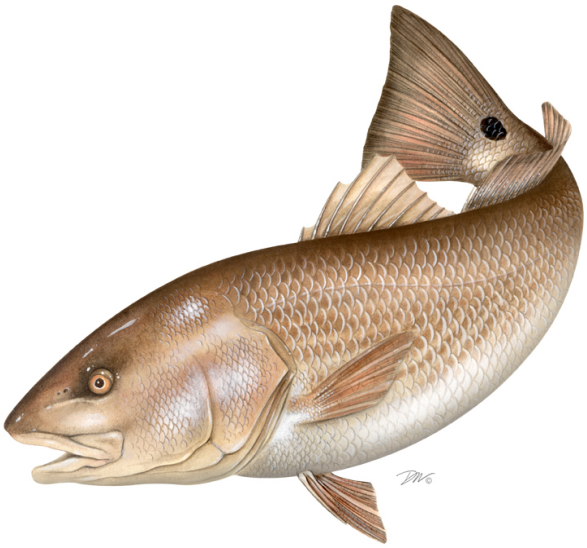
ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR

RED DRUM
(*Sciaenops ocellatus*)

2019 FISHING YEAR



Prepared by the Plan Review Team
Approved October 2020

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

Table of Contents

I. Status of the Fishery Management Plan

Date of FMP Approval:	Original FMP – October 1984
Amendments:	Amendment 1 – October 1991 Amendment 2 – June 2002 Addendum 1 – August 2013
Management Areas:	The Atlantic coast distribution of the resource from New Jersey through Florida Northern: New Jersey through North Carolina Southern: South Carolina through the east coast of Florida
Active Boards/Committees:	South Atlantic State/Federal Fisheries Management Board, Red Drum Technical Committee, Stock Assessment Subcommittee, Plan Development Team, Plan Review Team, South Atlantic Species Advisory Panel

The Atlantic States Marine Fisheries Commission (ASMFC) adopted an Interstate Fishery Management Plan (FMP) for Red Drum in 1984. The original management unit included the states from Maryland to Florida. In 1988, the Interstate Fisheries Management Program (ISFMP) Policy Board requested that all Atlantic coastal states from Maine to Florida implement the plan's recommended management regulations to prevent development of northern markets for southern fish. The states of New Jersey through Florida are now required to follow the FMP, while Maine through New York (including Pennsylvania) are encouraged to implement consistent provisions to protect the red drum spawning stock.

In 1990, the South Atlantic Fishery Management Council (Council) adopted a FMP for red drum that defined overfishing and optimum yield (OY) consistent with the Magnuson Fishery Conservation and Management Act of 1976. Adoption of this plan prohibited the harvest of red drum in the exclusive economic zone (EEZ), a moratorium that remains in effect today. Recognizing that all harvest would take place in state waters, the Council FMP recommended that states implement measures necessary to achieve the target level of at least 30% escapement.

Consequently, ASMFC initiated Amendment 1 in 1991, which included the goal to attain optimum yield from the fishery over time. Optimum yield was defined as the amount of harvest that could be taken while maintaining the level of spawning stock biomass per recruit (SSBR) at or above 30% of the level which would result if fishing mortality was zero. However, a lack of information on adult stock status resulted in the use of a 30% escapement rate of sub-adult red drum to the off-shore adult spawning stock.

Substantial reductions in fishing mortality were necessary to achieve the escapement rate; however, the lack of data on the status of adult red drum along the Atlantic coast led to the adoption of a phase-in approach with a 10% SSBR goal. In 1991, states implemented or maintained harvest controls necessary to attain the goal.

As hoped, these management measures led to increased escapement rates of juvenile red drum. Escapement estimates for the northern region of New Jersey through North Carolina (18%) and the southern region of South Carolina through Florida (17%) were estimated to be above the 10% phase-in goal, yet still below the ultimate goal of 30% (Vaughan and Carmichael 2000). North Carolina, South Carolina, and Georgia implemented substantive changes to their regulations from 1998-2001 that further restricted harvest.

The Council adopted new definitions of OY and overfishing for red drum in 1998. Optimum yield was redefined as the harvest associated with a 40% static spawning potential ratio (sSPR), overfishing as an sSPR less than 30%, and an overfishing threshold as 10% sSPR. In 1999, the Council recommended that management authority for red drum be transferred to the states through the Commission's Interstate Fishery Management Program (ISFMP) process. This was recommended, in part, due to the inability to accurately determine an overfished status, and therefore stock rebuilding targets and schedules, as required under the revised Sustainable Fisheries Act of 1996. The transfer necessitated the development of an amendment to the interstate FMP in order to include the provisions of the Atlantic Coastal Fisheries Cooperative Management Act.

ASFMC adopted Amendment 2 to the Red Drum FMP in June 2002 (ASMFC 2002), which serves as the current management plan. The goal of Amendment 2 is to achieve and maintain the OY for the Atlantic coast red drum fishery as the amount of harvest that can be taken by U.S. fishermen while maintaining the sSPR at or above 40%. There are four plan objectives:

- Achieve and maintain an escapement rate sufficient to prevent recruitment failure and achieve an sSPR at or above 40%.
- Provide a flexible management system to address incompatibility and inconsistency among state and federal regulations which minimizes regulatory delay while retaining substantial ASMFC, Council, and public input into management decisions; and which can adapt to changes in resource abundance, new scientific information, and changes in fishing patterns among user groups or by area.
- Promote cooperative collection of biological, economic, and sociological data required to effectively monitor and assess the status of the red drum resource and evaluate management efforts.
- Restore the age and size structure of the Atlantic coast red drum population.

The management area extends from New Jersey through the east coast of Florida, and is separated into a northern and southern region at the North Carolina/South Carolina border. The sSPR of 40% is considered a target; an sSPR below 30% (threshold level) results in an overfishing determination for red drum. Amendment 2 required all states within the management unit to implement appropriate recreational bag and size limit combinations needed to attain the target sSPR, and to maintain current, or implement more restrictive, commercial fishery regulations. All states were in compliance by January 1, 2003. See Table 1 for state commercial and recreational regulations in 2019.

Following the approval of Amendment 2 in 2002, the process to transfer management authority to ASMFC began, including an Environmental Assessment and public comment period. The final rule became effective November 5, 2008. It repeals the federal Atlantic Coast Red Drum Fishery Management Plan and transfers management authority of Atlantic red drum in the exclusive economic zone from the South Atlantic Fishery Management Council to the Atlantic States Marine Fisheries Commission.

