Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: **Sciaenids Management Board**

FROM: **Red Drum Technical Committee and Stock Assessment Subcommittee**

DATE: **April 21, 2025**

SUBJECT: **Red Drum TC/SAS Report on Board Tasks as Follow-up to 2024 Benchmark Assessment**

Summary

Task 1: Calculate the catch reduction needed for the southern stock to fish at $F_{30\%}$, $F_{35\%}$, and $F_{40\%}$ as well as the projected timeline to reach the threshold and target spawning stock biomasses (SSB) under each fishing mortality (F) scenario.

- The TC/SAS conducted projections of the Stock Synthesis (SS) assessment model to calculate the stockwide catch reductions necessary to reduce *F* from the average of the final three years of the stock assessment (2019-2021) to lower levels requested by the Board ($F_{30\%}$, $F_{35\%}$, and $F_{40\%}$).
- The TC/SAS also developed a methodology to estimate catch reductions achieved by changes to slot size limits, bag limits, and/or vessel limits with two different assumptions about angler compliance with regulations. This catch reduction analysis was applied to Florida data to estimate reductions already achieved from regulation changes following the stock assessment.
- Projections indicate the requested *F* scenarios of $F_{30\%}$, $F_{35\%}$, and $F_{40\%}$ would require stockwide catch reductions of 14.4%, 21.4%, and 28.1% from catches under the 2019-2021 average *F* level, respectively. *SSB* was only projected to reach the target in the $F_{40\%}$ scenario with a timeline of 32 years. *SSB* was projected to reach the threshold in the reduced *F* scenarios ranging from 23 years in the $F_{30\%}$ scenario to 5 years in the $F_{40\%}$ scenario. *SSB* was projected to remain below the target and threshold with 2019-2021 average *F*.
- Under a perfect compliance assumption, Florida's catch reduction from regulation changes following the stock assessment was estimated to be 16.8%. Incorporating additional mortality from potential noncompliance, the estimated average catch reduction was 14.9% (range of 12.8% to 15.2%). These catch reductions would result in a stockwide catch reduction of 9.3% and 8.3%, respectively, if other southern stock states were to maintain their current regulations.

Task 2: Discuss how to interpret the TLA result of "Moderate Action", as well as methods for estimating regulation change impacts for the northern stock.

- The TC/SAS concluded an investment by the northern stock states to improve the quantity and quality of their monitoring efforts, adherence to status-quo regulations, and a Traffic Light Analysis (TLA) update between assessments would all constitute "Moderate Action". The TC/SAS do not recommend specific regulatory changes in response to a "Moderate Action" result.
- The TC/SAS recommend using the same bag, vessel, and slot size catch reduction methods as those developed for the southern stock if the Board wishes to estimate catch reductions of regulatory changes for the northern stock. However, if estimated stockwide catch reductions associated with specified *F* scenarios are desired, a method to estimate these reductions would also need to be identified given that the TLA is a qualitative tool and does not have the same projection functionality as the SS model used for the southern stock.

Background

The 2024 Red Drum Benchmark Stock Assessment and Peer Review Report (ASMFC 2024) were presented to the Sciaenids Management Board (Board) at the 2024 ASMFC Annual Meeting and subsequently approved by the Board for management use. The assessment indicated the southern stock (South Carolina through the east coast of Florida) is overfished and experiencing overfishing, while the northern stock (New Jersey through North Carolina) is not overfished and not experiencing overfishing.

Stock status for the southern stock was determined using a Stock Synthesis model (SS; Methot et al. 2023), which estimates fishing mortality (*F*), annual spawning potential ratio (*SPR*), and spawning stock biomass (*SSB*). Reference points previously established in Amendment 2 to the Red Drum Interstate Fishery Management Plan (FMP) include $F_{30\%}$ and $SPR_{30\%}$ as overfishing thresholds and $F_{40\%}$ and $SPR_{40\%}$ as fishing mortality targets (ASMFC 2002). *SSB* reference points had not previously been defined for red drum but were recommended during the 2024 benchmark assessment as the *SSB* produced when fishing at the overfishing threshold (i.e., $SSB_{30\%}$, *SSB* threshold) and the fishing mortality target ($SSB_{40\%}$, *SSB* target). Stock status determinations are based on terminal three-year (2019-2021) averages of *F, SPR,* and *SSB* relative to these reference points. Terminal age-2 *F* (0.526) was above the *F* threshold (0.396) and *F* target (0.301), while *SPR* (0.207) was below the *SPR* threshold (0.300) and *SPR* target (0.400). In addition, the stock is below the *SSB* target (13,250 mt) and *SSB* threshold (9,917 mt) with a terminal *SSB* of 8,737 mt. These stock status determinations need to be addressed through regulatory changes to return the stock to a favorable stock status.

The appropriateness of the *SPR* reference points for red drum has been evaluated by the Red Drum Technical Committee (TC) and Stock Assessment Subcommittee (SAS) in the past. In May 2016, the Red Drum TC/SAS was tasked, in part, by the Board to "investigate whether the current biological reference point for overfishing ($SPR_{30\%}$ threshold) is appropriate given the species' long life history." After a literature review, the TC and SAS concluded that spawning

potential ratios, including the current threshold (30%) and target (40%), are appropriate metrics for red drum management. Reference points were evaluated again according to a term of reference of the 2024 stock assessment and peer review and the SPR reference points were again endorsed for red drum by the TC, SAS, and Peer Review Panel.

The northern stock uses a Traffic Light Analysis (TLA) to determine stock status with reference points established in the 2024 Red Drum Benchmark Stock Assessment. Reference points consist of specified color proportion thresholds and number of years. Red drum adult abundance (via fishery-independent surveys) and fishery performance (calculated as fishery harvest divided by abundance of slot-sized fish) metrics were used to determine overfished and overfishing stock status, respectively.

