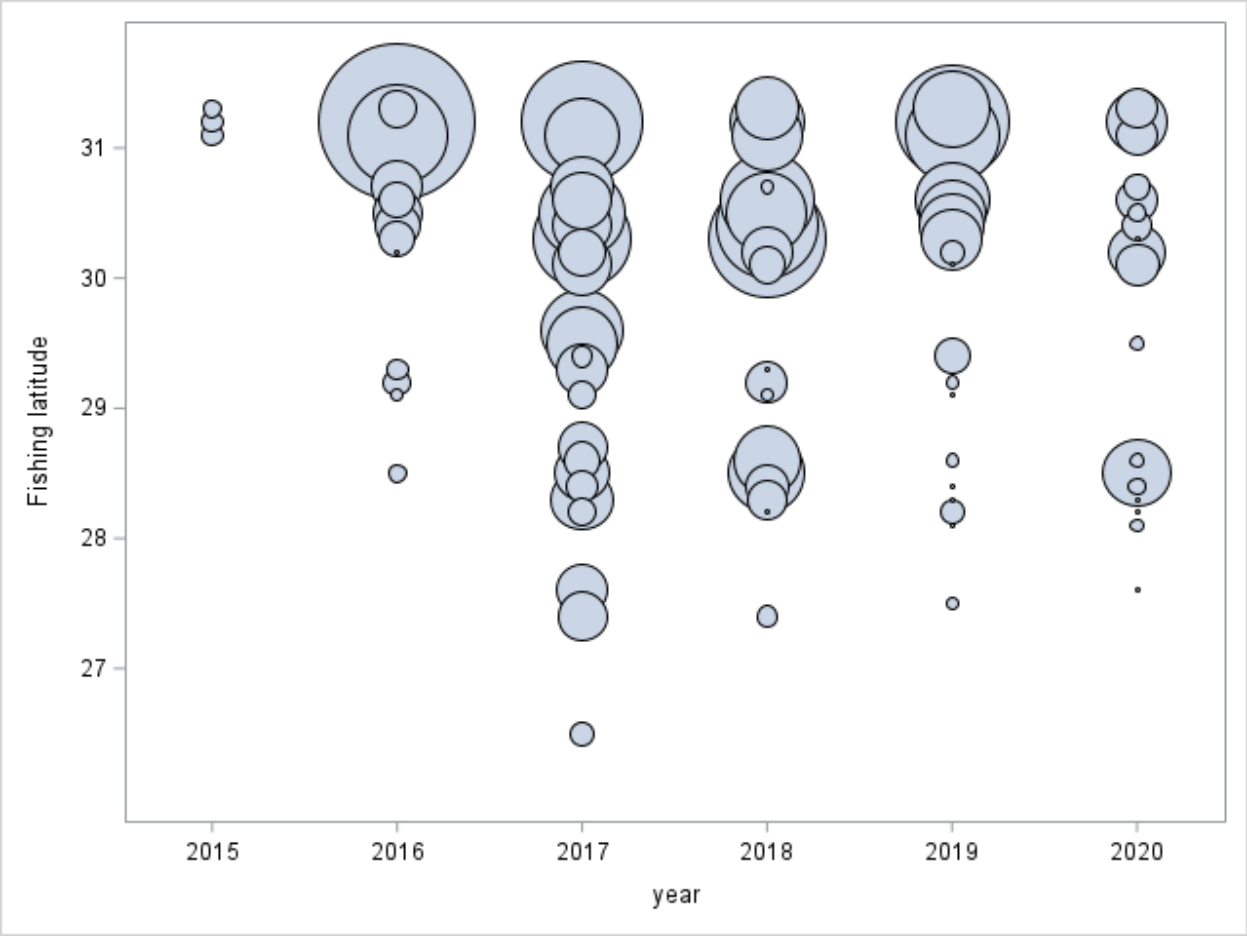


Figure 7. Florida dockside sampling of private anglers: Total numbers of red snapper **RETAINED + MEASURED** by latitude (0.1º increments) and year. Latitudes were derived from angler-reported fishing areas. The smallest dots represent latitudes at which anglers reported fishing but no anglers reported targeting or releasing Red Snapper. No dot represents latitudes for which no data exists. Note that early in the time-series sampling effort was concentrated in the northern half of the geographic range.