The Board approved Addendum I to Amendment 2 in August 2013. The Addendum revised the habitat section of Amendment 2 to include current information on red drum spawning habitat and life-stages (egg, larval, juvenile, sub-adult, and adult). It also identified and described the distribution of key habitats and habitats of concern.

II. Status of the Stocks

The 2017 Red Drum Stock Assessment and Peer Review Report indicate overfishing is not occurring for either the northern or southern stock of red drum (ASMFC 2017). The assessment was unable to determine an overfished/not overfished status because population abundance could not be reliably estimated due to limited data for the older fish (ages 4+). In 2020, the next benchmark assessment was initiated and will comprise of a simulation assessment prior to the benchmark assessment.

Northern Region (NJ-NC)

Recruitment (age 1 abundance) has varied annually with a large peak occurring in 2012 (Figure 1). The trend in the three-year average sSPR indicates low sSPR early in the time series with increases during 1991 – 1997 and fluctuations thereafter (Figure 2). The average sSPR has been above the overfishing threshold ($F_{30\%}$) since 1994, and at or above the target ($F_{40\%}$) since 1996, except during one year (2002). Fishing pressure and mortality appear to be stabilized near the target fishing mortality. The average sSPR is also likely above the target benchmark.

Southern Region (SC-FL)

Recruitment (age 1 abundance) has fluctuated without apparent trend since 1991 (Figure 1). A high level of uncertainty exists around the three-year average sSPR estimates for the southern region. While the 3-year average sSPR estimate in 2013 was above both the target ($F_{40\%}$) and the overfishing threshold ($F_{30\%}$), indicating that overfishing is not occurring, the high level of uncertainty around this estimate indicates that this conclusion should be considered with extreme caution (Figure 2).

NOTE: In 2018, the Marine Recreational Information Program transitioned from estimating effort using the Coastal Household Telephone Survey (CHTS) to the mail-based Fishing Effort Survey (FES). The 2017 stock assessment used CHTS data to estimate recreational harvest. However, as red drum is not managed by a quota and to accommodate the transition, recreational harvest estimates based on the FES data or calibration are shown in this report. Due to differing estimation methodologies, these harvest data should not be compared to reference points from the 2017 stock assessment. Harvest estimates based on either effort survey can be compared at: https://www.st.nmfs.noaa.gov/st1/recreational/queries/.

III. Status of the Fishery

Total red drum landings from New Jersey through the east coast of Florida in 2019 are estimated at 4.8 million pounds (Tables 2 and 3, Figure 3). This is roughly 3.4 million pounds less than was landed in 2018. 2019 total landings are below the previous ten-year (2009-2018) average of 6.9 million pounds. The commercial and recreational fisheries harvested 1% and 99% of the total, respectively. The southern region includes South Carolina through Florida's east coast, while the northern region includes New Jersey through North Carolina. In 2019, 80% of the total landings came from the southern region where the fishery is exclusively recreational, and 20% from the northern region (Figure 4).

Coastwide commercial landings comprise a small portion of the total harvest. Landings have ranged from approximately 55,000 pounds (2004) to 423,000 pounds (1984) since 1981 (Figure 3). In 2019, red drum were commercially landed only in Maryland, Virginia, and North Carolina (Table 2). Coastwide commercial harvest decreased from 145,349 pounds in 2018 to 58,075 pounds in 2019, with 97% harvested by North Carolina. Historically, North Carolina and Florida shared the majority of commercial harvest, but commercial harvest has been prohibited in Florida under state regulation since January 1988. South Carolina and Georgia designated red drum as a gamefish, banning commercial harvest and sale since 1987 and 2013, respectively.

In North Carolina, a daily commercial trip limit and an annual cap of 250,000 pounds with payback of any overage constrain the commercial harvest. Unique to this state, the red drum fishing year extends from September 1 to August 31. In 2008, the Board approved use of this fishing year to monitor the cap. During the 2009/2010 and the 2013/2014 fishing years, North Carolina had overages of 25,858 pounds and 12,753 pounds, respectively. The commercial harvest for each following fishing year remained well below the adjusted cap allowance, providing sufficient payback.

Recreational harvest of red drum peaked in 1984 at 2.9 million fish (or 10.1 million pounds; Tables 3 and 4). Following this peak and a subsequent decline, the recreational fishery has shown an increasing trend from the late 1980s through the present, both in terms of harvest and catch (Figures 3 and 5). Recreational harvest decreased in number from 2.3 million fish (8.2 million pounds) in 2018 to 1.5 million fish (4.8 million pounds) in 2019. The 2019 harvest is below the previous 10-year average (2009-2018) for recreational harvest in numbers (1.9 million) and pounds (6.9 million). Florida anglers landed the largest share of the coastwide recreational harvest in numbers (40%), followed by South Carolina (22%) and Georgia (18%).

Anglers release far more red drum than they keep; the percent of the catch released has been over 80% during the last decade (Figure 5). Recreational releases show an increasing trend over the time series, due to an increasing trend in catch with roughly stable release proportions for the last 20 years. The proportion of releases in 2019 was 89% (versus 81% in 2018), and the overall number of fish released was 11.6 million in 2019 (Figure 5, Table 5). It is estimated that

8% of released fish die as a result of being caught, resulting in an estimated 931,263 dead discarded fish in 2019 (Table 5). Recreational removals from the fishery are thus estimated to be 2.4 million fish in 2019 (Figure 6).

IV. Status of Assessment Advice

Current stock status information comes from the 2017 stock assessment (ASMFC 2017) completed by the ASMFC Red Drum Stock Assessment Subcommittee (SAS) and Technical Committee (TC), peer reviewed by an independent panel of experts through ASMFC's desk review process, and approved by the South Atlantic State-Federal Fisheries Management Board for use in management decisions. Previous interstate management decisions were based on the last coastwide assessment, SEDAR 18 (SAFMC 2009), and prior to 2009, decisions were based on regional assessments conducted by Vaughan and Helser (1990), Vaughan (1992, 1993, 1996), and Vaughan and Carmichael (2000) that reflected the current stock structure, two stocks divided at the North Carolina-South Carolina border. Several states have also conducted state-specific assessments (e.g., Murphy and Munyandorero 2009; Takade and Paramore 2007 [update of Vaughan and Carmichael 2000]).

In 2017, a state-specific stock assessment was completed by South Carolina, which indicated that the South Carolina population of red drum was experiencing overfishing (Murphy 2017). This assessment result prompted new state management regulations, which went into effect on July 1, 2018 (Table 1).