Annual metric color results (proportions of green, yellow, and red) from the TLA are tabulated across consecutive years, including the year of interest and a number of preceding years. The number of proceeding years is dependent on the metric and stock being evaluated. These tabulated metric summaries are colored according to the most favorable annual metric result across the years being summarized and are used to assess stock status. For example, fishery performance is tabulated over 7 years in the northern stock and, if the TLA proportion red in all seven individual years exceeds the color threshold set for this metric, the tabulated metric summary for the final year is red. If the TLA proportion red does not exceed the color threshold in at least one of the 7 years but the proportion yellow does, the tabulated metric summary for the final year is yellow. Lastly, if neither the proportion red or yellow for any of the 7 annual metric results exceeds the color threshold, the tabulated metric summary is green. To maintain consistency between the TLA stock status determinations and the SS stock status determinations, the TLA identified an overfished or overfishing status if tabulated metric summaries for any of the last three years of the assessment were red. As with the SPR reference points used with SS model results, the TLA reference points were endorsed as proxies for red drum by the TC, SAS, and Peer Review Panel.

The northern stock's TLA tabulated metric summaries for the fishery performance and adult abundance metrics were yellow and green, respectively, for each of the last three years of the assessment (i.e., 2019, 2020, or 2021). However, the TLA also showed increased occurrence of yellow and red annual metrics in recent years for adult abundance and fishery performance, indicating the northern red drum stock may be experiencing unfavorable trends for both metrics that may need correction with regulatory changes if they continue into the future. Additionally, yellow TLA tabulated metric summaries were assigned the terminology "Moderate Action" in the stock assessment report, but details on the meaning of this terminology were not provided.

Following approval of the 2024 Red Drum Benchmark Stock Assessment and Peer Review Report for management use, the Board tasked the Red Drum TC and SAS to conduct several analyses related to the southern and northern red drum stocks to assist with determining next steps.

1. Calculate the catch reduction needed for the southern stock to fish at $F_{30\%}$, $F_{35\%}$, and $F_{40\%}$ as well as the projected timeline to reach the threshold and target *SSBs* under each *F* scenario. These analyses should not incorporate effort trends and should include alternative analyses with and without noncompliance assumptions.[1]
2. Discuss how to interpret the TLA result of "Moderate Action", as well as methods for estimating regulation change impacts for the northern stock.

The Red Drum TC/SAS met to discuss these tasks on November 6, 2024, January 31, 2025, and March 6, 2025. A Catch Reduction Sub-Group of the TC/SAS met on November 20, 2024 and January 13, 2025 to develop the methodology for calculating the catch reductions.

As a reminder, throughout this memo, "year" refers to a fishing year of September 1 of calendar year "y" through August 31 of calendar year "y+1".

Task 1: *Calculate the catch reduction needed for the southern stock to fish at $F_{30\%}$, $F_{35\%}$, and $F_{40\%}$ as well as the projected timeline to reach the threshold and target SSBs under each F scenario. These analyses should not incorporate effort trends and should include alternative analyses with and without noncompliance assumptions.*

Projection Methodology

A series of stock projections were conducted for the southern stock to address the Board's first task. The SS forecast feature was used for projections. This is the internal projection feature of the modeling platform used in the benchmark stock assessment and uses population dynamics equations consistent with those used to estimate stock status. Projections use specified forecast fishing mortality levels and recruitment to project the stock in the terminal year of the assessment forward for a user-specified number of years. Here, some initial testing was done to determine the forecast period necessary for spawning stock biomass to reach equilibrium in all projection scenarios, which found that 40 years was sufficient. All projections used the same recruitment specifications which are the recruitment levels expected from the model stock-recruitment relationship given the spawning stock biomass level at the time of spawning. Due to uncertainty about this relationship and lack of data to estimate it, this relationship essentially simplifies to a constant average recruitment level expected across spawning stock biomass levels, except for when the spawning stock biomass has crashed to very low levels near zero which does not occur in the assessment or projection time series.

[1] The initial motion by the Sciaenids Management Board (Board) at their October 2024 meeting read: "Motion to request the Stock Assessment Subcommittee/Technical Committee to produce the static spawning potential ratio for a range of slot size limits (between 14" and 27") associated with bag limits ranging from 0 to 5 fish per person for: (a) the southern region and/or (b) SC, GA, FL individually." However, after some initial discussion, the TC/SAS determined this analysis would not be possible. At the February 2025 Board meeting, a second motion was passed, as seen here. Further discussion with the southern states Administrative Commissioners provided clarification that this motion was intended to replace the October 2024 motion.

The goals of projections were to (1) determine stockwide catch reductions necessary to reduce fishing mortality from the average of the final three years of the stock assessment time series (2019-2021) when the stock was declared to be experiencing overfishing to lower levels requested by the Board ($F_{30\%}$, $F_{35\%}$, and $F_{40\%}$) and (2) determine the number of years under these lower levels of fishing mortality necessary to reach spawning stock biomass reference points within 0.5%[2]. Catch was calculated as total fishery removals from all fleets including harvest and dead discards (8% of live releases calculated using the same discard mortality rate used in the stock assessment). First, a baseline projection was completed projecting the population under the 2019-2021 average fishing mortality used for stock status determination (Table 1, Figure 1) to determine equilibrium catch levels expected under status quo fishing mortality. Fishing mortality was partitioned among the three state-specific fleets in the model according to average estimated contributions during the final three years of the assessment. Secondly, a projection was completed with the population projected under each lower fishing mortality scenario requested by the Board. Fishing mortality was partitioned among fleets in each of these projection scenarios as it was in the baseline projection. The final step was to compare the catch from the baseline projection to catch under each lower fishing mortality scenario projection in the final year of the forecast to determine the precent reduction in catch needed to move fishing mortality from the 2019-2021 average to the lower specified level using the following equation:

$$Percent\ reduction = \frac{\overline{2019\ through\ 2021\ F}\ Catch_{y40} - Lower\ F\ Scenario\ Catch_{y40}}{\overline{2019\ through\ 2021\ F}\ Catch_{y40}}\ x\ 100$$

Florida made regulatory changes immediately following the stock assessment time series (September 2022), so the impacts of these changes are not accounted for in the stock assessment or projections. These changes are expected to have changed selectivity estimated in the stock assessment, so impacts of these regulations were estimated through bag and vessel limit catch reduction analyses instead (see the next section). Additionally, these projections do not explicitly make any assumptions about effort change or compliance with regulations. Rather, they just provide expected equilibrium catch levels under specified fishing mortality levels that can be compared across scenarios to determine relative catch changes. Impacts of effort changes and/or non-compliance with regulations are evaluated with bag, vessel, and size limit catch reduction analyses.