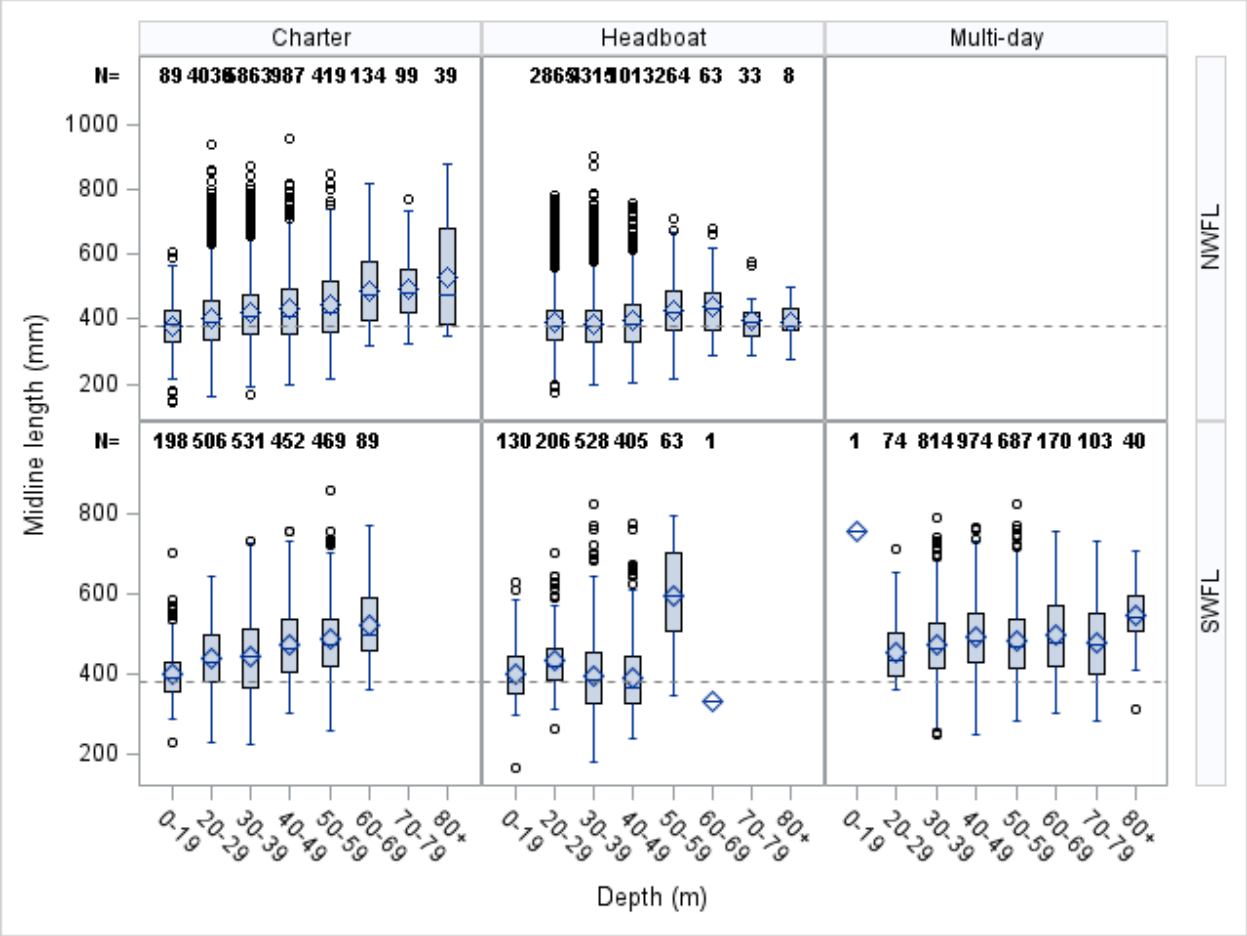


Figure 8. Florida at-Sea sampling of the for-hire fleet. Midline length (mm) of all **RETAINED + RELEASED Red** Snapper as a function of capture depth (m) 2009-2019. Total numbers of fish encountered in each fleet are listed in each panel. The current minimum legal size (16’ TL) is indicated by a dashed line.

