Regulatory Amendment 35

Red Snapper Catch Levels and Snapper Grouper Release Mortality Reduction

Data Report

September 2022

Background

In June 2022, the Council requested Council, Southeast Fisheries Science Center (SEFSC), and Southeast Regional Office (SERO) staffs to develop analyses to inform further discussion and consideration of time/area closures of the snapper grouper fishery during the September 2022 Council Meeting.

List of Requested Analyses:
1. Commercial discards (numbers) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL (Cape Canaveral north), central FL (Cape Canaveral to Jupiter), and south FL (south of Jupiter), 2005-2021.
2. Private recreational discards (numbers) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL, central FL, and south FL, 2005-2021.
3. Recreational charter discards (numbers) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL, central FL, and south FL, 2005-2021.
4. Head boat discards (numbers) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL, central FL, and south FL, 2005-2021.
5. Commercial landings (numbers and pounds) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL, central FL, and south FL, 2005-2021.
6. Private recreational landings (numbers and pounds) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL, central FL, and south FL, 2005-2021.

7. Recreational charter landings (numbers and pounds) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL, central FL, and south FL, 2005-2021.
8. Head boat landings (numbers and pounds) for all stocks in the snapper grouper complex by wave for NC, SC, GA, north FL, central FL, and south FL, 2005-2021.
9. A discard-only projection (F_{landed}=0) and ABC recommendation for red snapper. This projection would assume no landings occur and would give perspective on the minimum number of red snapper removals (in this case, all removals would be dead discards) that must be reduced to end overfishing.
10. Analysis of discard hot spots as described by the SEFSC.
11. Florida Fish and Wildlife Commission (FWC) State Reef Fish Survey discard estimates to compare with Marine Recreational Information Program (MRIP) discard estimates.
12. Analyses and discussion of expected economic and social impacts resulting from reduced effort and catch of snapper grouper species.
13. Discussion of stock assessment results and sensitivity runs from Southeast Data, Assessment, and Review (SEDAR) 73.

The following reports respond to the Council's requests for recreational data (requests 2, 3, 4, 6, 7, and 8), a discard-only projection (9), and hot spot analysis (10).

Commercial (1, 5) and FWC State Reef Fish Survey (11) data have been requested and will be provided to the Council when available. Economic and social analyses (12) are standard parts of the information provided in amendments and will be developed as part of Snapper Grouper Regulatory Amendment 35. Finally, SEFSC staff will be available to answer Council questions on the SEDAR 73 stock assessment results and sensitivity runs during the September 2022 Council meeting (13).

Regulatory Amendment 35 Data

SAFMC Staff

2022-8-20

Contents

1 Introduction

At the June 2022 Council meeting, the Council requested a list of data needed for a better understanding of the recreational fishery. The report describes the number of fish caught (kept + released), kept, and released in the recreational fishery (private recreational, charter, and headboat) by combining datasets from the Marine Recreational Information Program (MRIP) and the Southeast Region Headboat Survey. **NOTE: The estimates of landings for Red Snapper come from MRIP and are substainally higher than estimates that are used to monitor catch for comparison with annual catch limits**.

The figures includes data from 1984 to 2021 collected in the South Atlantic region (North Carolina/Virgina border through Monroe County) with most of the graphs focusing on the last five years (2017 to 2021). Data are presented by state for North Carolina, South Carolina, and Georgia. Florida is separated into three regions: north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), and south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe) **(Figure 1)**.

2 Spatial Plots

In the following plots, recreational data are presented with landings on the x-axis and location on the y-axis for 12 assessed species in the South Atlantic region organized alphabetically. **Figure 2** includes landings and releases from 1984 to 2021. The remaining graphs focus on 2017 to 2021 (catch **(Figure 3)** , number kept **(Figure 4)**, and number released **(Figure 5)**). For each graph, average landings are scaled within a species by area (circle size) and among species (circle color). For example, a large circle for Black Grouper off south Florida relative to all other circles in the Black Grouper graph indicates most of the catch of Black Grouper is coming from south Florida. The color of the circle indicates relative catch levels across species with red indicating low and purple indicating high. In **Figure 2**, the color of the circle for Black Grouper catch is red (low) indicating catch is low relative to other species such as Yellowtail Snapper and White Grunt with purple and blue circles (high).
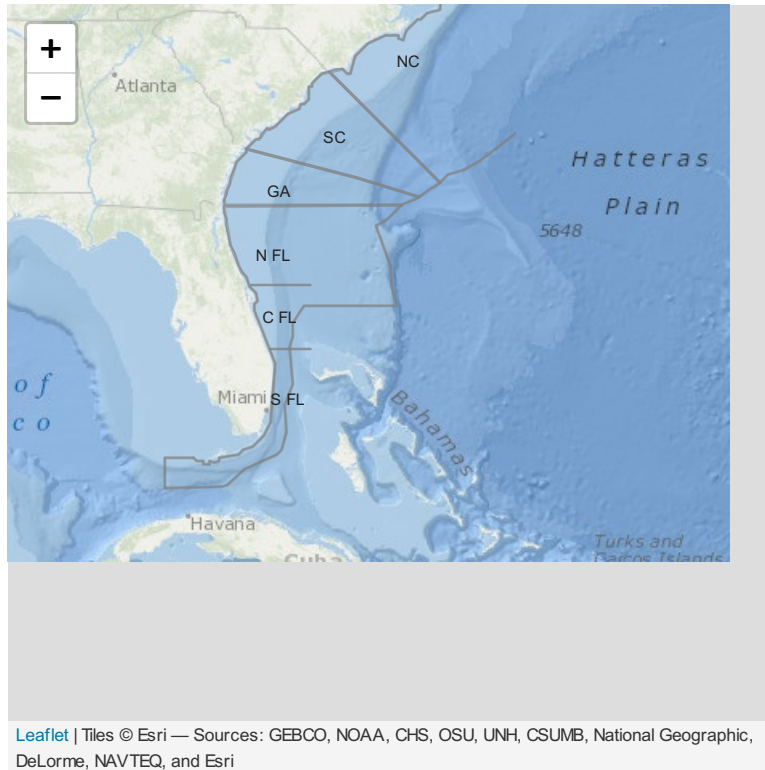
Figure 1: Map of state and area codes.

3 Seasonal Plots

In the following plots, recreational data are presented with wave on the x-axis and landings on the y-axis for 12 assessed species in the South Atlantic region organized alphabetically. The graphs focus on 2017 to 2021 (catch **(Figure 6)**, number kept **(Figure 7)**, and number released **(Figure 8)**). For each graph, landings are scaled among species based on bar height.