The 2017 coastwide stock assessment uses a statistical catch at age (SCAA) model with age-specific data for red drum ages 1 through 7+. This model is similar to that used in the 2009 assessment, with data updated through 2013. Data from 1989-2013 were included from the following sources: commercial and recreational harvest and discard data, fishery-dependent and -independent biological sampling data, tagging data, and fishery-independent survey abundance data.

The Peer Review Panel considered the use of a SCAA model appropriate given the types of data available for red drum. For the northern region, the Review Panel agreed that the model was informative of age 1-3 abundance and exploitation rates, but not for older age groups. The model was also found to be informative of annual trends in sSPR and the 2011-2013 average sSPR. For the southern region, the Review Panel agreed that estimates of age 7+ fish seemed to be more consistent with the population biology, leading to a large fraction of biomass being unavailable to exploitation. For both regions, most of the sSPR is contained within the larger, fully mature, age 7+ fish, thus even a small increase in fishing mortality on older red drum (due to harvest or other factors) could quickly lead to a decrease in sSPR and overfishing.

At the Winter meeting of ASMFC, the Board reviewed a proposal from the SAS that recommended a population simulation model be developed to simulate the full red drum population. The simulated population would be used to test a variety of assessment modeling techniques to determine which model would be the most applicable for the next benchmark stock assessment. Due to the work and modeling expertise needed for the simulation

assessment, the benchmark assessment has be postponed until 2024. The simulation population modeling is scheduled to be completed in 2022.

V. Status of Research and Monitoring

No monitoring or research programs are annually required of the states except for the submission of a compliance report. The following fishery-dependent (other than catch and effort data) and fishery-independent monitoring programs were reported in the 2019 reports.

Fishery Dependent Monitoring

- Delaware DFW – Commercial monitoring through mandatory logbook reports, supplemented by federal dealer reports (SAFIS). No samples collected in 2019.
- Maryland DNR – Commercial pound nets sampled bi-weekly in the Chesapeake Bay from early summer to late fall (2019, n=6). Only three of the 27 years of sampling exceeded 20 fish, and no red drum were encountered in ten of the survey years. Seafood dealer sampling was conducted in 2019, but no red drum were encountered.
- PRFC – Red drum are harvested incidentally in the commercial pound net and haul seine fisheries. The mandatory commercial harvest daily reporting system, which collects harvest and discards/releases, reported 30 lbs of red drum released alive in 2019
- Virginia MRC – Volunteer anglers have participated since 1995 in the Virginia Game Fish Tagging Program (2019: 2,916 fish tagged, 178 reported recaptures). Carcasses are collected through the Marine Sportfish Collection Project since 2007 (2019, n=2). VMRC collects samples from commercial fish packing operations for length (2019, n=72) and weight (2019, n=72).
- North Carolina DMF – Commercial cap monitored through trip ticket program. Commercially-landed red drum sampled through biological monitoring program since 1982 (2019, n=91 fish measured, primarily gill net). Recreational lengths from MRIP sampling (2019, n=87).
- South Carolina DNR – State finfish survey conducted in January and February (2019, n=325 caught and 34 harvested, mean catch rate: 0.70 red drum/targeted angler hour). Charter Vessel Trip Reporting (2019 caught (targeted and non-targeted): 60,566 red drum; live release rate: 93.3%). SC Marine Game Fish Tagging Program studies movement patterns, growth rates, and release-mortality rates (in 2019 fish tagged: 6,346; recaptured: 1,271). SCDNR Sub-Adult Red Drum Tagging Program tags fish caught by the SCDNR electrofishing and trammel net fishery-independent surveys and other fishery-independent sampling efforts (in 2019 fish tagged: 2,298; recaptured: 604). SCDNR Adult Red Drum Tagging Program tags fish caught by the SCDNR inshore fisheries research section longline fishery-independent survey (in 2019 tagged: 531; recaptured: 9). Tournament and freezer fish programs (2019 n=25).
- Georgia CRD – Age, length, and sex data collected through the Marine Sportfish Carcass Recovery Project (2019, n=805).
- Florida FWC – MRIP CPUE for 2019 showed large fluctuations with overall increasing trends in both regions along the Atlantic coast of Florida.
- NMFS – Length measurements and recreational catch, harvest, release, and effort data are collected via the Marine Recreational Information Program.

Fishery Independent Monitoring

- New Jersey DFW – Five annual nearshore trawl surveys conducted since 1988, in January/February, April, June, August, and October. Length and weight data, and catch per unit effort (CPUE) in number of fish per tow and biomass per tow recorded for all species. Only two red drum were caught in entire time series (single tow, 2013).
- Delaware DFW – 30-ft bottom trawl survey and 16-ft bottom trawl survey. Neither survey has ever captured red drum.
- North Carolina DMF – Seine survey since 1991 produces age-0 abundance index (2019, n=783; CPUE of 6.53, above long-term average). Gill net survey in Pamlico Sound since 2001 characterizes size and age distribution, produces abundance index, improves bycatch estimates, and studies habitat usage (CPUE of 2.55, near long-term average). Longline survey since 2007 produces adult index of abundance and tags fish (2019, n=133; CPUE of 2.22 well below long-term average). The longline survey was impacted by Hurricane Dorian.
- South Carolina DNR – Estuarine trammel net survey for subadults (2019 CPUE below 10-year average). Electrofishing survey in low salinity estuarine areas for juveniles/subadults (2019 CPUE below 10-year average). Inshore and coastal bottom longline survey for biological data and adult abundance index (531 tagged, 78 sampled for life history in 2019). Genetic sub-sampling and tagging conducted during these three surveys.
- Georgia CRD – Estuarine trammel net survey for subadult biological data and abundance index (2019, both areas n=86). Estuarine gill net survey for young-of-year (YOY) biological data and abundance index (2019, both areas n=383). Bottom longline survey for adult biological data and abundance index (2019, n=31 in GA).
- Florida FWC-FWRI – Seine surveys characterizing young-of-year (YOY) (<40 mm standard length) and sub-adult (>299 mm) abundance along the northeast (NE) and southeast (SE) Florida coasts. 2019 NE YOY index declined from 2018. 2019 NE sub-adult index was similar to 2018. 2019 SE YOY index was similar to that of 2018. 2019 SE sub-adult index was similar to 2019.