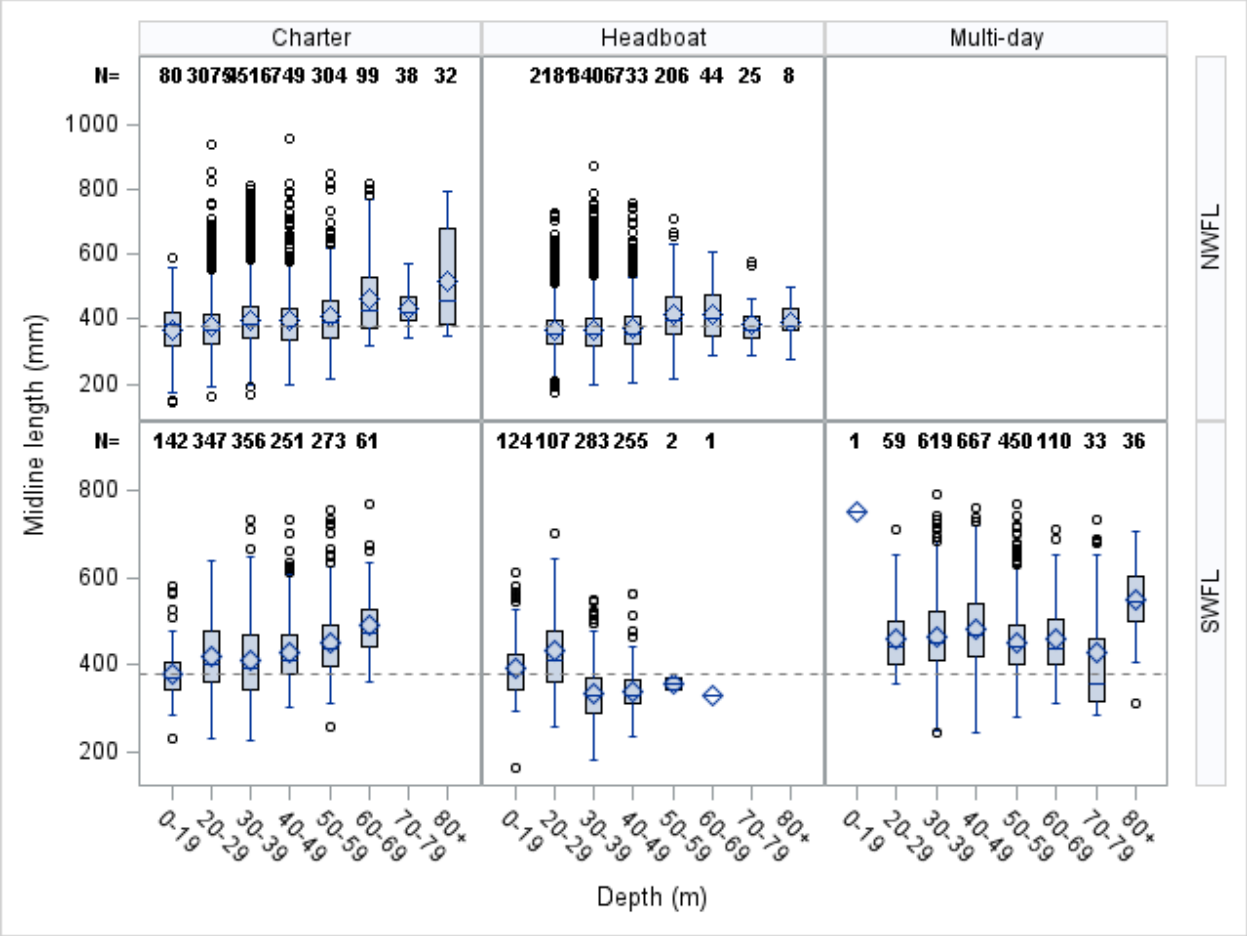


Figure 9. Florida at-Sea sampling of the for-hire fleet. Midline length (mm) of all **RELEASED Red** Snapper as a function of capture depth (m) 2009-2019. Total numbers of fish encountered in each fleet are listed in each panel. The current minimum legal size (16’ TL) is indicated by a dashed line.