Projection Results

Catches vary in the first few years of the projections (Figure 2) due to varying year class strengths in the stock during the terminal years of the assessment, including a well above average 2022-year class. This above average year class leads to an initial increase in catches. As

[2] The tolerance of 0.5% for spawning stock biomass rebuilding calculations is due to the asymptotic nature of projections. For example, projecting the stock at $F_{30\%}$ would project the spawning stock biomass to approach an asymptote equal to the $SSB_{30\%}$ threshold, but never actually meet or exceed this asymptote. If specified rebuilding timeframes and/or years to meet or exceed that exact reference point level is desired, fishing mortality levels necessary to achieve these specifications can be determined during next steps.

this year class ages out of the slot and migrates offshore, subsequent average recruitment levels lead to catches and spawning stock biomass hitting equilibriums (Figure 3). Once catches have reached equilibrium levels, projections indicate the requested fishing mortality levels of $F_{30\%}$, $F_{35\%}$, and $F_{40\%}$ would require catch reductions of 14.4%, 21.4%, and 28.1% from catches under the 2019-2021 average fishing mortality levels, respectively (Table 1). Spawning stock biomass reaches threshold levels more quickly under lower fishing mortality levels, ranging from 23 years under $F_{30\%}$ to 5 years under $F_{40\%}$ (Table 1). The population is not projected to reach the spawning stock biomass target under the two higher fishing mortality scenarios (i.e., $F_{30\%}$ and $F_{35\%}$), as it reaches an equilibrium at spawning stock biomass levels associated with the specified fishing mortality level (e.g., $SSB_{30\%}$ when fished at $F_{30\%}$). Spawning stock biomass is projected to reach the target after 32 years of fishing at the $F_{40\%}$ level. Spawning stock biomass is projected to decline further from the terminal year estimate and remain well below the target and threshold levels under long-term equilibrium conditions if the 2019-2021 average fishing mortality is maintained. It is important to note that if reduced spawning potential (i.e., spawning stock biomass consistently lower than the threshold) leads to lower-than-average recruitment estimated during the stock assessment time series, declines in spawning stock biomass would be more pronounced.

Only a single projection was done for each scenario to understand reductions and rebuilding timeframes under average, equilibrium conditions. Additional projections can be done with an iterative approach to provide information on risk and uncertainty, if desired, during next steps. Objectives for such risk and uncertainty information from the Board would assist the TC with determining the most appropriate changes to the projection methodology to provide this information.

Catch Reduction Analysis Methodology

Each of the *F* scenarios examined in projections ($F_{30\%}$, $F_{35\%}$, and $F_{40\%}$) require a reduction in catch to reduce the 2019-2021 average *F* levels from the end of the stock assessment. To estimate the expected catch reduction from specific regulation changes, the TC developed tools to evaluate the impacts of state-specific changes to slot limits, bag limits, or vessel limits. However, these tools are limited to evaluating catch reductions within what was allowable under the regulations during the terminal year of the assessment. Therefore, these tools cannot be used to evaluate how catch may change if a bag, vessel, or slot limit is liberalized from what the regulations allowed during the assessment terminal year because there is no catch data to inform the analyses under less restrictive regulations.

The catch reduction analysis tool for bag and vessel limit changes uses Marine Recreational Information Program (MRIP) data from the most recent four-year period where regulations were consistent within each state in the southern stock assessment region (September 2018 through August 2022). Using those data, the tool reduces the number of red drum harvested per trip by an individual or party if it is greater than the bag or vessel limit being analyzed. The reduction in number of fish harvested would then be added to the total amount of released fish. The number of dead discards attributed to a bag and vessel limit is then calculated using the 8% dead discard rate used in the 2024 benchmark stock assessment. The number of dead

discards and harvested fish with and without the regulation changes are compared to estimate the catch reduction achieved under a specific bag or vessel limit change.

Similarly, the catch reduction tool used to assess the impact of slot limit changes uses the same data range (September 2018 through August 2022). However, only the MRIP Access Point Angler Intercept Survey (APAIS) data could be used for this analysis because it contains length measurements. This analysis uses the length frequencies of harvested red drum to estimate how much catch could be reduced by narrowing the existing slot limit. To create the one-inch length bins, the MRIP data is converted from fork length (FL) to total length (TL) using conversion from the stock assessment and then rounded down to the nearest inch. Then the slot limit can be changed to estimate the number of harvested fish that would be reduced, and that reduced harvest is added to the number of released fish, with the number of dead discards calculated as described for the bag and vessel limit analysis. When both slot limit changes and bag or vessel limit changes are examined, the total estimated catch reduction is calculated using the following equation:

$$Percent\ reduction = A + B + A * B,$$

where A is the percent reduction estimated with the bag and vessel limit catch reduction tool and B is the percent reduction estimated with the slot size catch reduction tool.

This calculation adjusts the individual reductions so as not to double count reductions when both regulation change types are implemented on the same population (Chen and Rao 2007).

Since each state has different regulations, the catch reduction tools are set up to estimate impacts of state-specific potential regulation changes. The catch reduction tools are further refined into three regions for Florida for a more accurate catch reduction estimate, as the state has divided its east coast into three management regions with different regulations since September 2022. Florida regulations include reduced bag and vessel limit for its Northeast region (FL_NE), catch-and-release only in the Indian River Lagoon region (FL_IRL), and a reduced vessel limit in the Southeast region (FL_SE).

When states put forward proposals with their respective calculated catch reductions, the total catch reduction expected to be achieved can be estimated. This would be done by summing the reduced total catch for each state and dividing the sum by the total catch before reductions. Therefore, the total catch reduction for the southern stock would be more heavily influenced by regulations in states with greater removals. If one state does not achieve a proportional catch reduction equivalent to the overall stockwide reduction required, the remaining states would have to take proportionally larger reductions to achieve the overall stockwide reduction necessary.