VI. Status of Management Measures and Issues

Fishery Management Plan

Amendment 2 was fully implemented by January 1, 2003, providing the management requirements for 2018. Requirements include: recreational regulations designed to achieve at least 40% sSPR, a maximum size limit of 27 inches or less, and current or more stringent commercial regulations. States are also required to have in place law enforcement capabilities adequate to successfully implement their red drum regulations. In August 2013, the Board approved Addendum I to Amendment 2 of the Red Drum FMP. The Addendum revises the habitat section of Amendment 2 to include the most current information on red drum spawning habitat for each life stage (egg, larval, juvenile, sub-adult, and adult). It also identifies the distribution of key habitats and habitats of concern, including potential threats and bottlenecks.

De Minimis Requests

New Jersey and Delaware requested *de minimis* status through the annual reporting process. While Amendment 2 does not include a specific method to determine whether a state qualifies for *de minimis*, the PRT chose to evaluate an individual state's contribution to the fishery by comparing the two-year average of total landings of the state to that of the management unit. New Jersey and Delaware each harvested zero percent of the two-year average of total landings. *De minimis* status does not exempt either state from any requirement; it may exempt them from future management measures implemented through addenda to Amendment 2, as determined by the Board.

VII. Implementation of FMP Compliance Requirements for 2020

The PRT finds that all states have implemented the requirements of Amendment 2.

VIII. Recommendations of the Plan Review Team

Management and Regulatory Recommendations

- Consider approval of the *de minimis* requests by New Jersey and Delaware.
- Support a continued moratorium of red drum fishing in the exclusive economic zone.

Prioritized Research and Monitoring Recommendations (H) = High, (M) = Medium, (L) = Low

Stock Assessment and Population Dynamics

- Implement surveys (e.g. logbooks, electronic methods, etc.) in each state throughout the management unit to determine the length composition (and age data, if possible) of recreational discards (B2) of red drum. This information has been highlighted as the single largest data gap in previous assessments. (H)
- Further study is needed to determine discard mortality estimates for the Atlantic coast, both for recreational and commercial gears. Additionally, discard estimates should examine the impact of slot-size limit management and explore regulatory discard impacts due to high-grading. Investigate covariates affecting discard mortality (e.g., depth, size, seasonality), and explore methods of determining *in situ* mortality (as opposed to tank studies) and mitigating mortality (e.g. gear types, handling methods, use of descending devices on adults). (H)
- Improve catch/effort estimates and biological sampling from recreational and commercial fisheries for red drum, including increased intercepts of night fisheries for red drum. (H)
- Expand biological sampling based on a statistical analysis to adequately characterize the age/size composition of removals by all statistical strata (gears, states, etc.). (H)
- Each state should develop an on-going red drum tagging program that can be used to estimate both fishing and natural mortality and movements. This should include concurrent evaluations of tag retention, tagging mortality, and angler tag reporting rates. The importance of each state's tagging data to the assessment should be evaluated, including analysis of historical tagging data to determine if existing and historic recreational data sources (e.g., tagging) can be used to evaluate better B2 selectivity. (H)

- Establish programs to provide ongoing estimates of commercial and recreational discard mortality using appropriate statistical methods. Discard estimates should examine the impact of slot-size limit management and explore regulatory discard impacts due to high-grading. (M)
- Evaluate the broader survey needs to identify gaps in current activities and provide for potential expansion and/or standardization between/among current surveys. (M)
- Review all available stock structure data (genetics, tagging, etc.) to determine stock structure and most appropriate management boundaries. (M)

Biological

- Explore methods to effectively sample the adult population in estuarine, nearshore, and open ocean waters, such as in the ongoing red drum long line survey, and to determine the size, age and sex composition of the adults. (H)
- Continue genetic analyses (i.e., SC DNR analyses) to evaluate stock structure and mixing and temporal changes in genetic composition of the red drum population and other applications. (H)
- Refine maturity schedules on a geographic basis. Thoroughly examine the influence of size and age on reproductive function. Investigate the possibility of senescence in female red drum. Archive histological specimens across sizes to look for shifts in maturity schedules and make regional comparisons. Standardize histology reading methods of slides across states conducting such studies. (For reference, see SEDAR 44-DW02). (H)
- Determine habitat preferences, environmental conditions, growth rates, and food habits of larval and juvenile red drum throughout the species range along the Atlantic coast. Assess the effects of environmental factors on stock density/year class strength. Determine whether natural environmental perturbations affect recruitment and modify relationships with spawning stock size. (H)
- Continue tagging studies to determine stock identity, inshore/offshore migration patterns of all life stages (i.e. basic life history research). Specific effort should be given to developing a large-scale program for tagging adult red drum. (M)
- Fully evaluate the effects and effectiveness of using cultured red drum to facilitate higher catch rates along the Atlantic coast. (M)
- Conduct a tagging study using emerging technologies (i.e., acoustic tagging, satellite tagging, genetic tags) to evaluate stock mixing and identify movement of sub-adult fish transitioning to maturity. (M-L)
- Otolith microchemistry analysis should be considered for exploring links between sub-adult estuarine habitats and adult stock structure. (L)

Social (Unless otherwise indicated, the collection of sociological and/or economic data, also sometimes collectively described as "socioeconomic data," would be based on Atlantic Coastal Cooperative Statistics Program [ACCSP] standards.)

- Encourage the NMFS to fund socioeconomic add-on questions to the recreational fisheries survey that are specifically oriented to red drum recreational fishing. (H)

- States with significant fisheries (over 5,000 pounds) should periodically (e.g. every five years) collect socioeconomic data on red drum fisheries through add-ons to the recreational fisheries survey or by other means. (H)
- Using a human dimension analysis perspective, explore Atlantic red drum historical catch-release trends and explanatory factors such as the possible impacts of changes in recreational fishing technology and/or angler behavior on red drum catchability and selectivity over time. (H)
- Conduct applied research to evaluate the various projected (forecasted) social impacts on red drum fishery stakeholders of possible regulatory options (e.g. changing minimum sizes, etc.). (M)

Economic

- Using available secondary data and other information, develop models to estimate the local (community), state and regional level economic impacts (e.g. sales, jobs, income, etc.) of recreational red drum fisheries-related activities including the for-hire sector component (e.g. fishing guides). (H)
- Where appropriate, encourage individual member states to conduct studies to project and evaluate the estimated comparable net economic values associated with current and possible future regulatory regimes that could impact red drum recreational anglers, including those preferring catch and release fishing. (M)
- Using risk adjusted benefit-cost analysis protocols, project the estimated public sector-oriented net economic values over a time for various cultured red drum stocking scenarios compared to possible changes in other fishery management alternatives. (M)
- Encourage NOAA Fisheries to periodically conduct special surveys and related data analysis to determine the economic and operational characteristics of the recreational fishing for-hire component targeting red drum, especially fishing guide-oriented businesses in the South Atlantic states. (M)