4 Seasonal and Spatial Plots

In the following plots, recreational data are presented with wave on the x-axis and location on the y-axis for 12 assessed species in the South Atlantic region organized alphabetically. The graphs focus on 2017 to 2021 (catch **(Figure 9)**, number kept **(Figure 10)**, and number released **(Figure 11)**). For each graph, the size of the bubble indicates relative landings for the area and wave combination. Bubble size is not comparable across species.
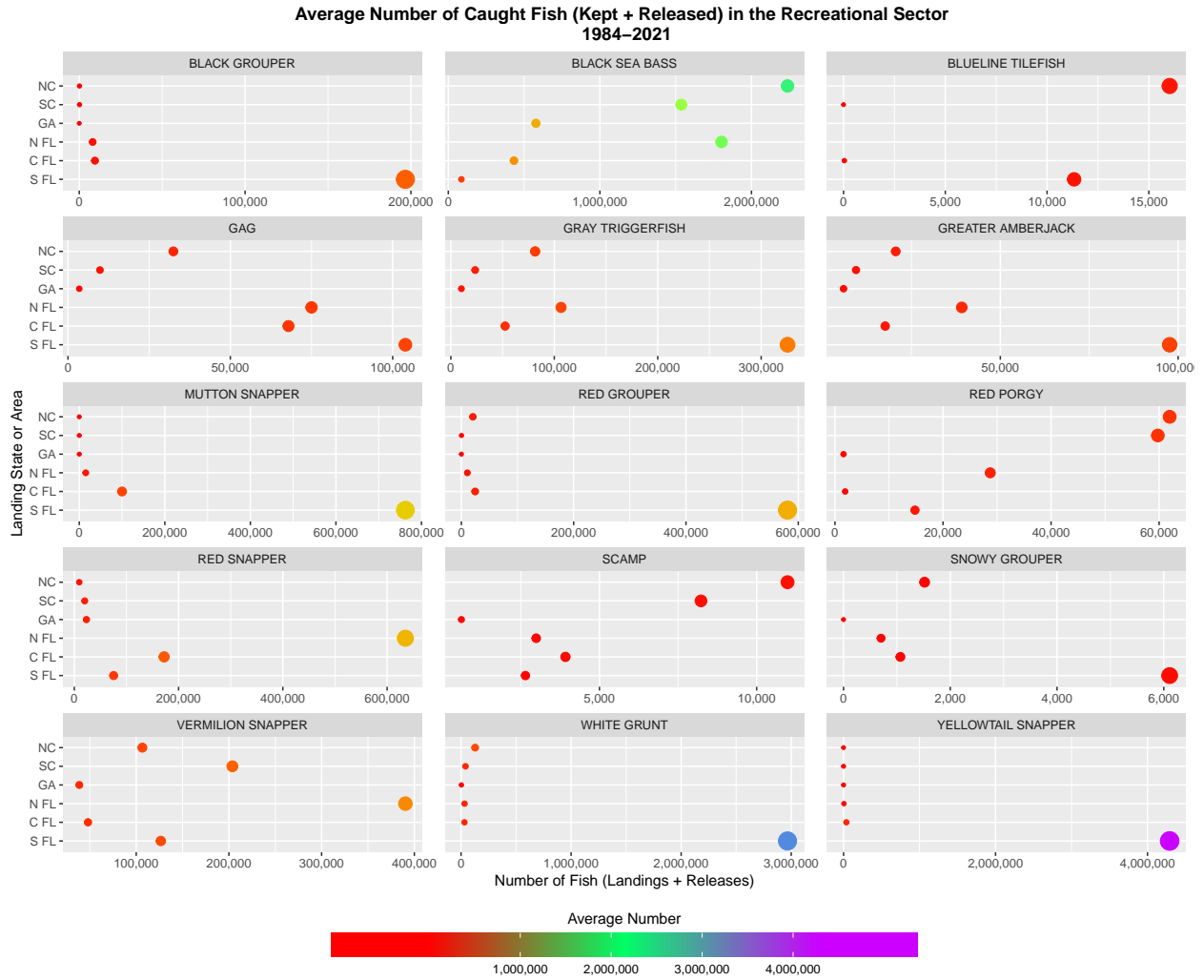
Figure 2: Average annual number of kept and released fish by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 1984 to 2021 by state or area. State and areas included are North Carolina (NC), South Carolina (SC), Georgia (GA), north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe). Size of the circle is relative catch level for the species, and color is relative across species.
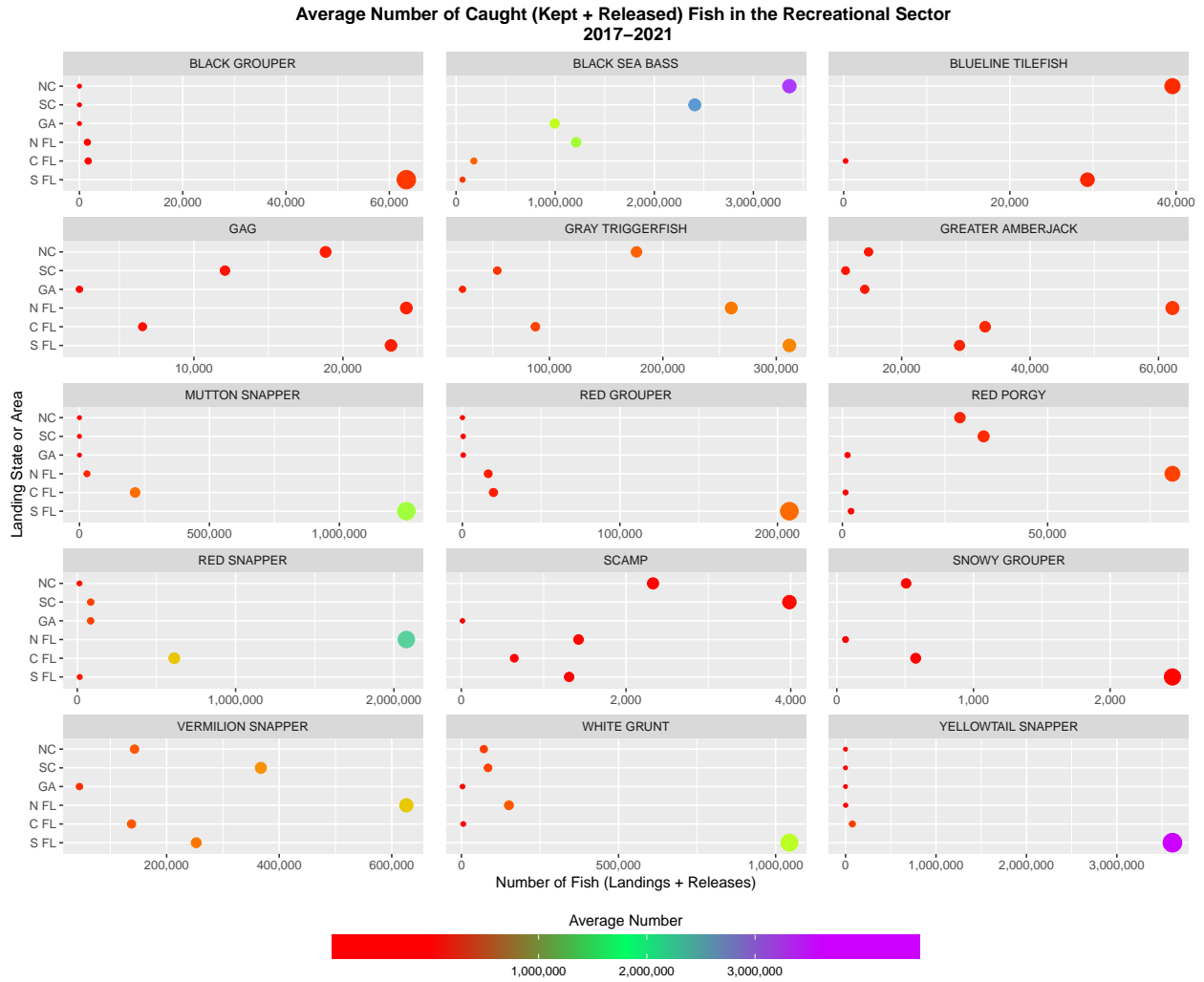
Figure 3: Average annual number of kept and released fish by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 2017 to 2021 by state or area. State and areas included are North Carolina (NC), South Carolina (SC), Georgia (GA), north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe). Size of the circle is relative catch level for the species, and color is relative across species.
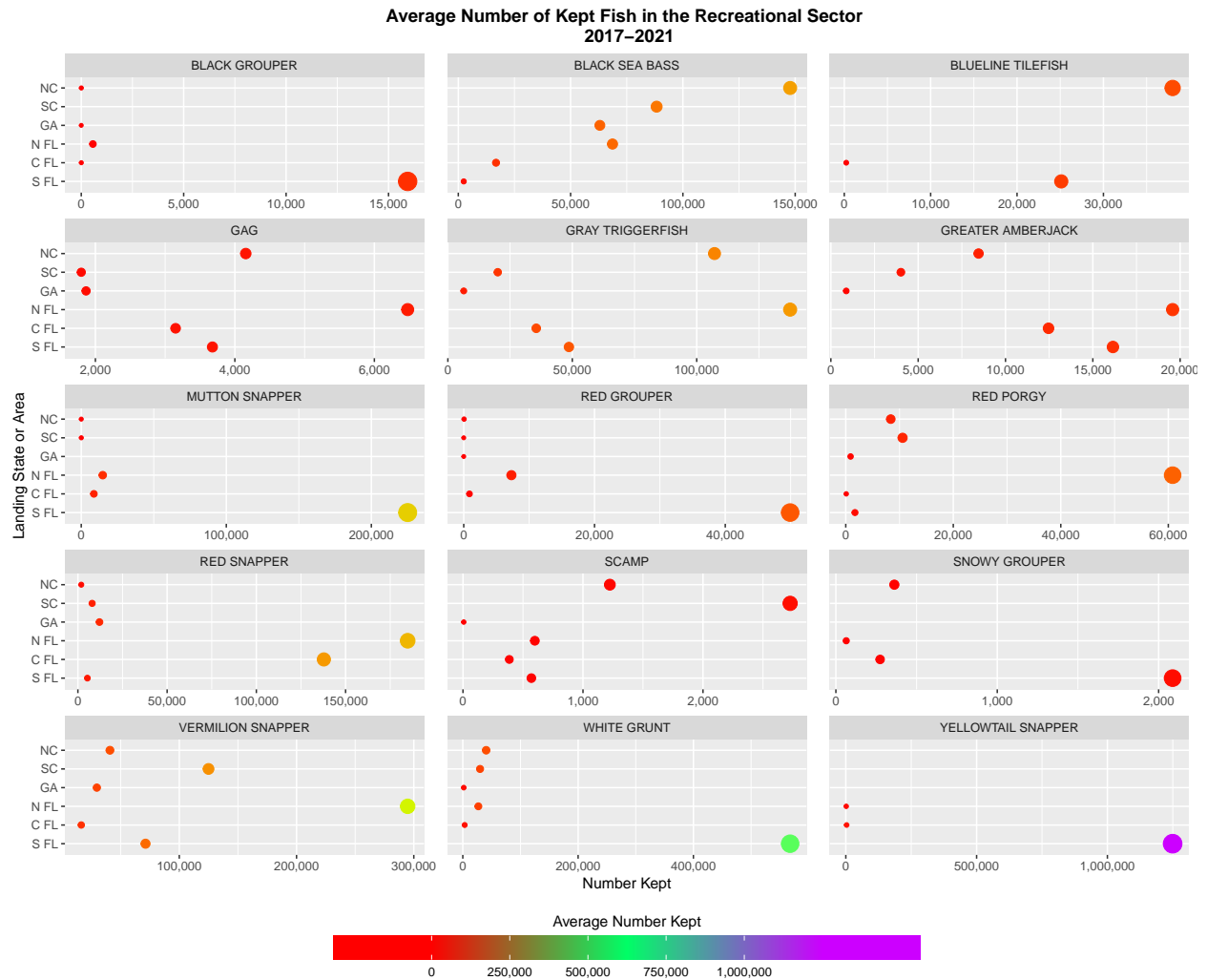
Figure 4: Average annual number of kept fish by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 2017 to 2021 by state or area. State and areas included are North Carolina (NC), South Carolina (SC), Georgia (GA), north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe). Size of the circle is relative catch level for the species, and color is relative across species.
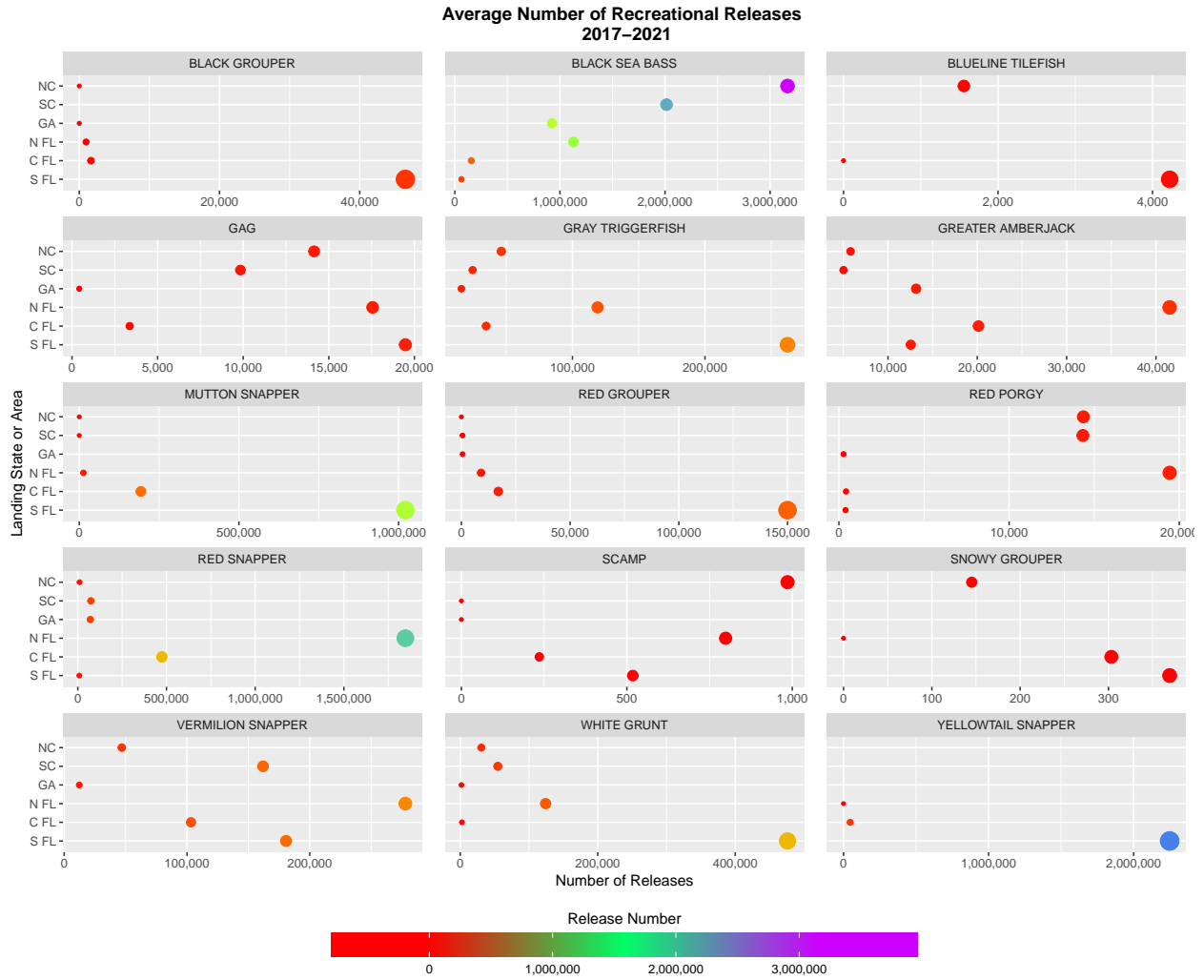
Figure 5: Average annual number of released fish by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 2017 to 2021 by state or area. State and areas included are North Carolina (NC), South Carolina (SC), Georgia (GA), north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe). Size of the circle is relative catch level for the species, and color is relative across species.