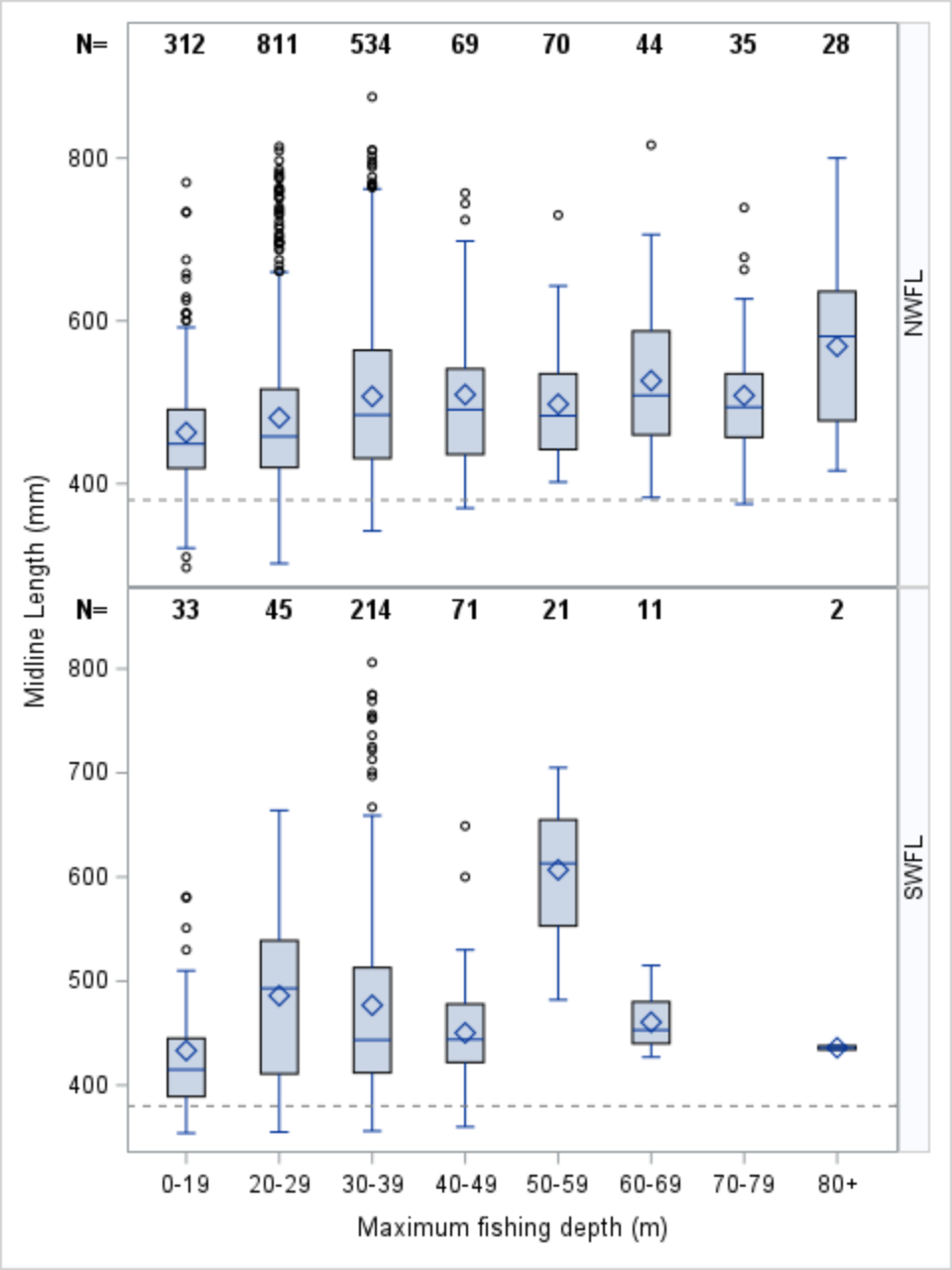
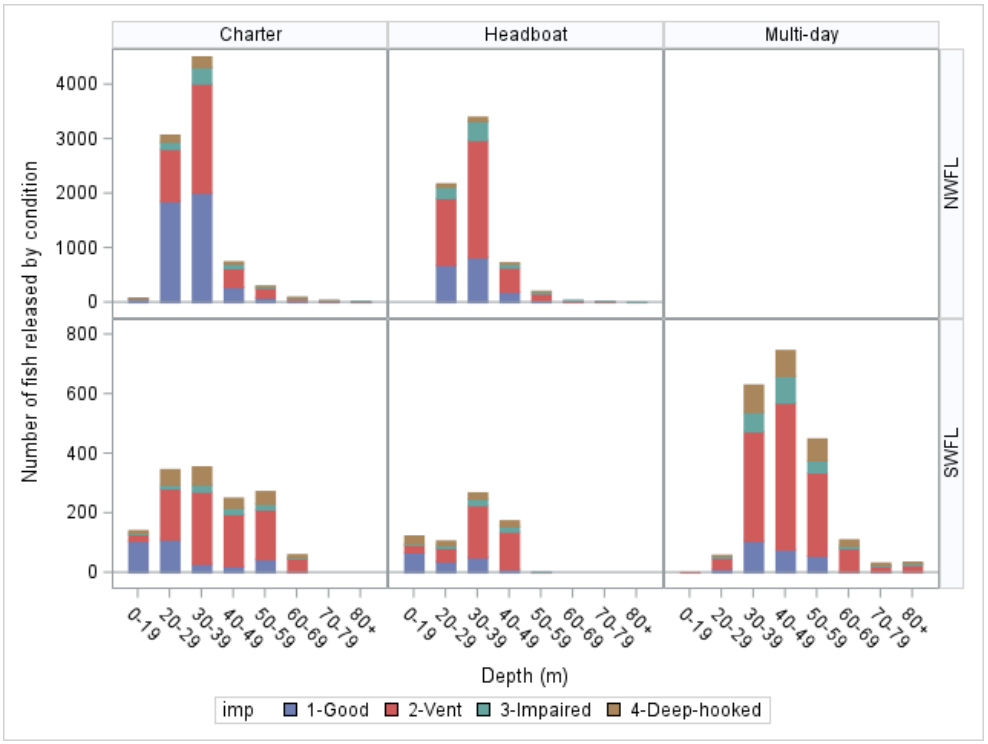