The catch reduction tools make several assumptions. These methods assume constant effort. Based on data from the MRIP Fishing Effort Survey (FES), in recent years the number of angler trips in South Carolina and Georgia has trended upward while the number of angler trips in Florida has generally declined since a peak in 2018 (Figure 4). Additionally, the projection does

not account for changes in angler behavior in response to regulation changes. It assumes the catch rates recorded in the MRIP samples from September 2018 through August 2022 are representative of what will be observed in the future. It is also important to consider that the time period being used for this catch reduction analysis includes years where angler behavior may have been influenced by COVID and COVID-era restrictions/behavioral changes. Some states reported higher-than-expected fishing effort during COVID, though the effort in these years is not outside the observed range during the time series (2000-2023; Figure 4). Due to the uncertainty with projecting future changes in effort and the ongoing issue of MRIP FES overestimating effort, the Board directed the TC to use constant effort for analyses.

The TC was also directed to consider noncompliance when estimating potential catch reductions from different regulation changes. For the purposes of bag/vessel limit catch reduction analyses, the TC considers noncompliance to mean trips where the combination of observed harvest and unavailable harvest for a trip was either greater than the vessel limit or greater than the maximum possible bag limit for a single angler or a group of anglers if on a vessel. For size limit catch reduction analyses, the TC considers noncompliance to mean when red drum length measurements converted from FL in mm (measurement from MRIP) to TL and rounded down to the nearest inch (measurement used for management) were outside the slot limit. Using these definitions, data were flagged and used to calculate a noncompliance rate. The TC further evaluated catch data to provide additional context on this issue given the uncertainty as to whether all catch flagged is truly noncompliant.

For the catch reduction analysis tools, the analyses use the number of red drum harvested, which is a combination of observed harvest and unavailable harvest. “Observed harvest” is when the MRIP APAIS sampler is able to visually confirm that a fish was harvested, while “unavailable harvest” is based on what the angler tells the MRIP APAIS sampler and falls under a variety of disposition categories. The disposition categories that could be included in “unavailable harvest” include when red drum are released dead, those cut up for bait (although this is illegal for red drum in some cases), and those harvested but that are not visually confirmed by the MRIP APAIS sampler (e.g., buried at the bottom of a cooler and anglers decline inspection). Because of the various dispositions included in “unavailable harvest,” especially the released dead category, there could be instances where the analyses used in the tool indicate a trip harvested more than the bag or vessel limit, but, in reality, the “harvest” was fish lost to depredation or a dead discard from another cause.

Disposition information is not included in the publicly available MRIP data from NOAA Fisheries, so staff from states within the southern stock range reached out to their MRIP samplers to assess the disposition categories. Each state analyzed the disposition categories and determined that the dead discard disposition code was rarely reported. Percentage of red drum harvest reported as released dead is provided for South Carolina, Georgia, and Florida in Tables 2, 3, and 4 respectively, and range from 0-5% of harvest, with only four of eighteen time periods evaluated with positive percentages.

For red drum recorded as being outside the slot size limit, the uncertainty about noncompliance comes from length measurements near the minimum and maximum size limits. Although red drum slot limits are set and enforced using TL by inch, MRIP APAIS samplers measure red drum using FL by mm. To assess noncompliance with slot limits, the MRIP APAIS FL samples were converted to TL using the length-length conversions from the 2024 red drum benchmark assessment and compared to the slot limit within the region in which it was caught. Although red drum tails are not heavily forked, every length-length conversion has some associated error, thus, red drum lengths converted from mm FL to inches TL that are just below or just above the slot limit may not truly represent angler noncompliance with slot limits. This difference between original measurement and conversion to enforcement measurement complicates estimation of this uncertainty, but converted length composition data available for size limit catch reduction analyses are reported in Table 5 to provide context on this issue.

The Board also requested that the TC show the impact of including noncompliance in the catch reduction estimates. Noncompliance rates were calculated for MRIP trip data within each state for each regulation (bag limit, vessel limit, slot limit), but the impact of incorporating noncompliance into the catch reduction analyses will change based on the regulations being considered by each state.

Catch Reduction Analysis on Florida's Current Regulations

Though states have not yet put forward any potential regulation packages to be analyzed for catch reductions in response to the stock assessment findings, we can test these tools on Florida because they are in the unique situation of already having implemented more restrictive regulations in 2022 immediately following the assessment time series. Further, the impact of those changes was not incorporated into the model projections for estimating catch reductions required to achieve a specific *F* scenario. As an example, Florida's new red drum regulations can be input into the catch reduction analysis tools to estimate the catch reduction achieved, and how incorporating noncompliance influences the catch reduction estimation for Florida. This would also provide insight into the potential catch reduction already achieved for the southern red drum stock from Florida's regulation changes.

To better visualize the impact of including additional documented mortality from potential noncompliance trips, the estimated catch reduction achieved from Florida's recent regulation changes was calculated under different scenarios. Under a perfect compliance assumption, Florida's catch reduction was estimated to be 16.8% (Table 6). For context, this would result in an overall catch reduction of 9.3% for the southern stock if all other states were to maintain their current regulations and be insufficient to meet the reductions necessary for the Board-requested *F* scenarios. Different draws of non-compliance data, over 1,000 iterations, were then used to estimate a minimum, maximum, and mean noncompliance rate. Providing a range around the catch reduction estimates with noncompliance helps to account for the rarity of noncompliant trips and the uncertainty of how noncompliance rates will change following regulation changes. Incorporating additional mortality from potential noncompliance, the estimated catch reduction range for Florida was 12.8% to 15.2% with an average catch reduction of 14.9% (Table 7). This average catch reduction would result in an overall catch

reduction of 8.3% for the southern stock if all other states were to maintain their current regulations and would also be insufficient to meet the reductions necessary for the Board-requested *F* scenarios. Incorporating additional documented mortality into catch reduction analyses has been done for striped bass and provides a more conservative catch reduction estimate than assuming 100% compliance.