Figure 6: Average number of fish caught (kept + released) by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 2017 to 2021 by wave.

Figure 7: Average number of fish kept by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 2017 to 2021 by wave.
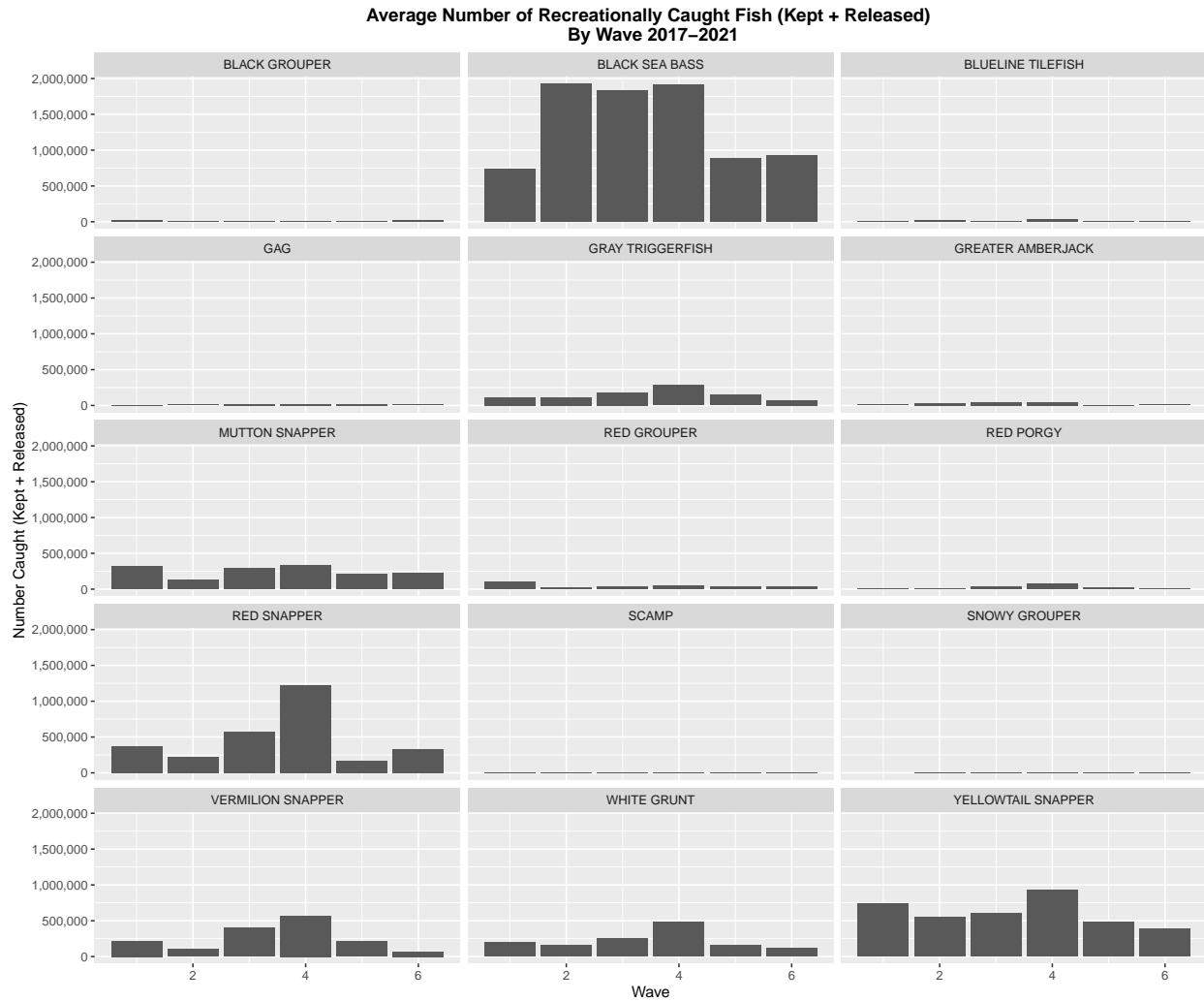
Figure 8: Average number of fish released by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 2017 to 2021 by wave.