Habitat

- Identify spawning areas of red drum in each state from North Carolina to Florida so these areas may be protected from degradation and/or destruction. Explore relationships between spawning activity (e.g. spawning sounds) and environmental parameters (e.g. temperature). (H)
- Identify changes in freshwater inflow on red drum nursery habitats. Quantify the relationship between freshwater inflows and red drum nursery/sub-adult habitats. (H)
- Determine the impacts of dredging and beach re-nourishment on red drum spawning and early life history stages. (M)
- Investigate the concept of estuarine reserves to increase the escapement rate of red drum along the Atlantic coast. (M)
- Identify impacts of water quality, environmental, and ecosystem changes on red drum stock dynamics for potential incorporation into stock assessment models. (M)
- Quantify relationships between red drum production and habitat and implications for future management planning. (L)

- Determine methods for restoring red drum habitat and/or improving existing environmental conditions that adversely affect red drum production. (L)

IX. References

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X. Figures

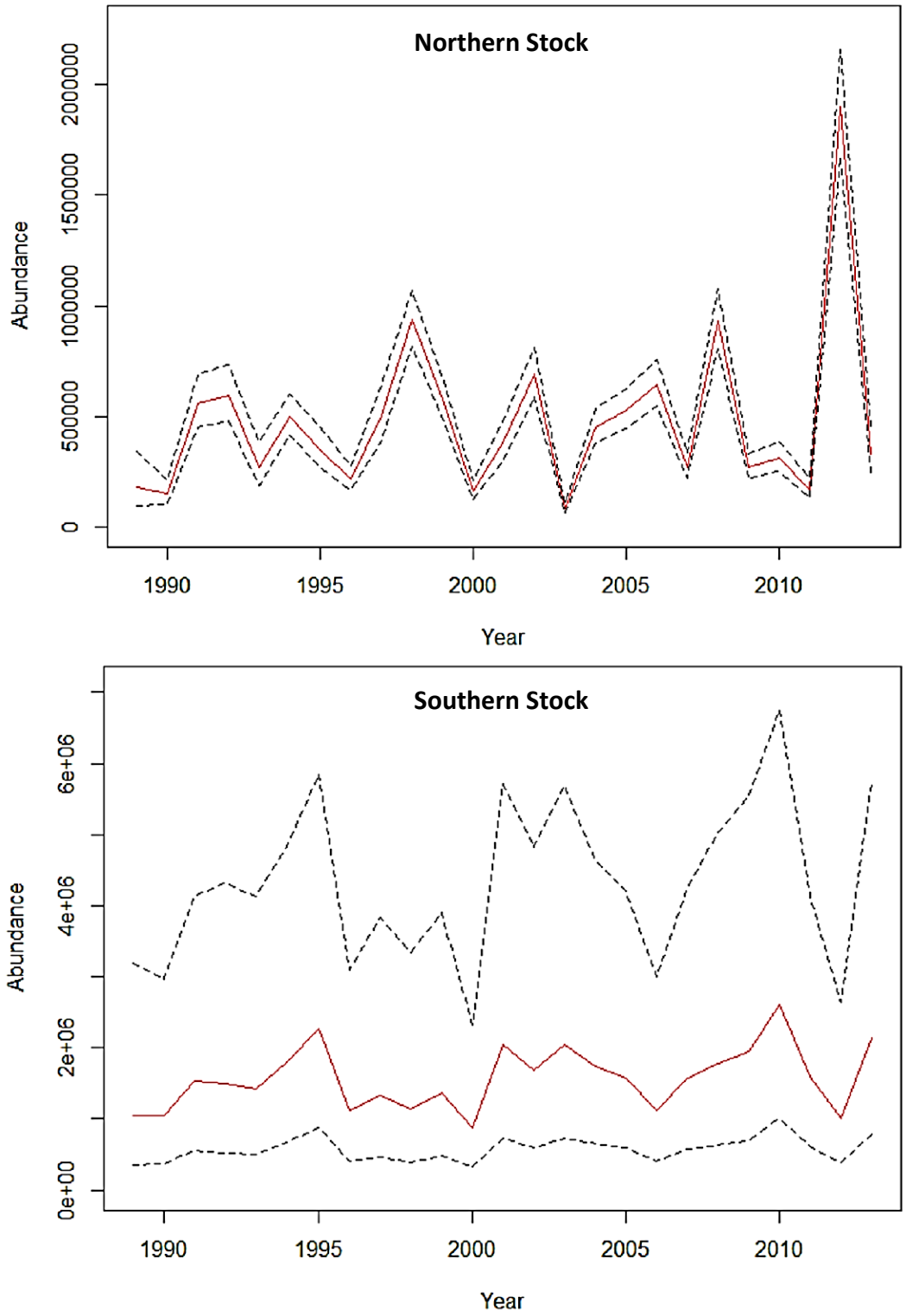

Figure 1. Predicted recruitment (age-1 abundance, red lines) with 95% confidence intervals (dashed black lines) for the northern (top) and southern (bottom) regions (Source: ASMFC 2017).