Although the catch reduction achieved by Florida's regulations can be estimated using the tools developed by the TC, some of the reduction in catch has already been realized since the regulations were implemented over two years ago. Comparing the average annual MRIP catch data from September 2022 through August 2024 (preliminary data since January 2024) to the average annual catch from September 2018 through August 2021, catch from the east coast of Florida has actually declined by 21.6%. However, this only uses two years of MRIP data, and more years of data would be needed to account for potential inter-annual variation in year class strength.

Task 2: *Discuss how to interpret the TLA result of "Moderate Action", as well as methods for estimating regulation change impacts for the northern stock.*

The TLA, used for the northern stock as the primary status determination methodology, established that the northern stock is neither experiencing overfishing nor is the stock overfished. Overfishing is defined by fishery performance, the threshold for which is a red tabulated metric summary in any one of the last three terminal years. In the case of the northern stock, the TLA has shown yellow tabulated metric summaries for all three of the previous three years, suggesting levels of "Moderate Action" from management as described in the stock assessment report. However, the report did not describe how to interpret the "Moderate Action" determination.

The TC and SAS recommend managers continue to monitor these trends and do not relax existing management measures for the northern stock. The TC and SAS conclude that this constitutes "Moderate Action" in this scenario and do not recommend specific regulatory changes for the northern stock at this time. However, fishery performance has been showing increasing proportions of red in annual metric results since the mid-2000s. Specifically, five of the seven terminal years for which data are available had red exceeding the color threshold (2016-2022), while from 2003-2015 only one year (2011) resulted in red exceeding the color threshold and three years (2003-2005) had green results. This trend points to increased fishing effort across the northern stock, consistently approaching threshold values. To monitor this trend moving forward, the TC and SAS recommend updating the TLA for both stocks between assessments. It is important to note that such an update would not trigger a new overfishing determination for the northern stock considering determinations of the terminal years of the assessment report and the seven-year period to trigger fisheries performance. However, such an update could benefit managers as they navigate managing this fishery and prepare for future assessments.

Per the TLA reference points, an overfished status is only triggered when the tabulated metric summary for adult abundance is red in any one of three previous years. The northern stock was

not determined to be overfished as none of the three previous years were red ("Elevated Action"). However, similar to fishery performance, recent annual metrics of adult abundance have been trending towards yellow and red designations. Specifically, from 2019 to 2022 two years had yellow exceeding the color threshold and the terminal year (2022) had red exceeding the color threshold. This contrasts with the period from 2012 to 2018 in which six years had green results and only one had yellow exceeding the color threshold. Considering the long-lived nature of this species, the indications of decreasing adult abundance substantiate the recommendation to more closely monitor the population and to not relax existing protections for the adult or sub-adult populations in the northern stock. Future assessments would greatly benefit from the development of abundance indices, most notably from the northern edge of the stock, including Virginia northward. An investment by the northern states to improve the quantity and quality of their red drum monitoring efforts, adherence to current status-quo protection measures, and a TLA update between assessments would all constitute "moderate action" on the part of managers and partner states.

To assist with continued monitoring efforts of the northern stock, the TC and SAS developed additional TLA scenarios for tabulated metric summaries during the benchmark stock assessment that represent concerning conditions managers would likely need to address via regulatory changes. Note, none of these scenarios were observed as of the most recent stock assessment and instead represent potential warning signs to be monitored in future TLA updates.

1. If fishery performance is yellow in any of the past three years and recruitment is red for five consecutive years (a generation of the vulnerable population), there has been consistent below average recruitment and increasing catch and/or decreasing sub-adult abundance.
2. If both fishery performance and adult abundance in any of the past three years are yellow, the stock is experiencing increasing catch and/or decreasing sub-adult abundance which is leading to declines in adult abundance.
3. If recruitment is red for five consecutive years and adult abundance is yellow in any of the past three years, there has been consistent below average recruitment representing concern for the future of the adult abundance.

Although the SS method was the primary method of stock status determination for the southern stock, the TLA for the southern stock did display an increased quantity of red results compared to the northern stock. This agreement between the two methods gives the TC and SAS confidence in utilizing the TLA for current and future stock determinations for the northern stock in the absence of formal integrated assessment models. Further, scenarios 2 and 3 above were both observed for the southern stock, adding further evidence of agreement between SS and TLA methods. These triggers offer the opportunity to utilize these cautionary scenarios to inform management decisions, as intended.

As a complementary analysis to the TLA, the Skate Method was used and included in the stock assessment for the northern stock. This method identified an extended period of overfishing

utilizing a North Carolina index and regional catch data. This methodology indicated *F* values have been steadily increasing since the beginning of the time series (2005), exceeding the overfishing threshold associated with this method since 2015. To prevent this designation, a relative decrease in catch on the order of 23% would have been needed in North Carolina since approximately 2015. The Skate Method represents a more risk-averse approach to management due to its shorter integration period (3 years) vs. the longer integration period needed for the TLA (7 years for fishery performance and 10 years for adult abundance), which is why it exceeded its threshold sooner than the TLA. This analysis also suggests recent increasing trends in *F* in the northern stock.

If the Board wishes to estimate the impacts of regulatory changes for the northern stock, the TC recommends using the same bag, vessel, and slot size catch reduction methods as those described above for the southern stock. Consistent with its recommendation that specific regulatory changes are not necessary for the northern stock at this time, the TC did not conduct any catch reduction analyses for the northern stock. If estimated stockwide catch reductions associated with specified *F* scenarios are desired in the future, a method to estimate these reductions would also need to be identified given that the TLA is a qualitative tool and does not have the same projection functionality as the SS model used for the southern stock.

References

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Tables

Table 1. Red drum southern stock projection scenario results. Age-2 fishing mortalities are reported here with fishing mortality for other ages determined according to model-estimated fleet selectivities.