Figure 9: Average annual number of fish caught (kept + released) by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments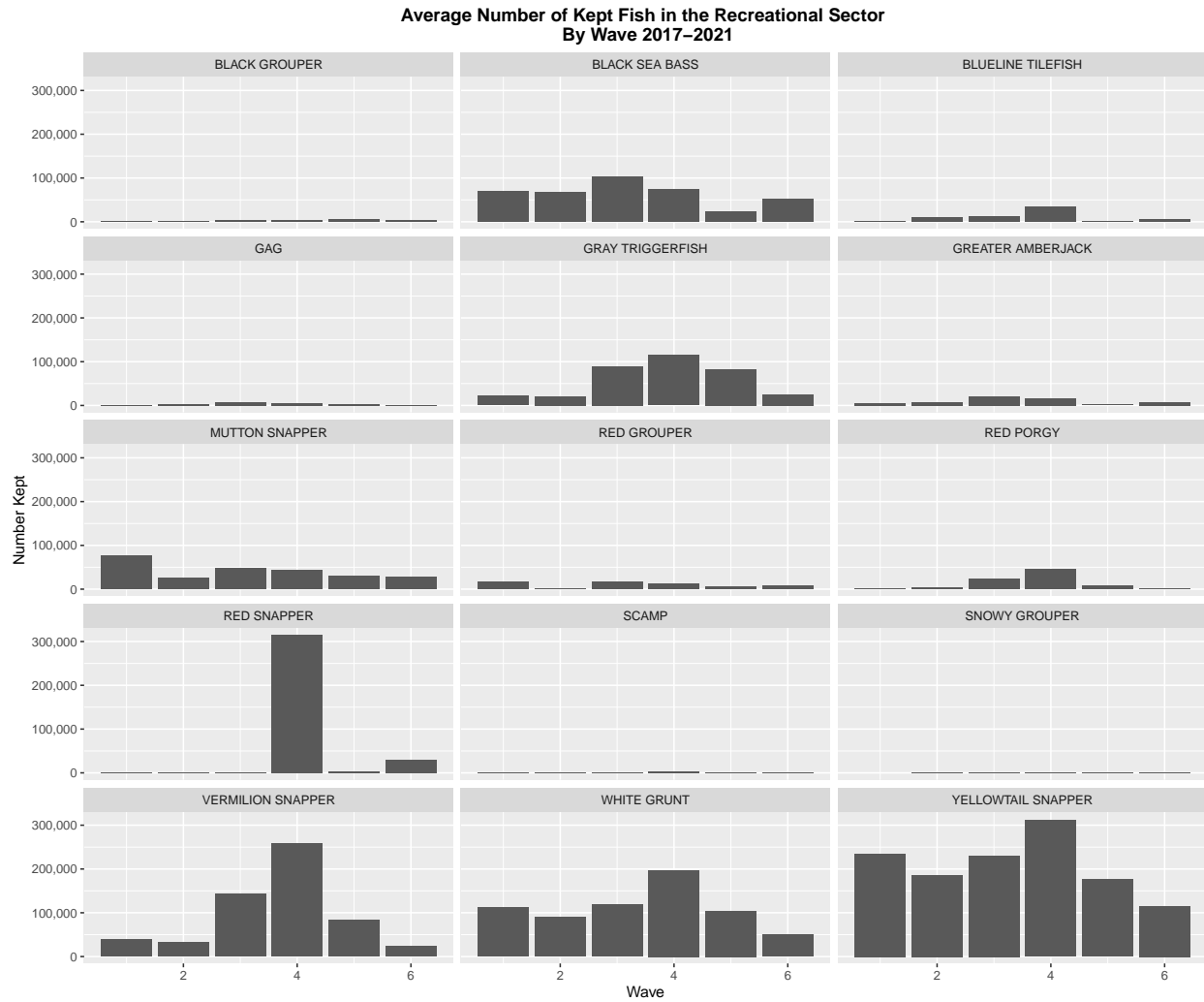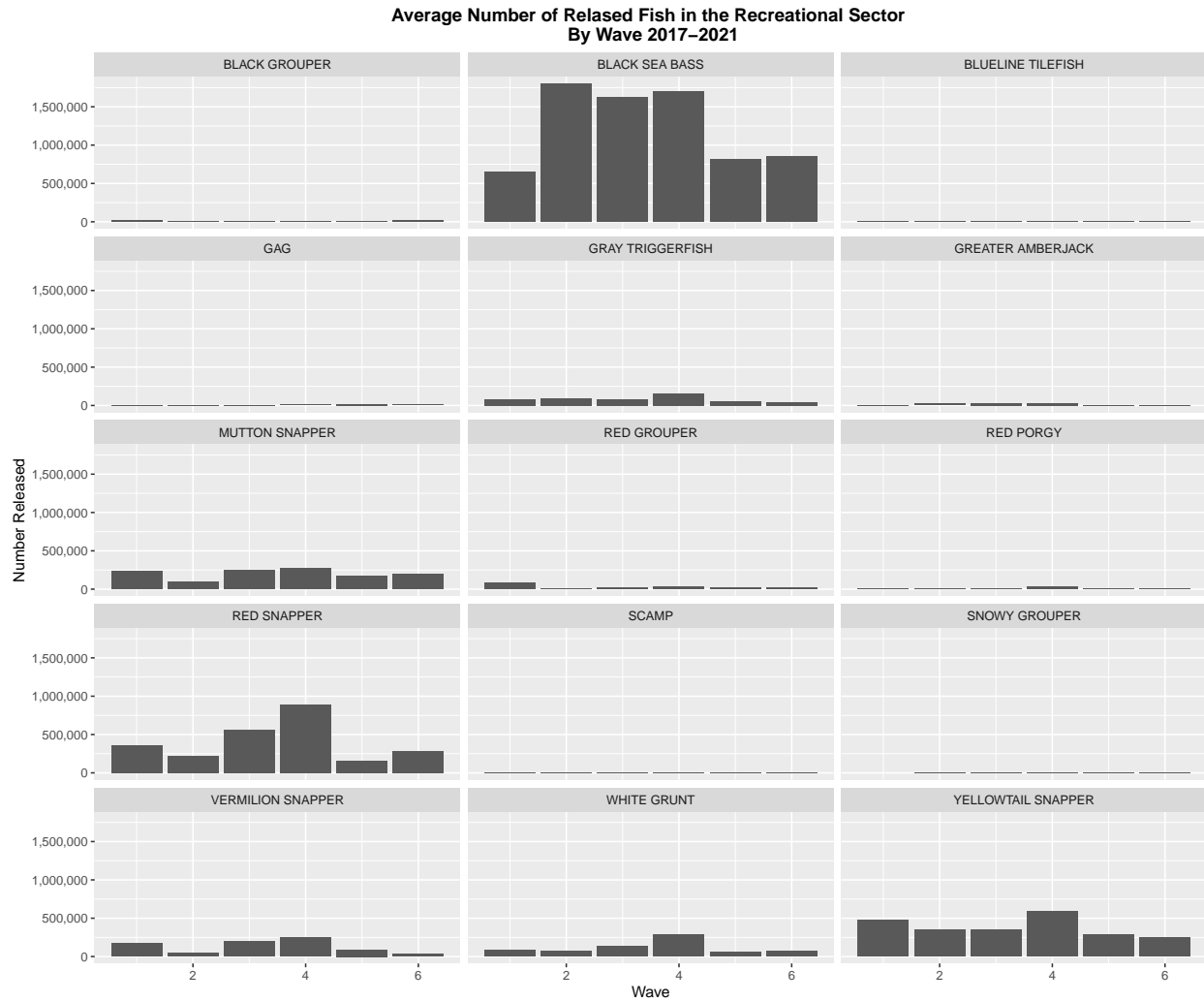 in the South Atlantic region from 2017 to 2021 by state or area and wave. State and areas included are North Carolina (NC), South Carolina (SC), Georgia (GA), north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe). Size of the circle is relative catch level for the species.
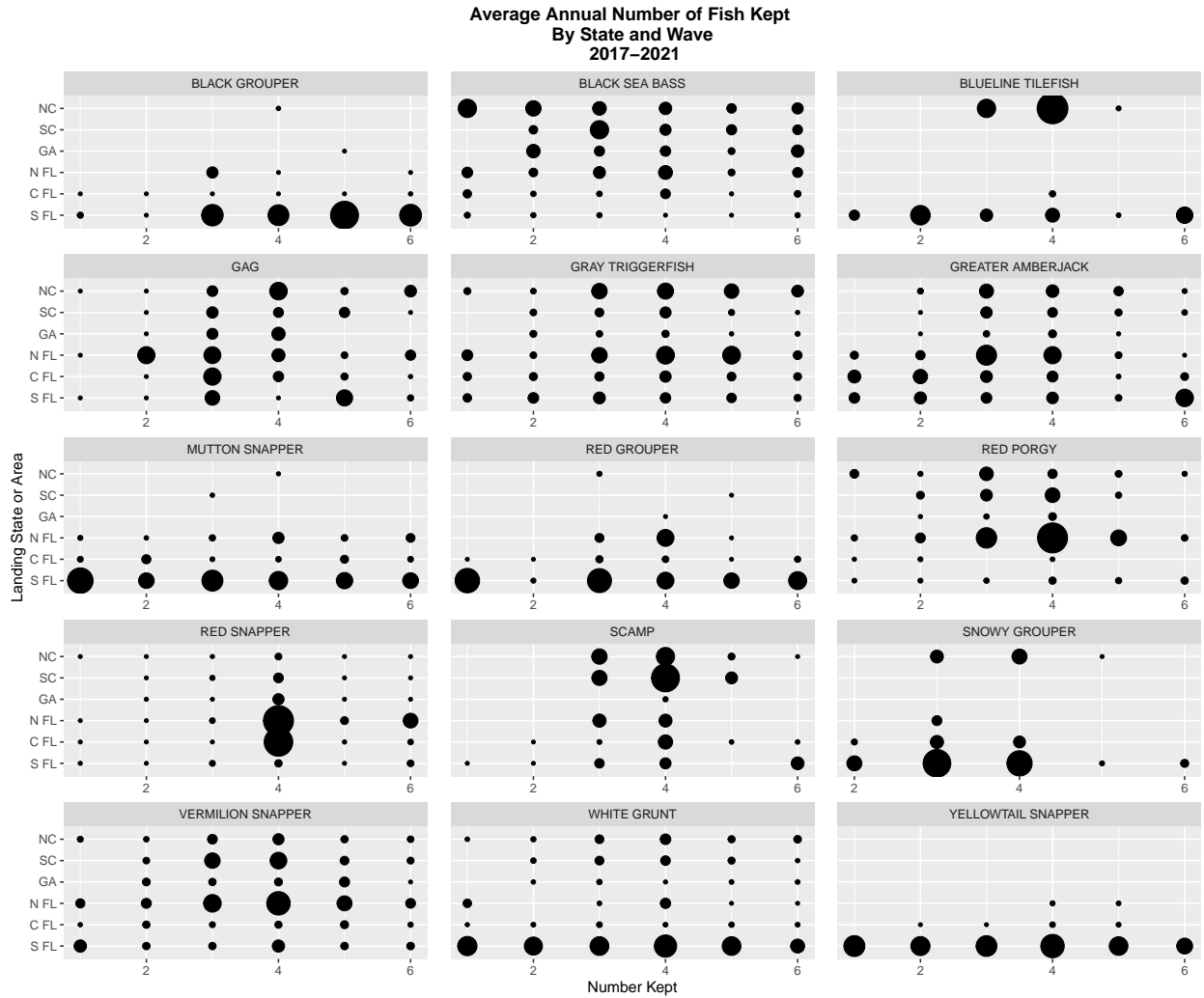
Figure 10: Average annual number of kept fish by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlan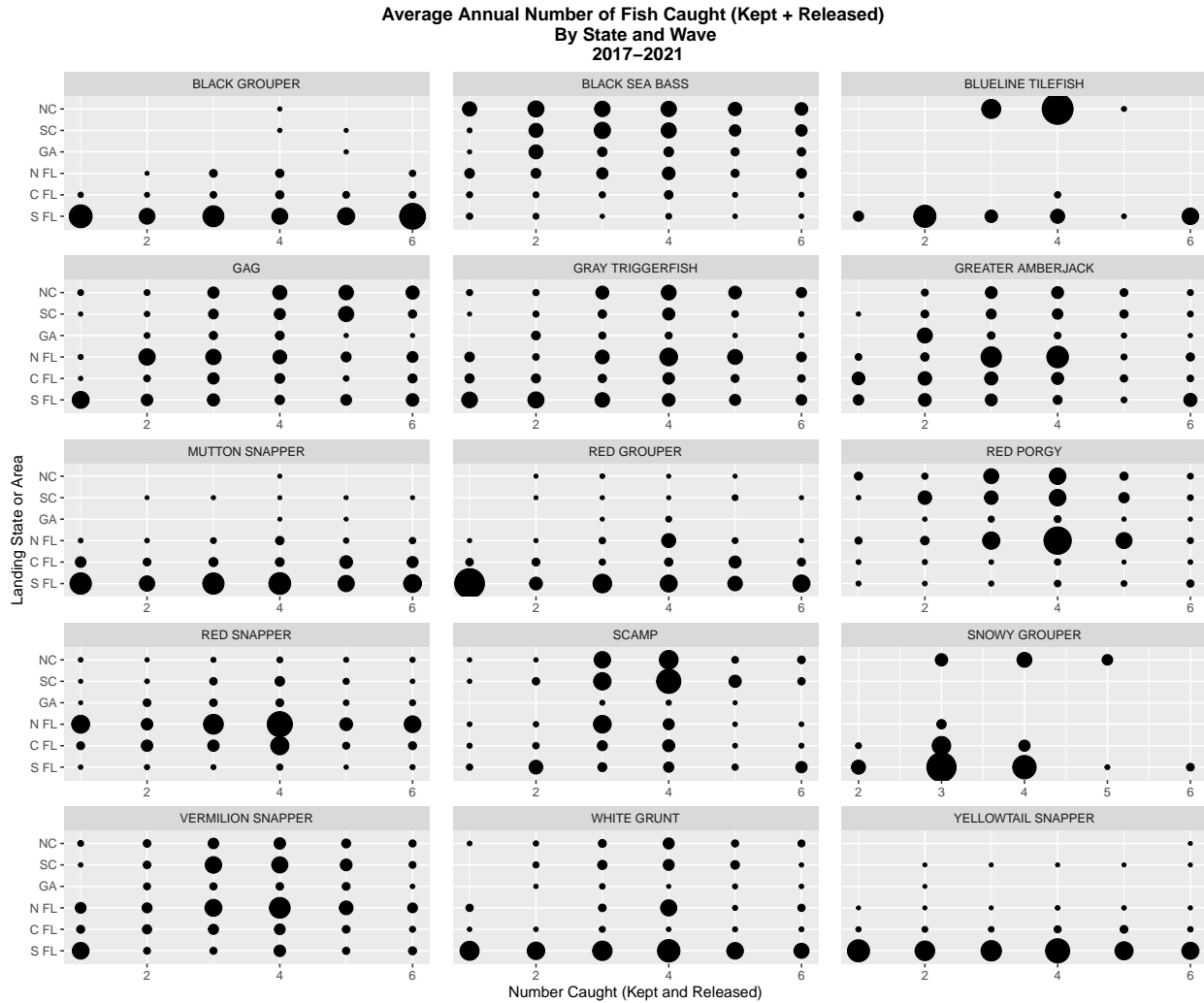tic region from 2017 to 2021 by state or area and wave. State and areas included are North Carolina (NC), South Carolina (SC), Georgia (GA), north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe). Size of the circle is relative catch level for the species.
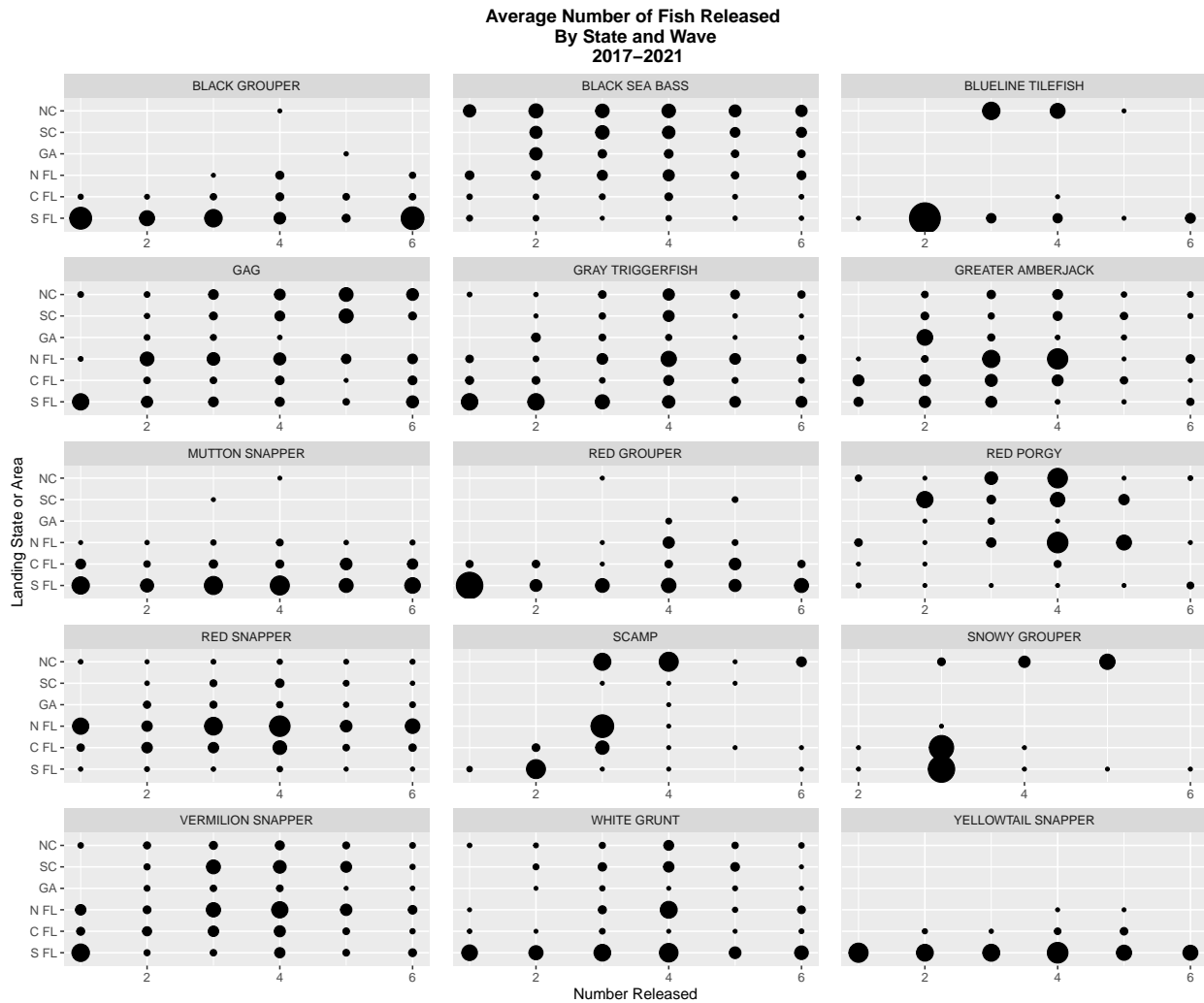
Figure 11: Average annaul number of released fish by the recreational sector (private rec, charter, and headboat, sources: MRIP and SRHS) in the snapper grouper complex with assessments in the South Atlantic region from 2017 to 2021 by state or area and wave. State and areas included are North Carolina (NC), South Carolina (SC), Georgia (GA), north Florida (N FL, counties include Nassau, Duval, Saint Johns, Flagler, Volusia), central Florida (C FL, counties include Brevard, Indian River, St Lucie), south Florida (S FL, counties include Martin, West Palm, Broward, Miami-Dade, Monroe). Size of the circle is relative catch level for the species.