Figure 10. Florida dockside sampling of private anglers: Midline length for **HARVESTED & MEASURED** red snapper as a function of reported maximum depth fished. The current minimum legal size (16’ TL) is indicated by a dashed line.



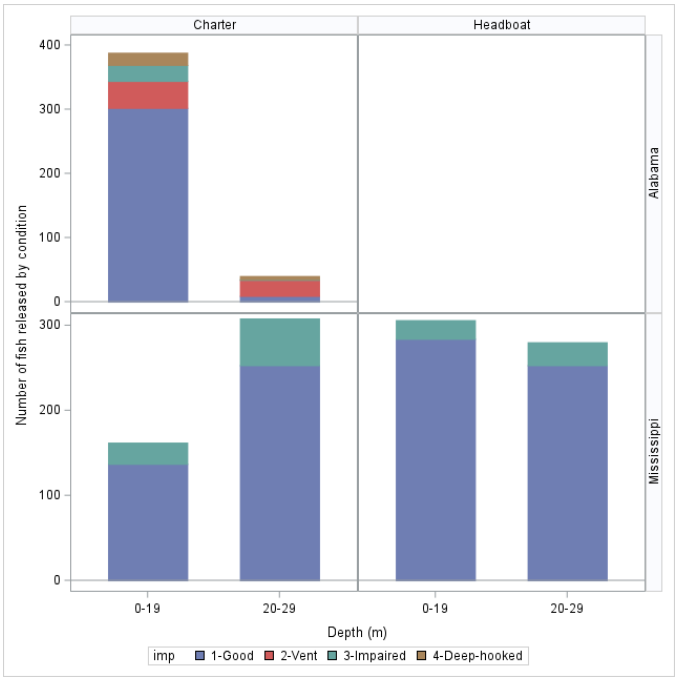


Figure 11. At-Sea sampling of the for-hire fleet: Total **NUMBER** of **RELEASED** Red Snapper observed in each of four impairment categories (Note different X and Y axes in each panel). Florida is divided into NWFL and SWFL regions. SWFL headboats are divided into single-day and multi-day trips. Alabama samplers only sampled charter trips. Release categories are described in Table 3.