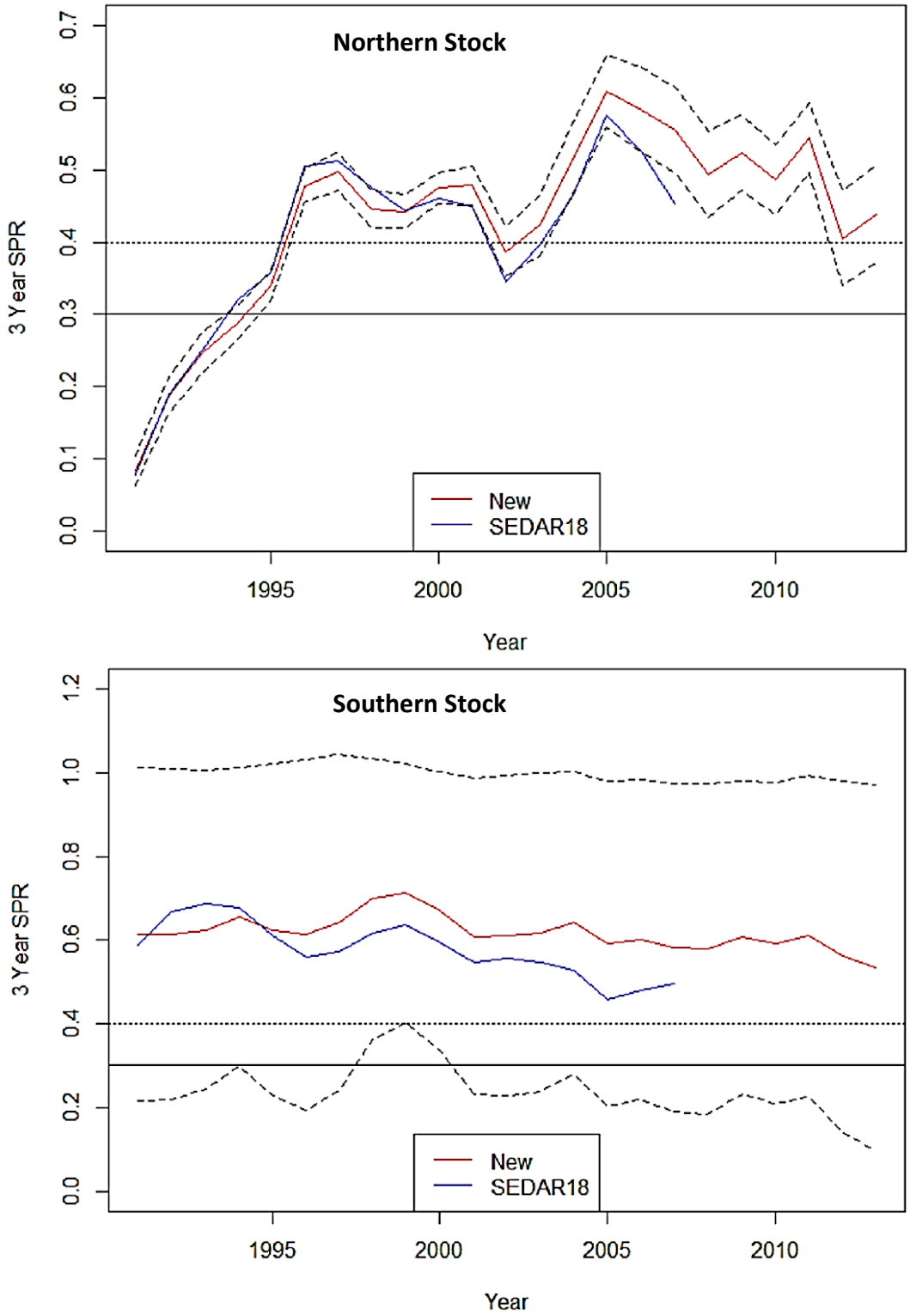

Figure 2. Three year average sSPR (red lines) for the northern (top) and southern (bottom) stocks with 95% confidence intervals (dashed black lines). Point estimates from the previous benchmark assessment (SEDAR18) are included for comparison. The target sSPR (dotted black line) is 40% and the threshold sSPR (solid black line) is 30% (Source: ASMFC 2017)**.**

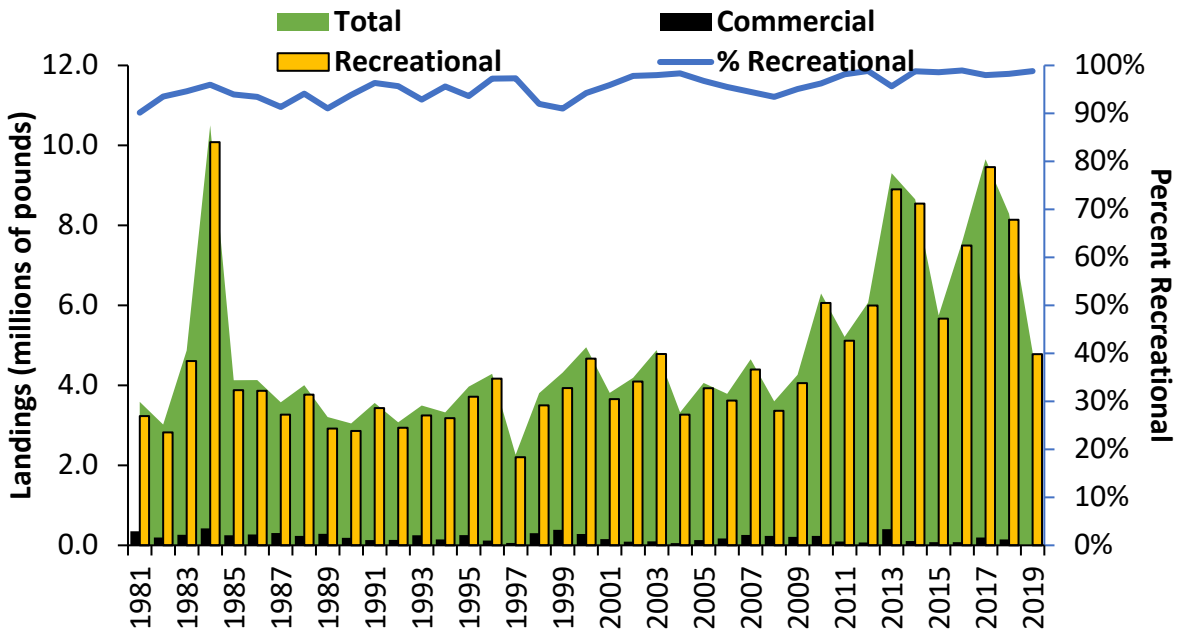

Figure 3. Commercial and recreational landings (pounds) of red drum. See Tables 2 and 3 for values and data sources.

*Recreational weight data for NC-FL in 1988 is unavailable. Recreational harvests in pounds were estimated for these states in this year by multiplying each state's 1988 harvest in numbers of fish by its time series average weight.