SEDAR73 Red Snapper Forecasts: A Discards-only Scenario

Prepared by NMFS Southeast Fisheries Science Center

Issued: 12 Aug 2022

Introduction

After the SAFMC meeting of June 2022, the SAFMC requested multiple analyses to help guide future management decisions regarding red snapper. Among those requests was a discards-only projection. This report fulfills that portion of the request. Specifically, this report addresses Item #9 of the SAFMC's request:

9. A discard-only projection (F_{landed}=0) and ABC recommendation for red snapper. This projection would assume no landings occur and would give perspective on the minimum number of red snapper removals (in this case, all removals would be dead discards) that must be reduced to end overfishing.

Methods

Except for modifications described here, the projection methods are identical to those of Scenario 13[1], which was selected by the SSC for setting the ABC at their July 2021 meeting. Scenario 13 was defined by the following attributes:

- recruitment was based on the recent 10-yr average
- release mortality applied the "mixed" approach
- fishing rate was F=F30
- discard-mortality reductions from descender devices were not reallocated to landings

The projection of this report had the same attributes. It differed in that it assumed zero landings. To do so, it applied F=F30 as the fishing rate, but all fish were assumed to be discarded. This was accomplished by applying the fishing rate that would have went toward landings, multiplied by the discard mortality rate, D_L. For the base model run or for each MCBE iteration, D_L is the weighted average discard mortality rate,

$$D_L = (P_{L.CH}D.CH_4 + P_{L.HB}D.HB_4 + P_{L.GR}D.GR_4)/(P_{L.CH} + P_{L.HB} + P_{L.GR})$$

where $P_{L.CH}$ is the terminal (last three assessment years) proportion of total fishing mortality toward commercial handline landings, $P_{L.HB}$ is the terminal proportion of total fishing mortality toward headboat landings, and $P_{L.GR}$ is the terminal proportion of total fishing mortality toward

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[1] https://safmc.net/documents/2022/06/sedar73-red-snapper-forecasts-new-methodology-and-additional-scenarios.pdf/

general recreational landings. Values of $D.CH_4$, $D.HB_4$, and $D.GR_4$ are fleet-specific discard mortality rates from block 4 (i.e., they account for descender devices). Then, the fishing rate that would have went toward landings was $F = D_L F_{30}$, and those mortalities were added to the discards. The projections were run for a timeframe of 5 years.