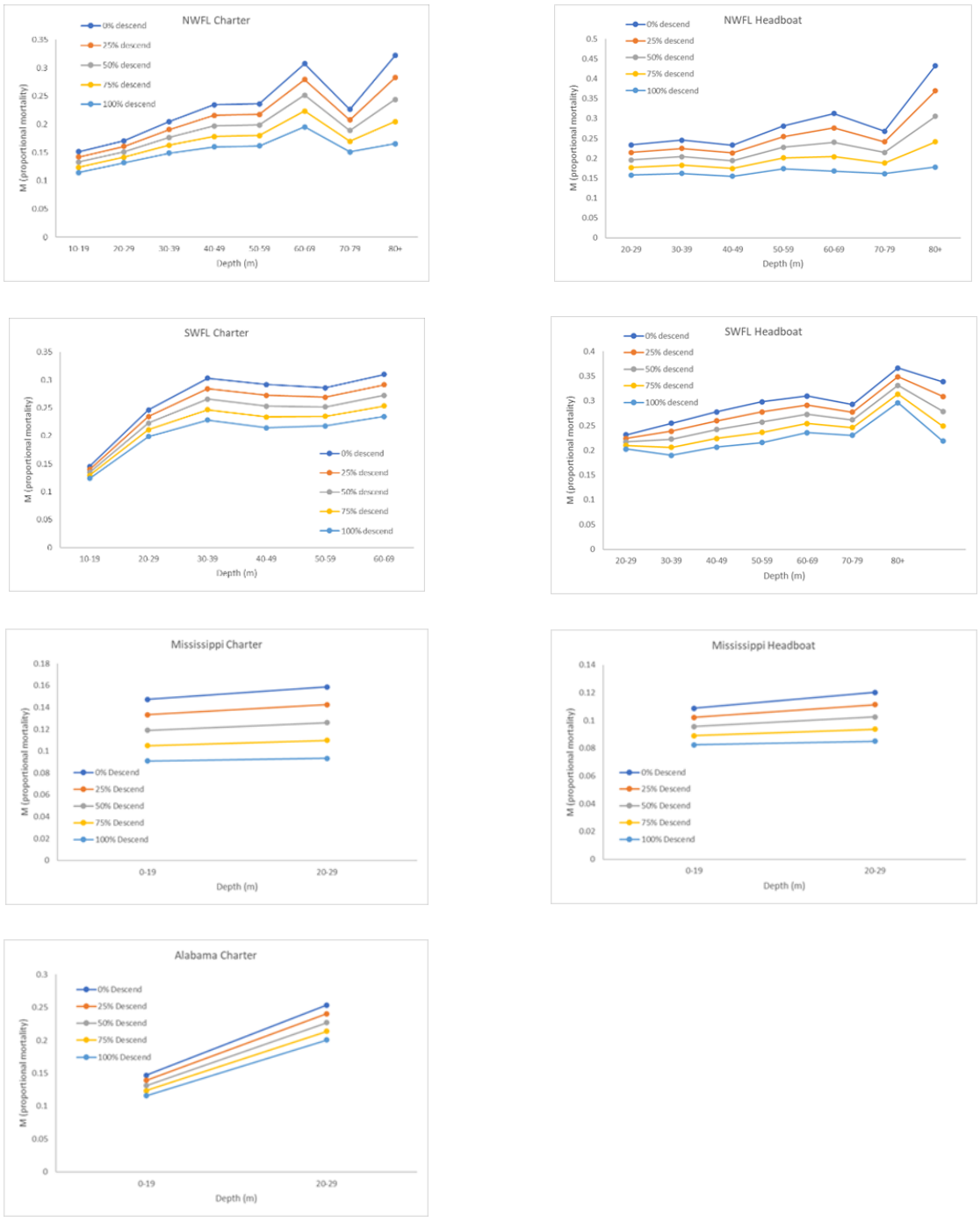


Figure 12. **For-hire fleet:** Estimated mortality by depth based on survival likelihood and proportion of released fish in each of four impairment categories (Table 3). Each line represents a different proportion of fish transferred from vented or impaired category to descended. Note that the values estimated in the NWFL and SWFL headboat fleets include mathematical adjustments to account for over-sampling of long duration and multiple-day trips. Fish in Alabama and Mississippi were never released deeper than 29 m.