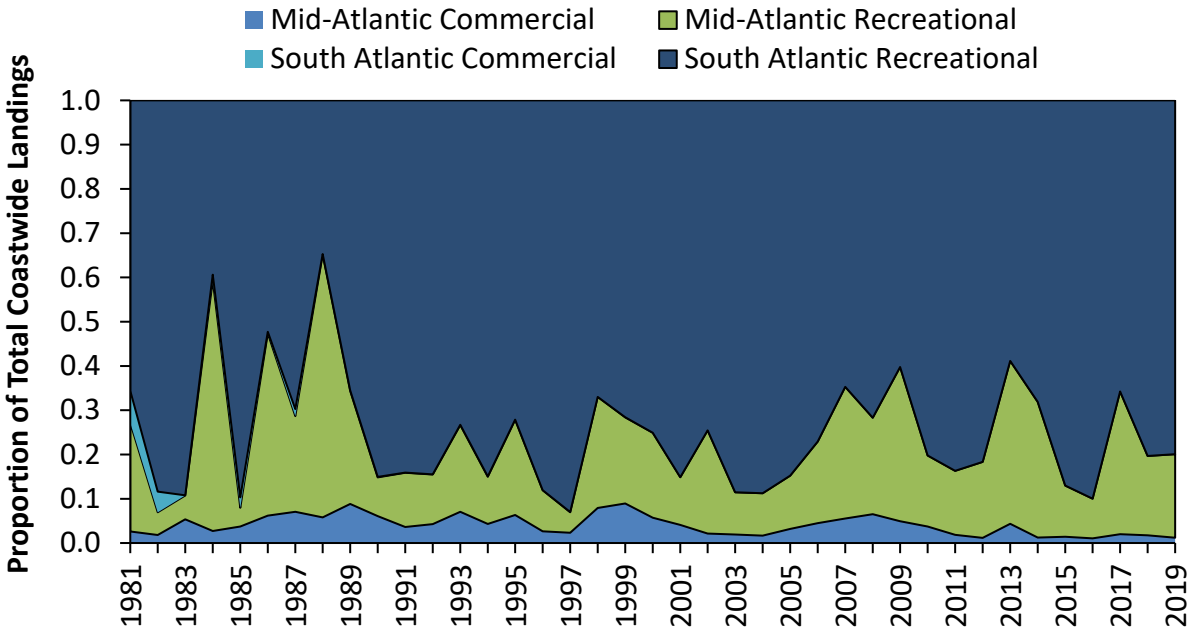

Figure 4. Proportion of regional, sector-specific landings to total coastwide landings (pounds). See Tables 2 and 3 for data sources.

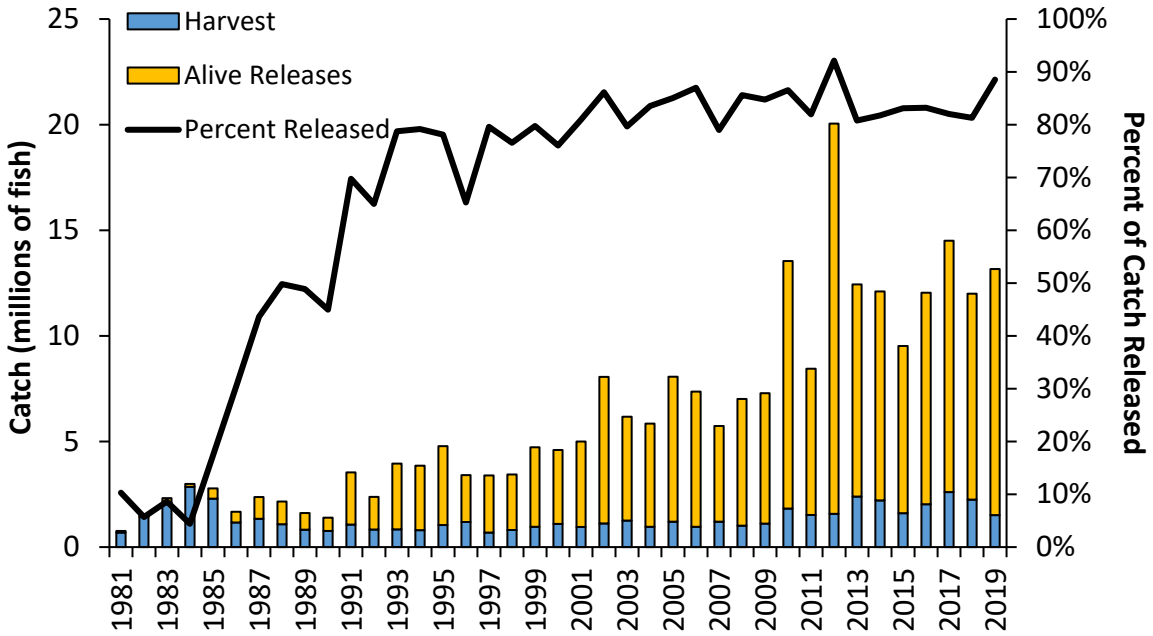

Figure 5. Recreational catch (harvest and alive releases) of red drum (numbers) and the proportion of catch that is released. See Tables 4 and 5 for values and data sources.

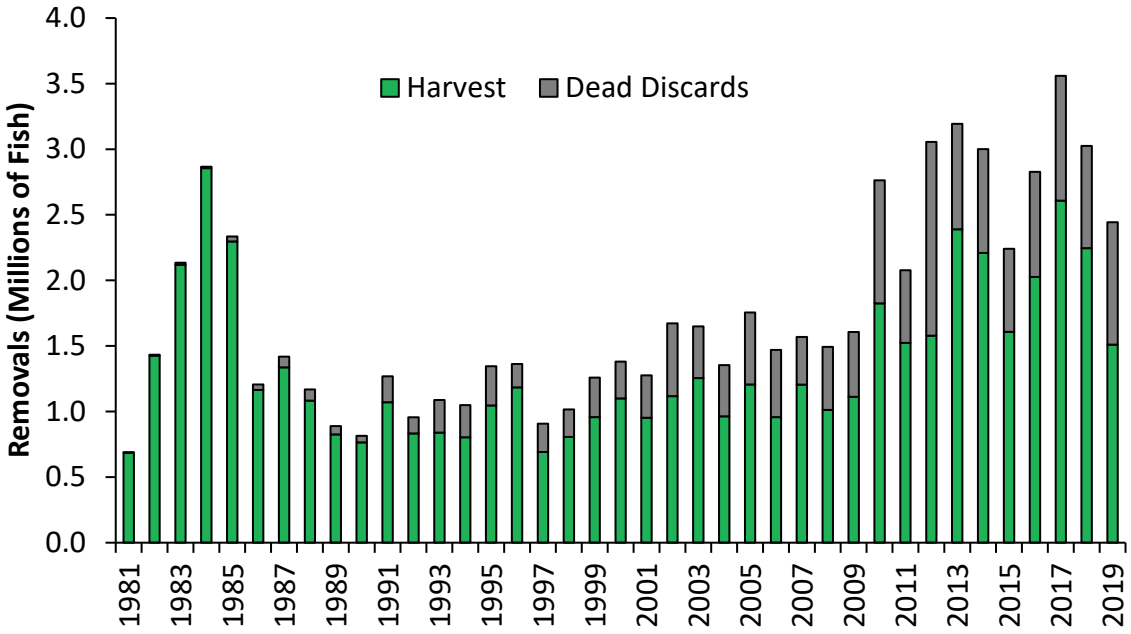

Figure 6. Recreational removals (harvest and dead discards) of red drum (numbers). Dead discards are estimated by applying an 8% discard mortality rate to alive releases. See Tables 4 & 5 for values and data sources.