Results and discussion

Results of this discards-only scenario are presented in Table 1 and Figure 1. For convenience of comparison, the analogous projection with landings (Scenario 13) is shown in the appendix, replicated from the July 2021 report to the SSC.

It is important to highlight the limitations of these projections for management advice. These projections assume no landings and reduction in discards starting in 2022. Given the timing of this report and the status of red snapper management actions, this assumption is violated. Nonetheless, this projection can provide some insight (but not exact numbers) into the maximum allowable discards when fishing at the F limit of F30, had management begun in 2022. Should a more precise number for the maximum allowable discards that ensure adequate rebuilding be needed, these projections would need to be updated. The primary rationale for starting them in 2022 was for direct comparison to Scenario 13.

The forecasts of this report are accompanied by the typical list of caveats when forecasting fishery population dynamics (see SEDAR 2021). A very important uncertainty here and when forecasting any fish stock lies in the level of future recruitment. The SAFMC SSC recently agreed with procedures set forth by the SSC Catch Level Projections Workgroup[2], reviewed at their April 2022 meeting. Applied to red snapper, these procedures call for short term projections to be based on recent recruitment (higher than average), while long-term projections for rebuilding and benchmark determination to be based on long-term average recruitment. Although projection calculations can be carried out to any length of time and some times are done so for illustrative purposes, it does not mean all parts of the analysis should be used for management advice. The interpretation by the SSC should be followed closely.

Literature

SEDAR. 2021. SEDAR 73 South Atlantic Red Snapper Stock Assessment Report. SEDAR, North Charleston SC. 194 pp. available online at: http://sedarweb.org/sedar-73.

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[2] https://safmc.net/wp-content/uploads/2022/05/A03a_Catch-level-projections-WG-Report-Draft_FINAL.pdf

Table 1. Discards-only projection results with F= F30 starting in 2022 and recent average recruitment. Benchmarks are based on Block 3 and discard mortality on Block 4 with no reallocation of F toward landings. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (1e8 eggs), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), D = dead discards expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), and pr.reb = proportion of stochastic projection replicates with SSB ≥ SSB$_{F30}$. The extension "b" indicates expected values (deterministic) from the base run; the extension "m" indicates median values from the stochastic projections.

year	R.b	R.m	F.b	F.m	S.b	S.m	L.b(n)	L.m(n)	L.b(w)	L.m(w)	D.b(n)	D.m(n)	D.b(w)	D.m(w)	pr.reb
2020	718	628	0.39	0.34	307585	325176	40	39	416	409	443	407	2019	1909	0.053
2021	718	625	0.35	0.31	347034	372492	39	38	420	413	332	288	1626	1474	0.117
2022	718	634	0.21	0.21	407804	436871	0	0	0	0	202	197	1062	1076	0.219
2023	718	626	0.21	0.21	483261	511115	0	0	0	0	211	201	1139	1124	0.348
2024	718	632	0.21	0.21	561644	586917	0	0	0	0	217	205	1199	1158	0.485

Figure 1. Discards-only projection results with F=F30 starting in 2022 and recent average recruitment. Benchmarks are based on Block 3, and discard mortality on Block 4 with no reallocation of F toward landings.
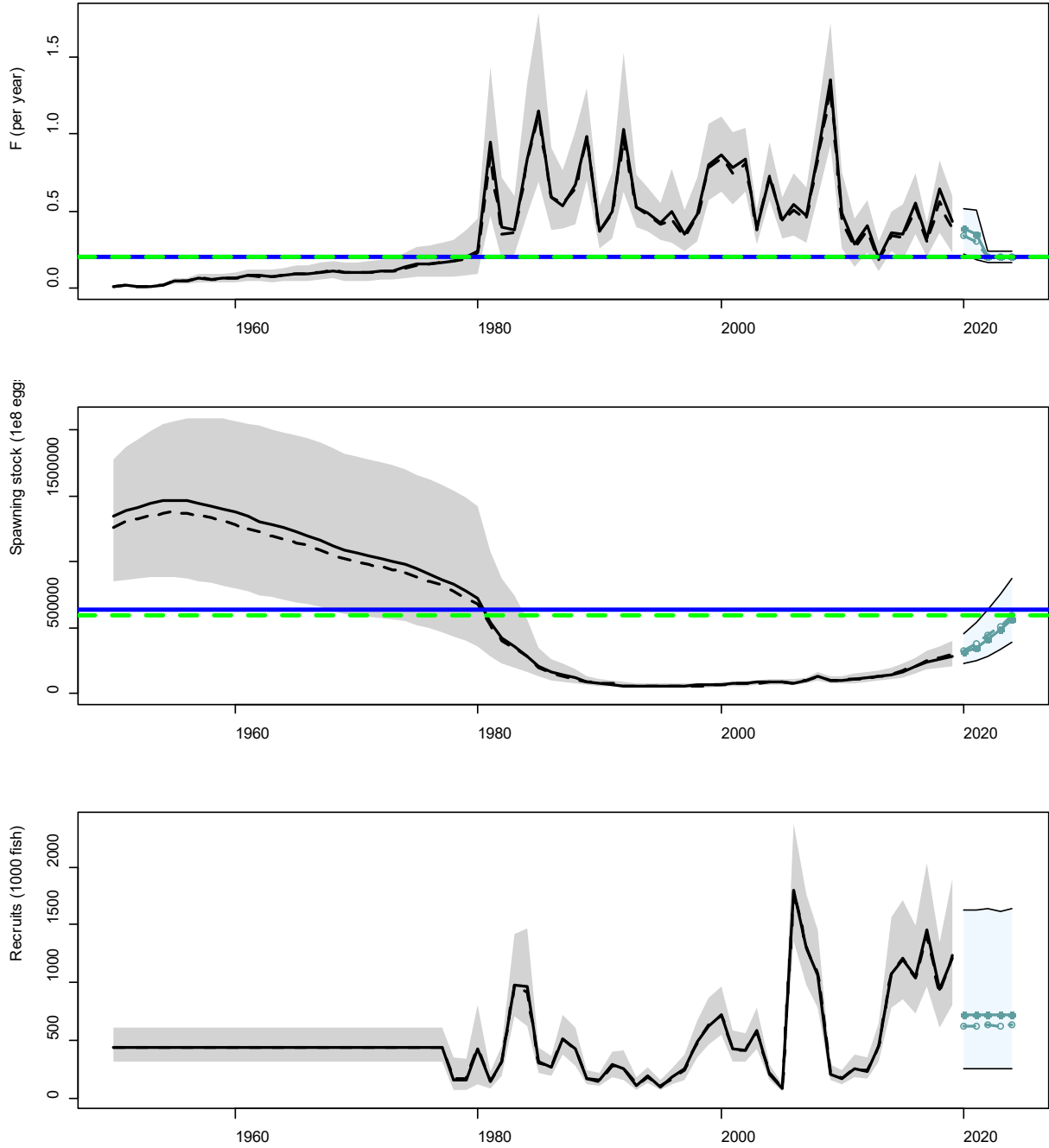
Appendix Table 1. Scenario 13 projection results with F= F30 starting in 2022 and recent average recruitment. Benchmarks are based on Block 3 and discard mortality on Block 4 with no reallocation of F toward landings. R = number of age-1 recruits (in 1000s), F = fishing mortality rate (per year), S = spawning stock (1e8 eggs), L = landings expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), D = dead discards expressed in numbers (n, in 1000s) or whole weight (w, in 1000 lb), and pr.reb = proportion of stochastic projection replicates with SSB $\geq$ SSB$_{F30}$. The extension "b" indicates expected values (deterministic) from the base run; the extension "m" indicates median values from the stochastic projections.

year	R.b	R.m	F.b	F.m	S.b	S.m	L.b(n)	L.m(n)	L.b(w)	L.m(w)	D.b(n)	D.m(n)	D.b(w)	D.m(w)	pr.reb
2020	718	628	0.39	0.34	307585	325212	40	39	416	409	443	407	2019	1910	0.053
2021	718	629	0.35	0.31	347034	372325	39	38	420	413	332	288	1626	1473	0.117
2022	718	629	0.21	0.21	401322	430186	25	28	284	319	195	189	983	996	0.206
2023	718	629	0.21	0.21	465178	491225	28	31	327	363	202	191	1036	1016	0.307
2024	718	629	0.21	0.21	529917	551037	31	33	368	403	207	194	1076	1034	0.415
2025	718	630	0.21	0.21	593360	608291	33	35	408	441	210	196	1104	1050	0.526
2026	718	623	0.21	0.21	653509	662653	35	36	446	475	211	196	1122	1062	0.637
2027	718	630	0.21	0.21	710246	712268	36	38	480	506	212	197	1133	1067	0.733
2028	718	629	0.21	0.21	762093	757711	38	39	511	533	212	197	1138	1072	0.81
2029	718	630	0.21	0.21	809274	799286	39	40	538	559	212	197	1143	1076	0.871
2030	718	624	0.21	0.21	851779	835646	40	41	562	581	212	198	1146	1080	0.915
2031	718	625	0.21	0.21	889553	868429	41	42	584	602	212	198	1148	1083	0.946
2032	718	628	0.21	0.21	923163	896936	42	43	603	619	213	198	1151	1086	0.968
2033	718	627	0.21	0.21	952682	921751	42	44	620	635	213	198	1153	1092	0.98
2034	718	631	0.21	0.21	978473	944097	43	44	634	649	213	199	1154	1093	0.988
2035	718	629	0.21	0.21	1001094	963960	44	45	647	662	213	199	1156	1096	0.993
2036	718	626	0.21	0.21	1020799	981064	44	45	658	673	213	199	1157	1097	0.996
2037	718	630	0.21	0.21	1037826	995602	44	45	668	683	213	199	1158	1099	0.998
2038	718	629	0.21	0.21	1052612	1008953	45	46	676	692	213	199	1159	1103	0.999
2039	718	629	0.21	0.21	1065380	1019871	45	46	683	698	213	199	1160	1103	0.999
2040	718	630	0.21	0.21	1076422	1030010	45	46	689	704	213	198	1161	1102	1
2041	718	634	0.21	0.21	1085957	1038653	45	47	695	710	213	199	1161	1105	1
2042	718	627	0.21	0.21	1094186	1046759	46	47	699	715	213	199	1162	1102	1
2043	718	631	0.21	0.21	1101288	1053572	46	47	703	719	213	199	1162	1103	1
2044	718	627	0.21	0.21	1107417	1059173	46	47	707	722	213	199	1163	1104	1