Scenario	Projected Age-2 Fishing Mortality	Catch Reduction Needed from 2019-2021 Average F Catch	Years to SSB Threshold (9,917 mt)	Years to SSB Target (13,250 mt)
$F_{40\%}$	0.301	28.1%	5	32
$F_{35\%}$	0.345	21.4%	6	NA
$F_{30\%}$	0.396	14.4%	23	NA
2019-2021 Average *F*	0.526	NA	NA	NA

Table 2. Percentages of reported dead fish in South Carolina MRIP intercept data by disposition.

Time Period	Type A Fish (i.e., Claim)	Type B1 Fish (i.e., Harvest)	
	Observed Harvest	Reported Harvest	Reported Released Dead
2018 (Sep-Dec)	89%	11%	0%
2019 (Mar-Aug)	92%	8%	0%
2019 (Sept-Dec)	92%	8%	0%
2020 (Mar-Aug)	93%	7%	0%
2020 (Sept-Dec)	88%	12%	0%
2021 (Mar-Aug)	88%	12%	0%
2021 (Sept-Dec)	83%	16%	1%
2022 (March-Aug)	72%	18%	0%

Table 3. Percentages of reported dead fish in Georgia MRIP intercept data by disposition.

Time Period	Type A Fish (i.e., Claim)	Type B1 Fish (i.e., Harvest)	
	Observed Harvest	Reported Harvest	Reported Released Dead
2018 (Sep-Dec)	87%	13%	0%
2019	85%	11%	5%
2020	84%	16%	0%
2021	92%	8%	0%
2022 (March-Aug)	96%	4%	0%

Table 4. Percentages of reported dead fish in Florida MRIP intercept data by disposition.

Time Period	Type A Fish (i.e., Claim)	Type B1 Fish (i.e. Harvest)	
	Observed Harvest	Reported Harvest	Reported Released Dead
2018 (Sep-Dec)	83.7%	16.3%	0.0%
2019	92.7%	6.7%	0.6%
2020	95.6%	4.4%	0.0%
2021	93.7%	5.8%	0.5%
2022 (March-Aug)	94.6%	5.4%	0.0%

Table 5. Percentage of red drum harvest-at-size from 2018-2021 MRIP data available for catch reduction analyses. Grey shaded cells show catch treated as compliant with slot size limits in place during these years.

Total Length (inches)	SC	GA	NE FL	IRL FL	SE FL
10		0.2%			
11		0.0%			
12	0.1%	0.2%			
13	0.2%	1.7%			
14	0.5%	13.5%	7.9%		
15	12.6%	20.3%			
16	20.5%	18.6%			
17	14.1%	14.1%	2.6%	10.5%	
18	9.6%	9.0%	9.4%	7.1%	
19	11.3%	7.0%	6.9%	3.5%	
20	11.3%	4.3%	5.4%	2.2%	
21	5.5%	5.9%	18.0%	21.5%	
22	7.7%	2.0%	10.9%	8.1%	
23	3.9%	1.8%	9.5%	9.4%	
24	0.7%	0.8%	8.9%	18.1%	
25	1.4%	0.2%	5.7%	8.5%	No Data
26	0.0%		4.9%	7.6%	
27			7.7%	3.1%	
28	0.2%	0.2%	2.1%	0.5%	
29			0.1%		
30					
31	0.4%				
32					
33					
34					
35					
36					
37					
38	0.1%				
39		0.1%			
40	0.1%				

Table 6. Catch reductions estimated for regulation changes that occurred following the stock assessment assuming perfect compliance with regulations.

Jurisdiction	2022 Regulation Changes	Removals		Reduction
		With 2018-2021 Regulations	With Current Regulations	
South Carolina	None	1,651,574	1,651,574	0.0%
Georgia	None	1,709,947	1,709,947	0.0%
Florida		4,207,205	3,499,687	16.8%
Northeast	*Reduced vessel and bag limits*	*3,479,763*	*3,129,735*	*10.1%*
Indian River Lagoon	*Catch-and-release only*	*725,409*	*367,919*	*49.3%*
Southeast	*Reduced vessel limit*	*2,033*	*2,033*	*0.0%**
Southern Stock	N/A	7,568,726	6,861,208	9.3%

**All removals from the Southeast Florida management region from 2018-2021 were due to discard mortality of released fish, hence no reduction to removals from regulation changes designed to reduce harvest.*

Table 7. Catch reductions estimated for regulation changes that occurred following the stock assessment assuming noncompliance with regulations based on rates observed from 2018-2021. Ranges on reductions are reported for 1,000 analysis iterations due to the random selection process for noncompliance rate calculations used in the analysis.

Jurisdiction	Removals				Reduction		
	With 2018-2021 Regulations	With Current Regulations					
		Minimum	Mean	Maximum	Minimum**	Mean	Maximum**
South Carolina	1,651,574	1,651,574	1,651,574	1,651,574	0.0%	0.0%	0.0%
Georgia	1,709,947	1,709,947	1,709,947	1,709,947	0.0%	0.0%	0.0%
Florida	4,207,205	3,566,826	3,581,553	3,668,650	12.8%	14.9%	15.2%
Northeast	*3,479,763*	*3,170,789*	*3,178,253*	*3,237,547*	*7.0%*	*8.7%*	*8.9%*
Indian River Lagoon	*725,409*	*394,005*	*401,267*	*429,070*	*40.9%*	*44.7%*	*45.7%*
Southeast	*2,033*	*2,033*	*2,033*	*2,033*	*0.0%**	*0.0%**	*0.0%**
Southern Stock	7,568,726	6,928,348	6,943,074	7,030,171	7.1%	8.3%	8.5%

All removals from the Southeast Florida management region from 2018-2021 were due to discard mortality of released fish, hence no reduction to removals from regulation changes designed to reduce harvest. Minimum reductions are calculated with the maximum removals across iterations, while the maximum reductions are calculated with the minimum removals across iterations.*