XI. Tables

Table 1. Red drum regulations for 2019. The states of New Jersey through Florida are required to meet the requirements in the FMP; states north of New Jersey are encouraged to follow the regulations. All size limits are total length.

State	Recreational	Commercial
NJ	18" - 27", 1 fish	18" - 27", 1 fish
DE	20" - 27", 5 fish	20" - 27", 5 fish
MD	18" - 27", 1 fish	18" - 25", 5 fish
PRFC	18" - 25", 5 fish	18" - 25", 5 fish
VA	18" - 26", 3 fish	18" - 25", 5 fish
NC	18" - 27", 1 fish	18" - 27"; 250,000 lb harvest cap with overage payback (150,000 lbs Sept 1- April 30; 100,000 lbs May 1-Aug 31); harvest of red drum allowed with 7 fish daily trip limit; red drum must be less than 50% of catch (lbs); small mesh (<5" stretched mesh) gill nets attendance requirement May 1 - November 30. Fishing year: September 1 – August 31.
SC	15" - 23", 2 fish per person per day bag limit and 6 fish per boat per day boat limit	Gamefish Only
GA	14" - 23", 5 fish	Gamefish Only
FL	18" - 27"; Northern Region – 2 fish per person per day, 8 fish vessel limit, Southern Region – 1 fish per person day bag limit, 8 fish vessel limit	Sale of native fish prohibited

Table 2. Commercial landings (pounds) of red drum by state, 2010-2019. (Source: personal communication with ACCSP, Arlington, VA, for years prior to 2019 and state compliance reports for 2019, except as noted below.)

Year	NJ	DE	MD	PRFC	VA	NC	SC	GA	FL	Total
2010			C	22	3,966	231,828		C		235,816
2011				3	4,397	91,980		C		96,380
2012	C		334	81	2,786	66,519				69,720
2013	C		2,696	268	30,137	371,949				405,050
2014	C		295	3	14,733	90,647				105,677
2015			C	0	814	80,282				81,095
2016			C	0	1,898	77,833				79,731
2017	C		626	0	6,971	186,411	C			194,023
2018			C	0	885	144,464				145,349
2019			C	0	1,650	56,393		0		58,043

Notes: PRFC landings from agency reporting program; "C" indicates confidential landings.

Table 3. Recreational landings (pounds) of red drum by state, 2010-2019. (Source: personal communication with MRIP for data prior to 2019; state compliance reports for 2019)

Year	NJ	DE	MD	VA	NC
2010				173,622	835,143
2011	15,567				737,853
2012		9,948	158,313	225,732	648,342
2013		13,536	12,086	1,185,572	2,214,045
2014				979,388	1,674,595
2015				98,329	567,730
2016				45,451	633,496
2017			6,782	1,628,692	1,475,852
2018				31,566	1,452,358
2019	4,107		2,113	470,940	436,219

Year	SC	GA	FL		Total
2010	1,137,142	719,068	3,196,674		6,061,649
2011	1,058,774	433,306	2,871,989		5,117,489
2012	1,007,542	221,044	3,727,020		5,997,941
2013	682,544	452,283	4,341,545		8,901,611
2014	921,971	387,367	4,582,561		8,545,882
2015	656,747	394,787	3,949,000		5,666,593
2016	536,550	586,235	5,694,370		7,496,102
2017	1,048,249	826,857	4,470,905		9,457,337
2018	643,213	1,186,306	4,829,344		8,142,787
2019	862,124	630,294	2,372,773		4,778,570

Table 4. Recreational landings (numbers) of red drum by state, 2010-2019. (Source: personal communication with MRIP for data prior to 2019; state compliance reports for 2019)

Year	NJ	DE	MD	VA	NC
2010				44,123	179,828
2011	5,432				156,484
2012		2,256	62,444	90,856	152,005
2013		3,734	4,766	333,590	520,758
2014				251,501	324,303
2015				22,102	143,876
2016				15,866	169,195
2017			4,943	347,145	353,716
2018				6,334	299,577
2019	1,331		1,258	205,824	97,186

Year	SC	GA	FL		Total
2010	437,219	442,578	721,011		1,824,759
2011	373,083	200,521	787,958		1,523,478
2012	296,380	96,354	877,569		1,577,864
2013	282,688	236,760	1,007,729		2,390,025
2014	393,424	212,193	1,027,980		2,209,401
2015	258,493	201,049	981,685		1,607,205
2016	241,224	289,928	1,309,505		2,025,718
2017	455,887	467,522	978,520		2,607,733
2018	262,725	606,836	1,069,604		2,245,076
2019	333,315	271,970	599,348		1,510,232

Table 5. Recreational alive releases and dead discards (numbers) of red drum by state, 2010-2019. Dead discards are estimated based on an 8% release mortality rate. (Source: personal communication with MRIP for data prior to 2019; state compliance reports for 2019)

Year	NJ	DE	MD	VA	NC
2010			6,801	88,328	1,670,693
2011				156,584	587,369
2012		42,738	1,250,726	8,323,032	4,939,534
2013		1,325	7,125	576,743	1,892,171
2014		264	659	1,108,646	1,086,967
2015			1,456	78,590	1,308,072
2016		2,598	47,908	164,575	3,203,452
2017			14,148	1,722,618	2,165,656
2018	4,715		21,384	85,338	1,729,260
2019		474	5,740	865,957	2,976,601

Year	SC	GA	FL	Total Releases	Dead Discards
2010	2,269,230	926,494	6,759,301	11,720,847	937,668
2011	1,617,509	370,451	4,191,567	6,923,480	553,878
2012	1,083,096	220,312	2,614,554	18,473,992	1,477,919
2013	1,864,510	504,759	5,196,513	10,043,146	803,452
2014	1,874,809	750,619	5,074,602	9,896,566	791,725
2015	1,432,754	961,277	4,132,461	7,914,610	633,169
2016	1,266,931	601,153	4,734,303	10,020,920	801,674
2017	2,094,199	1,176,524	4,727,411	11,900,556	952,044
2018	1,493,803	1,045,570	5,375,011	9,755,081	780,406
2019	2,911,653	1,206,707	3,673,651	11,640,783	931,263