Release Hot Spots of U.S. South Atlantic Red Snapper

SEFSC

8 August 2022

Summary

This document describes the spatial and temporal distribution of releases of South Atlantic Red Snapper from the recreational private and charter boat fleets, highlighting areas or times of concentrated releases (or, hot spots) of Red Snapper in the U.S. South Atlantic. These data are based on the effort scaled release estimates (B2) from the Marine Recreational Information Program (MRIP) intercept sampling.

Introduction

At their June 2022 meeting, the SAFMC requested an analysis of release hot spots for red snapper for consideration at the September 2022 meeting. The hot spots are defined here as both temporal (e.g. monthly) and spatial (e.g. latitude blocks) concentrations of releases. Based on SSC approved projection analyses from the most recent Red Snapper stock assessment, the approximate reduction in release mortalities needed to achieve rebuilding would be about 65%.

Only 1% of dead releases came from the commercial sector (although it should be noted the commercial release estimates are from unvalidated logbooks with a negative bias, or underreporting). The vast majority—97%—of dead releases came from the general recreational sector (private boat and charter boat), and of these, about 95% came from the private boat fleet[1]. Compared to 571,000 dead fish, release mortalities would need to be reduced to about 33%-37% of the current level, or 189,000-212,000 dead fish for the Red Snapper stock to end overfishing. This represents a reduction in dead releases of about 65%.

Methods and Results

Because the majority of releases come from the general recreational sector, this hot spot analysis was focused on data from the MRIP survey for the years 1982-2021. More specifically we focused the analysis on the private boat sector since it represents the majority of releases. Recent improvements to the MRIP database allow for easy computation of intercept specific estimates that have been scaled by fishing effort. The improved data allows for temporal analysis down to the month level, noting that MRIP staff do not recommend using any finer temporal scale. Assuming the location of the intercept sites is a sufficient proxy for fishing area allows for exploration of spatial patterns at a coastwide scale.

An unknown property of the intercept-specific sampling is the location that was actually fished. However, nearly all trips in the MRIP data are day trips (<12 hours fishing). Thus, the geographic extent of fishing represented by a single intercept location is limited to the travel distances of boats in less than a day's time. This is likely further restricted by the distance from the intercept site to the nearest inlet.

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[1] http://sedarweb.org/docs/wpapers/SEDAR73_WP09_General%20Recreational%20Data_SA_RS_11032020.pdf

Red Snapper are almost exclusively accessed at offshore sites, usually in federal waters. Red Snapper may inhabit specific habitat types, further focusing the potential areas of fishing effort associated with each intercept estimate. Also, given the sparsity of inlet access along some parts of the U.S. East Coast, the general area being fished by recreational boats may be further constrained.

Intercept sampling sites in the MRIP survey were summarized into latitude bins, which were determined by simply dividing the whole latitudinal range in the U.S. South Atlantic into 32 equal bins (0.33 degrees of latitude) ranging from 25.4°N to 35.8°N. Intercept sampling sites are distributed across access sites based on total fishing pressure and therefore are not evenly distributed along the entire coast. Furthermore, not all sites include fishing effort that caught Red Snapper. Thus, the number of intercepts per latitudinal bin are not evenly distributed and change through time based on recreational fishing patterns and potential targeting of Red Snapper.

The heat map in Figure 1 indicates most of the Red Snapper releases are occurring between the St. Johns River and Canaveral Inlet. This map also indicates a strong temporal trend of increasing releases in the most recent years (Fig. 1). This was dealt with by analyzing the data using all years and a subset of the most recent years.

Figure 2 indicates that the Red Snapper releases are spread throughout the year for the most part, with some concentration during the summer months and winter months in the most recent years. As was shown in Figure 1, the temporal increase in releases is quite evident (Fig. 2).

Figures 3 and 4 are the best indicators for time-area 'hotspots' of releases of Red Snapper from the dominant recreational private boat sector. These figures can be used to examine potential differences in fishing patterns in the most recent years compared to all years going back to 1982. The magenta highlighted boxes in these figures represent the smallest rectangular box that includes a minimum of 65% of the total releases. The 65% matches the amount of reduced releases needed to end overfishing.

Discussion

This analysis focused on the private boat sector because it accounts for 95% of recreational releases, and the recreational sector accounts for 97% of total coastwide dead releases. For the purposes of this report the 'hotspot' sector is recreational private boats. Within that sector, there is a clear concentration of time-area releases of Red Snapper off the northeast coast of Florida. The spatial hotspot for Red Snapper releases is between the St. John's River Inlet and Canaveral Inlet (Fig. 3). The temporal hotspot for Red Snapper is a little less concentrated and suggests the months of February to August as the primary temporal hotspot (Fig. 3). However, including all years of data suggests the temporal pattern of Red Snapper releases is more year-round (Fig. 4).

There are several important caveats to this analysis. First, the release estimates (B2) from the MRIP survey are based on self-reports from intercepted private boat anglers. The accuracy of these self-reported data has not been validated. One of the primary biases of concern with self-reported data is recall bias. Fortunately, the MRIP intercepts capture anglers as they return from a completed trip and thus recall bias should be minimal.

The latitude assignment for the intercept data is the location of the post-fishing trip interview and therefore does not indicate exactly where the anglers may have been fishing. As discussed above there are some limits to the spatial fishing area that each intercept might represent, but there is potential for a fairly large area of fishing that could be targeted by anglers leaving from particular intercept sites. Using latitude alone is a simplification of the U.S. East Coast and does include important factors like the data concentrating effect of more East-West coastlines, fishing ground distance from shore, and distance of launch site from inlet access. Since this analysis applies to Red Snapper positive intercepts, then to some degree the area of fishing is more likely to follow the distribution of Red Snapper (e.g. depth, habitat, etc.). Until supplemental data are collected to indicate more exact fishing ranges from various intercept sites, this data set should be treated with the understanding that intercept latitude may not match exactly with fishing effort latitude (although as noted above, we have reason to believe that intercept location is a reasonable approximation of fishing latitude).

This analysis does not consider any uncertainty measures (e.g. PSE) in the effort-scaled intercept estimates. Therefore, it is recommended that results be interpreted with a degree of smoothing or smearing when highlighting particular hotspots. Despite this issue the degree of concentration of releases indicates there are 'hotspots' of Red Snapper releases that may aid in determining appropriate management actions.