Figures

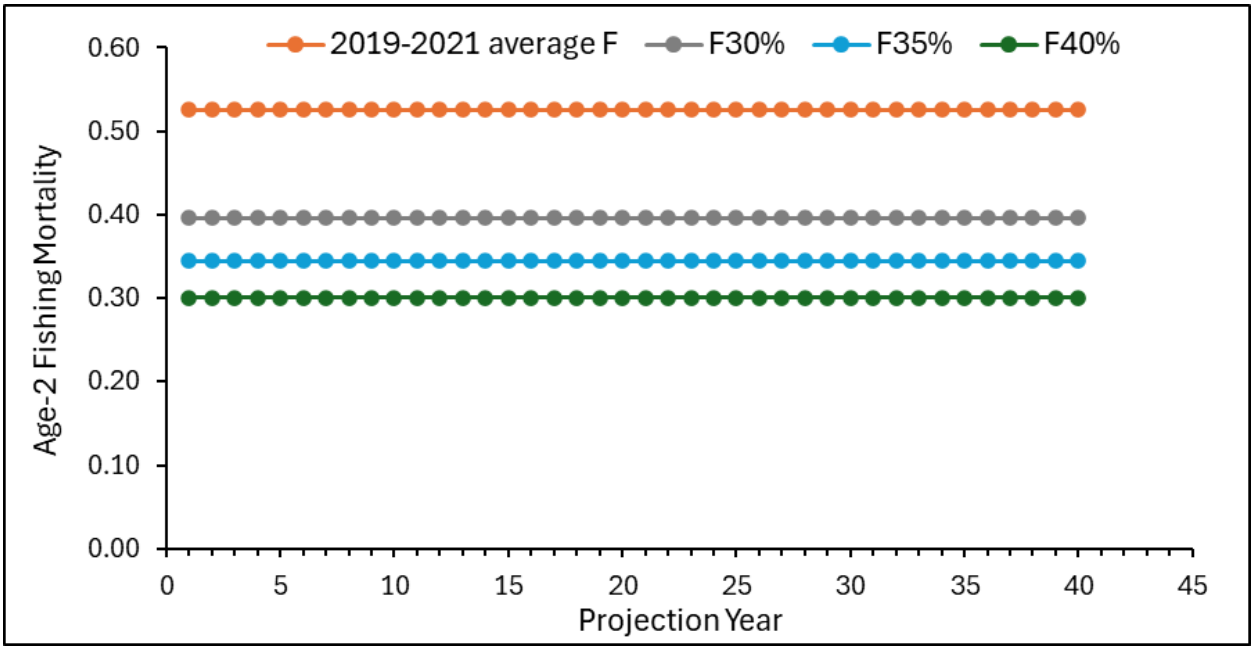

Figure 1. Red drum southern stock projection scenario fishing mortality for age-2 fish.

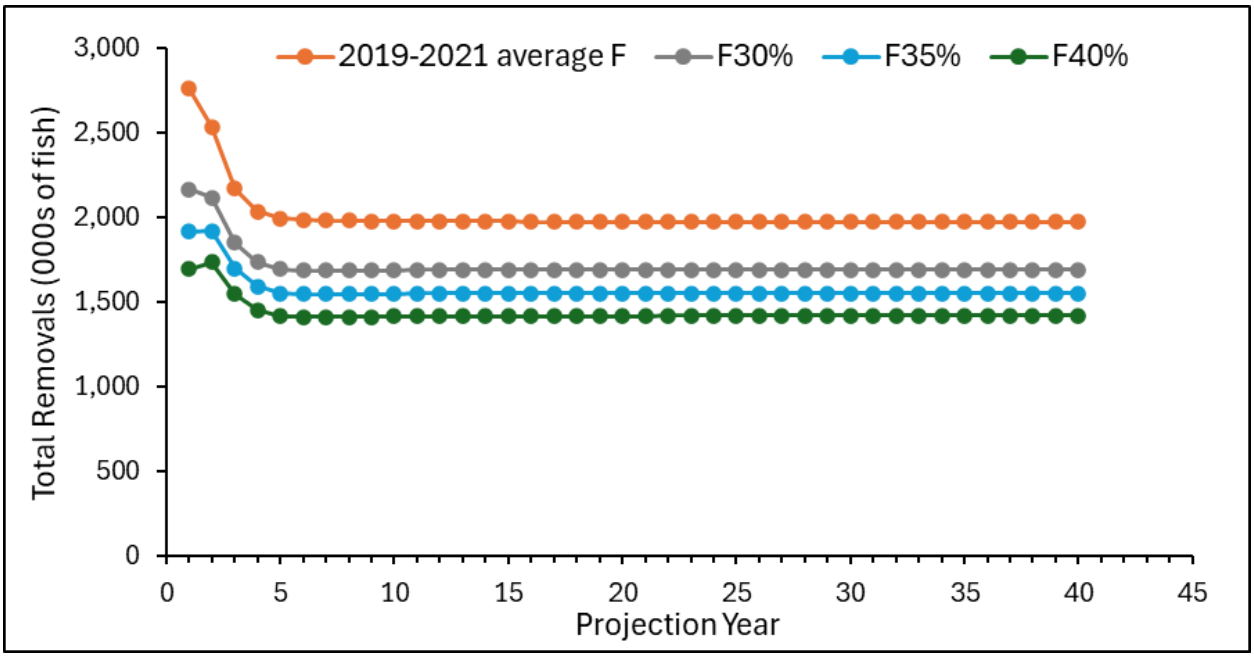

Figure 2. Red drum southern stock projection scenario total removals (harvest and dead discards).