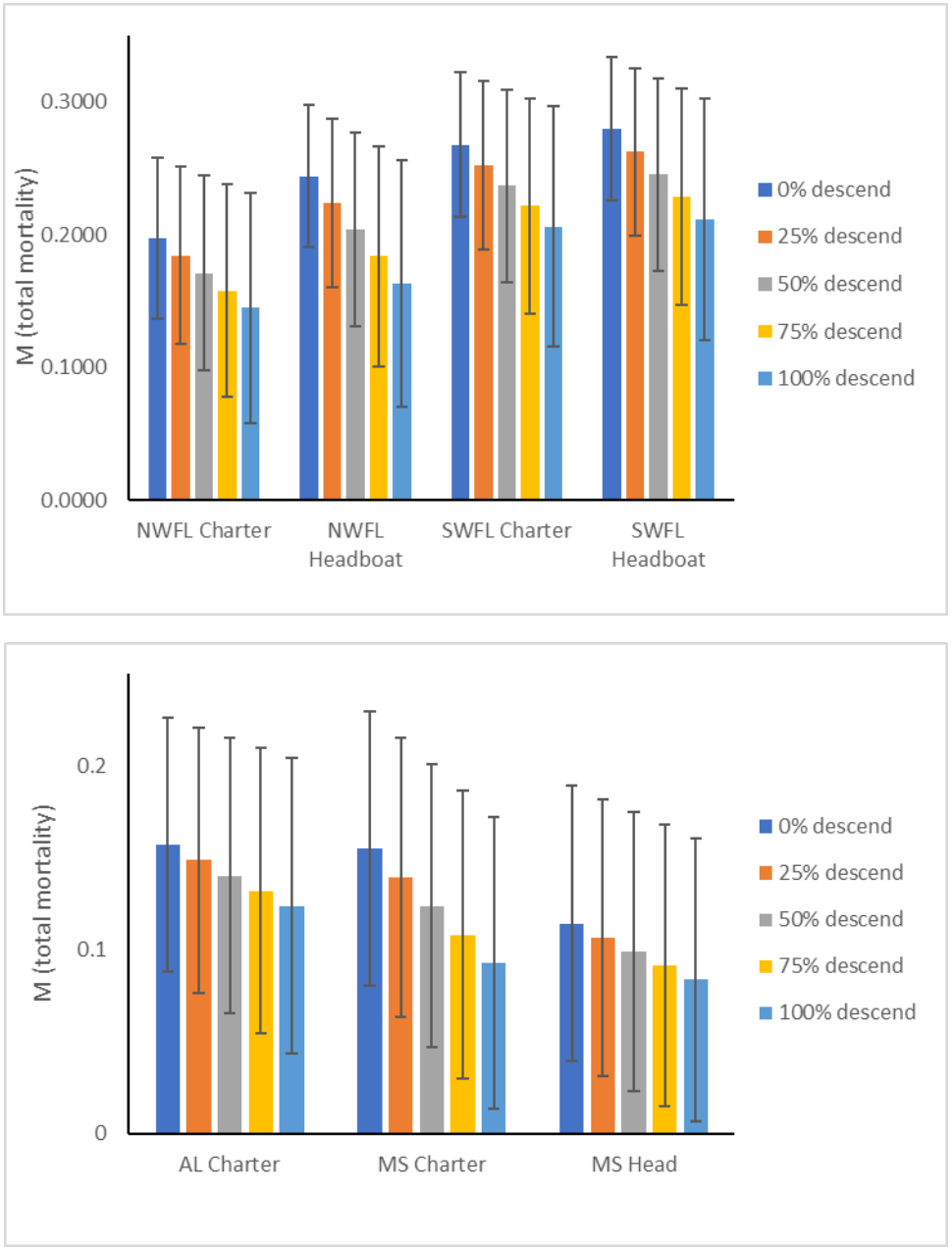


Figure 13. **For-hire fleet:** Estimated total mortality within each fleet based on proportional mortality by depth. Each bar represents a different proportion of fish transferred from vented or impaired category to descended. Note that the values estimated in the NWFL and SWFL headboat fleets include mathematical adjustments to account for over-sampling of long duration and multiple-day trips.

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