Figure 1. Heat map of summed MRIP releases (B2) by year and latitude bin for Red Snapper.
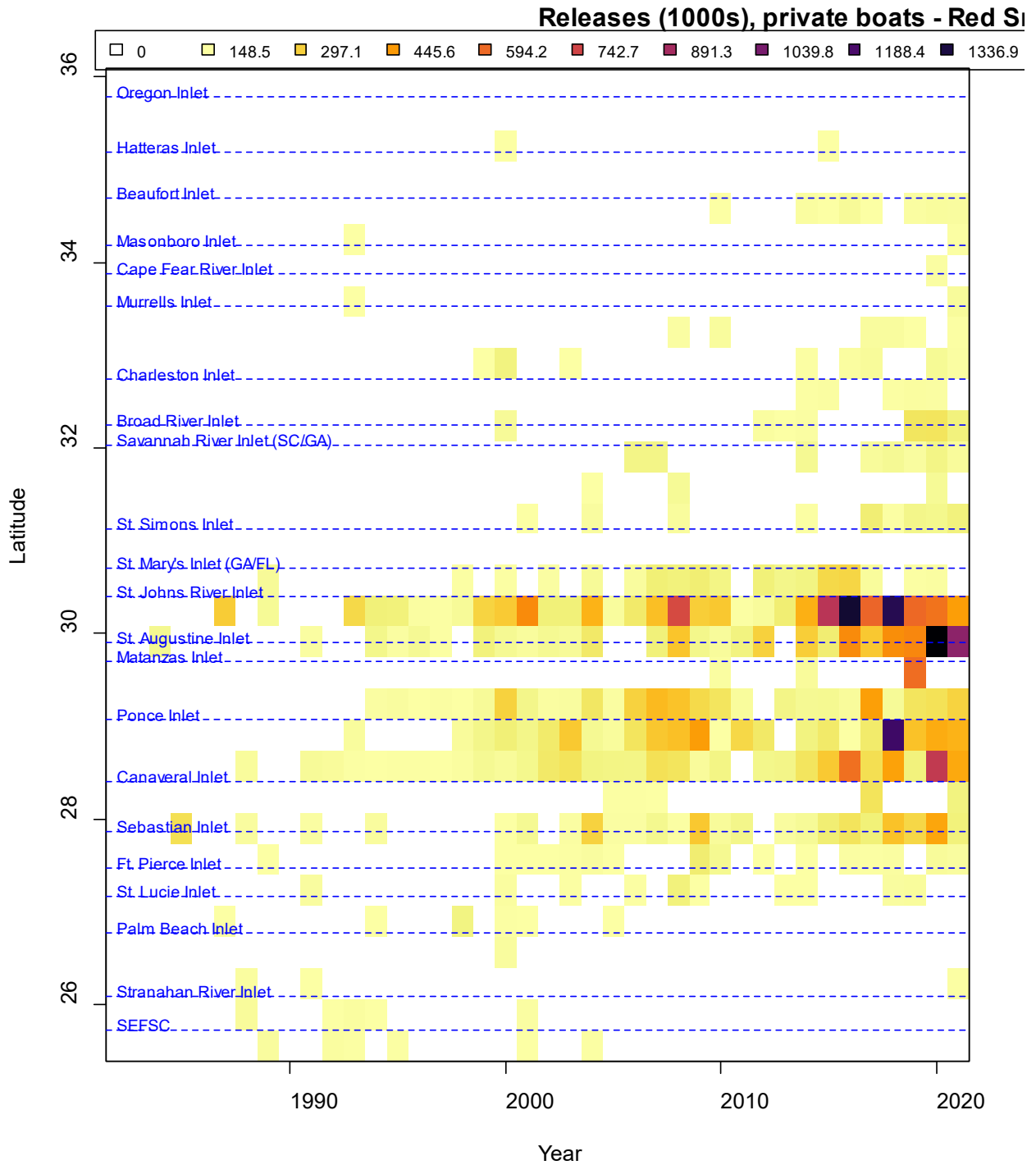
Figure 2. Heat map of summed MRIP releases (B2) by year and month bin for Red Snapper.
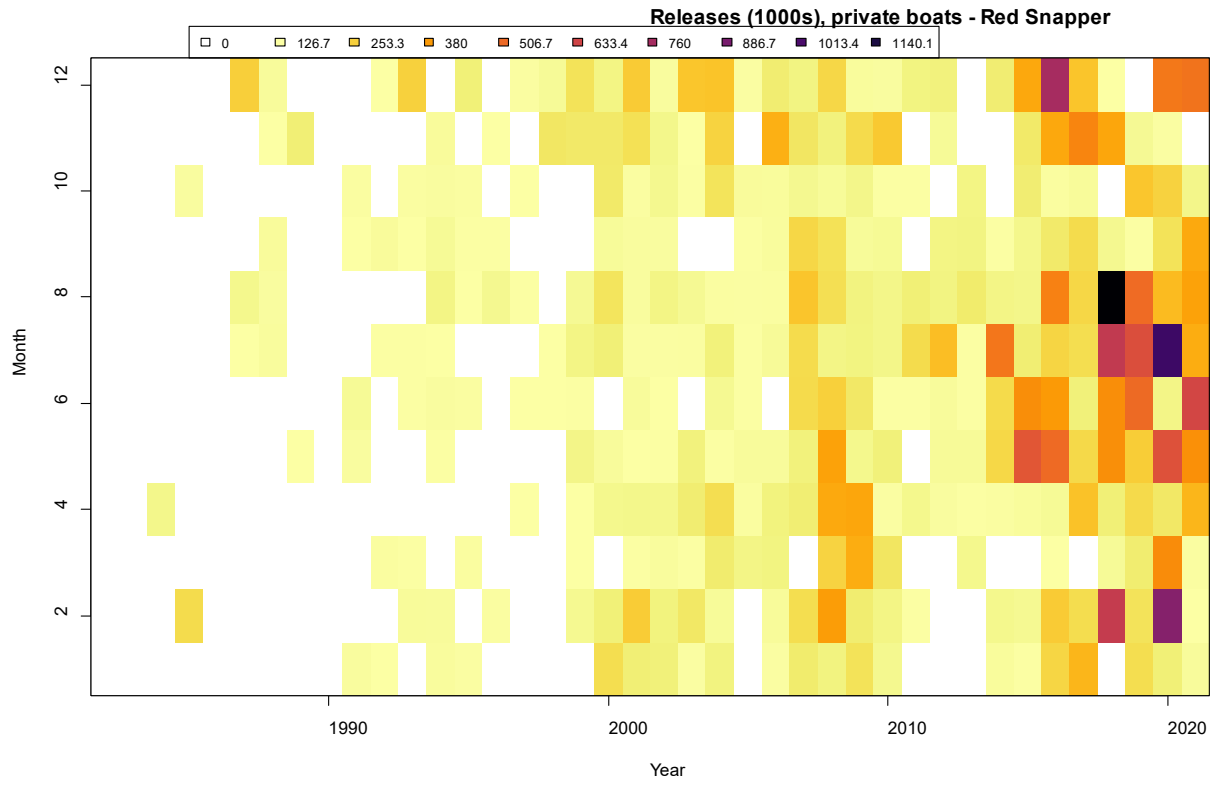
Figure 3. Distribution of percentages of Red Snapper releases (B2) from effort scaled MRIP intercept samples. Numbers in each year-latitude bin represents the percentage of the Red Snapper releases from 2017-2021. Marginal total percentages are indicated in dark green. The magenta highlighted box represents the smallest rectangle of temporal-spatial bins that represents at least 65% of total releases, the actual percentage indicated in the righthand legend is 66.3%.
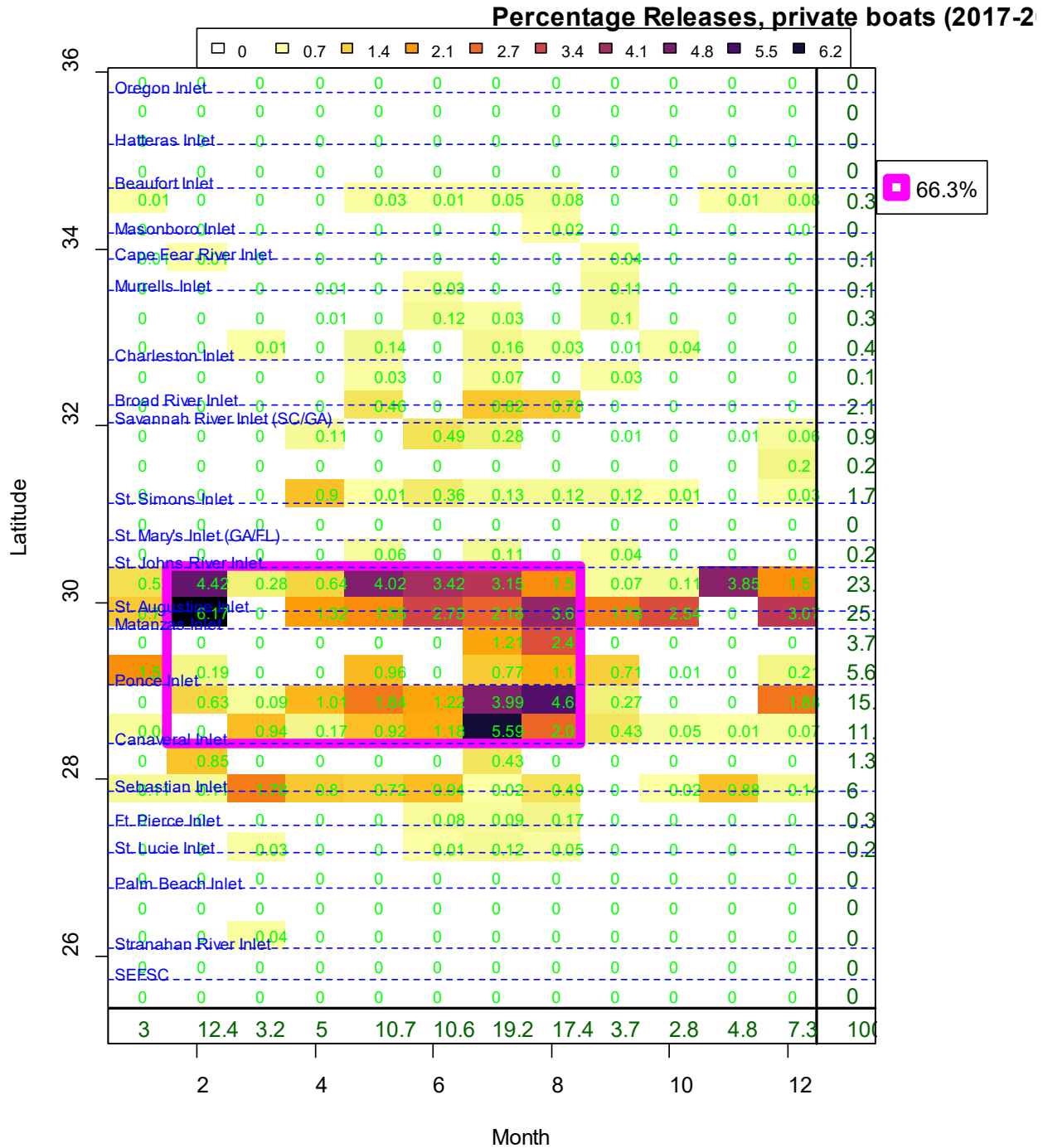
Figure 4. Distribution of percentages of Red Snapper releases (B2) from effort scaled MRIP intercept samples. Numbers in each year-latitude bin represents the percentage of the Red Snapper releases from 1982-2021. Marginal total percentages are indicated in dark green. The magenta highlighted box represents the smallest rectangle of temporal-spatial bins that represents at least 65% of total releases, the actual percentage indicated in the righthand legend is 68.3%.