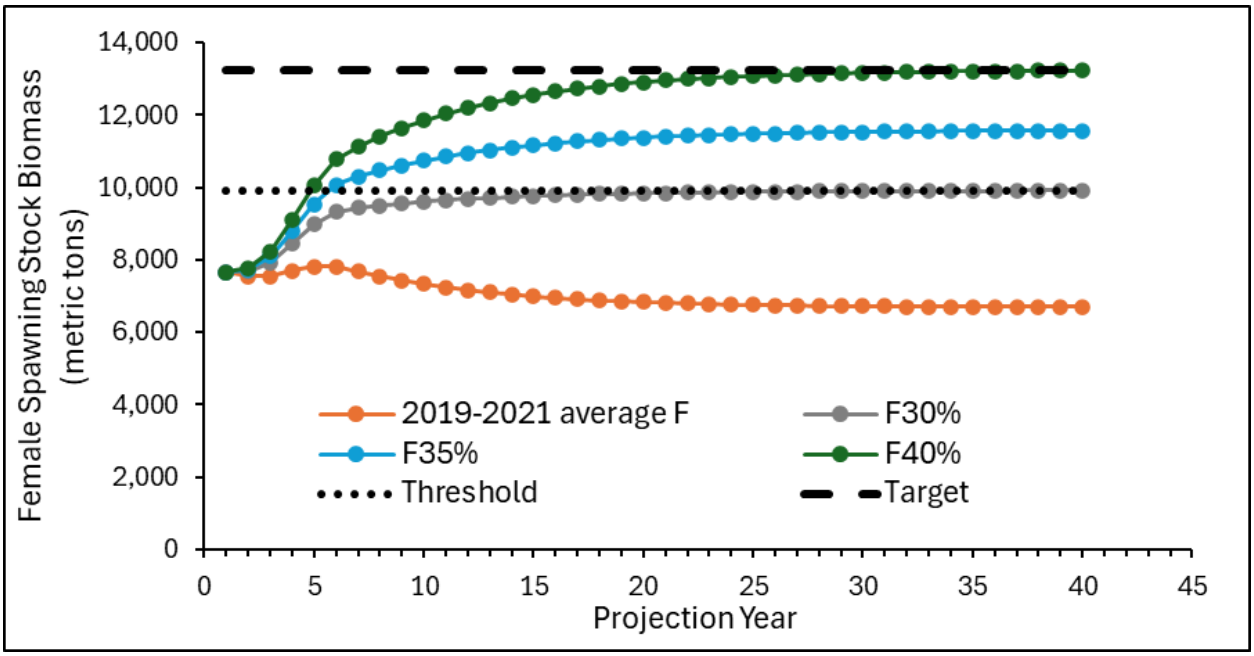

Figure 3. Red drum southern stock projection scenario female spawning stock biomass.

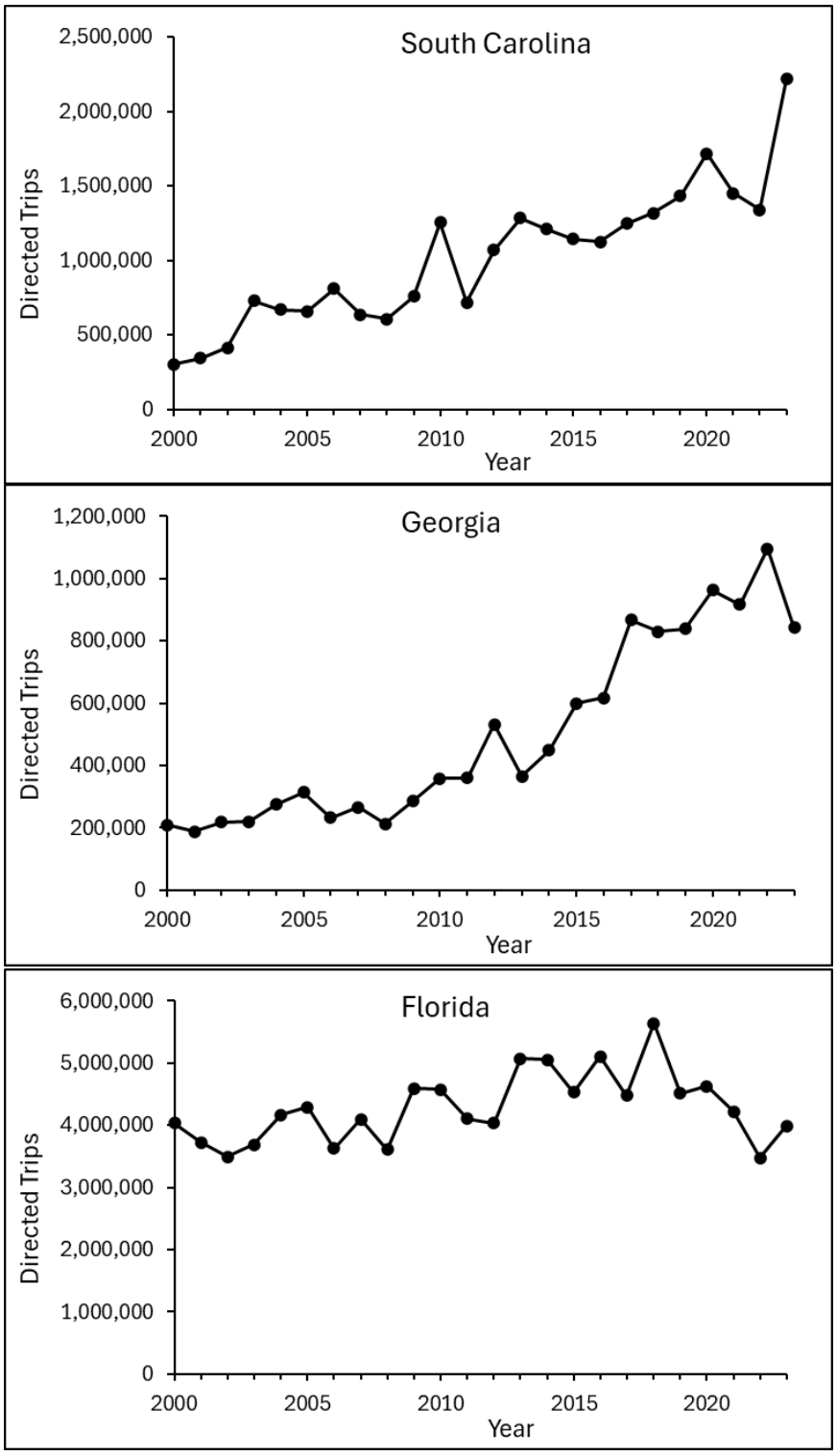

Figure 4. Recreational fishing trips directed at red drum in southern stock states. Directed is defined as red drum reported by the angler(s) as primary or secondary target species of the fishing trip. 2023 data are preliminary.