FISHERY MANAGEMENT PLAN UPDATE
SPOTTED SEATROUT
AUGUST 2019

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	February 2012
Amendments:	None
Revisions:	None
Supplements:	Supplement A to the 2012 FMP – February 2014
Information Updates:	None
Recommended Schedule Change:	None
MFC Scheduled Review:	Review started in 2019

Spotted seatrout *(Cynoscion nebulosus)* are managed under the authority of two state and one interstate fishery management plans (FMP). The North Carolina Marine Fisheries Commission (NCMFC) currently manages spotted seatrout under the North Carolina Spotted Seatrout FMP (NCDMF 2012) and Supplement A to the 2012 FMP (NCDMF 2014a). Supplement A maintains short–term measures in the spotted seatrout fishery (40% reduction at 14-inch total length minimum size) to address several sources of uncertainty in the 2009 stock assessment through acquisition and assessment of additional data. This supplement examined sources of uncertainty in the assessment, the rationale for not implementing on schedule the North Carolina Spotted Seatrout FMP February 2014 management measures, and presented possible interim management measures. At the February 2014 NCMFC meeting the commission voted to maintain short-term management measures in the spotted seatrout fishery (Proclamation FF-38-2014: 14-inch minimum size, 75-fish commercial trip limit with weekend closures in joint waters except in Albemarle and Currituck sounds; Proclamation FF-39-2014: 14-inch minimum size, four-fish recreational bag limit). These measures will remain in effect until an amendment is completed.

As required in the approved 2012 FMP, a stock assessment was completed on schedule (2014-2015), peer reviewed, approved for management, and was presented to the NCMFC at its May 2015 business meeting. A new benchmark stock assessment will begin in 2019. The North Carolina Division of Marine Fisheries (NCDMF) is on schedule to review the current state FMP for spotted seatrout beginning in 2019 and determine if changes to management are needed through the FMP amendment process.

The Atlantic States Marine Fisheries Commission (ASMFC) manages spotted seatrout in all Atlantic States who have a declared interest in the species. In addition to the state FMP, the ASMFC manages spotted seatrout under the Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout (ASMFC 2011). The goals for the Omnibus Amendment are to bring the FMPs for the three species under the authority of the ASMFC Interstate Fishery Management Program Charter, and bringing compliance requirements to each state. Because the intent of the Omnibus amendment was to bring the ASMFC spotted seatrout FMP into compliance with the new ASMFC charter, management measures were not adjusted and the identified objectives and compliance requirements to the states of the Omnibus Amendment are the same as Amendment 1 to the ASMFC spotted seatrout FMP (ASMFC 1990) and are as follows:

- Manage the spotted seatrout fishery restricting catch to mature individuals (12-inch minimum size).
- Manage the spotted seatrout stock to maintain sufficiently-high spawning stock biomass (20% SPR).
- Develop research priorities that will further refine the spotted seatrout management program to maximize the biological, social, and economic benefits derived from the spotted seatrout population.

To ensure compliance with interstate requirements, North Carolina also manages this species under the North Carolina Fishery Management Plan for Interjurisdictional Fisheries (IJ FMP). The goal of the IJ FMP is to adopt fishery management plans, consistent with N.C. law, approved by the Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, or the ASMFC by reference and implement corresponding fishery regulations in North Carolina to provide compliance or compatibility with approved fishery management plans and amendments, now and in the future. The goal of these plans, established under the Magnuson-Stevens Fishery Conservation and Management Act (federal council plans) and the Atlantic Coastal Fisheries Cooperative Management Act (ASMFC plans) are like the goals of the Fisheries Reform Act of 1997 to "ensure long-term viability" of these fisheries (NCDMF 2015).

Management Unit

The management unit for the North Carolina Spotted Seatrout FMP (NCDMF 2012) includes all spotted seatrout within the coastal and joint waters of North Carolina. The unit stock, or population unit, for North Carolina's assessment of spotted seatrout include all spotted seatrout caught in North Carolina and Virginia. Virginia landings were included in the stock assessment of spotted seatrout because of the high rate of mixing observed between North Carolina and Virginia.

Goal and Objectives

The goal of the North Carolina Spotted Seatrout FMP (NCDMF 2012) is to determine the status of the stock and ensure long-term sustainability for the spotted seatrout stock in North Carolina. To achieve this goal, it is recommended that the following objectives be met:

1. Develop an objective management program that provides conservation of the resource and sustainable harvest in the fishery.
2. Ensure the spawning stock is of sufficient capacity to prevent recruitment-overfishing.
3. Address socio-economic concerns of all user groups.
4. Restore, improve, and protect important habitats that affect growth, survival, and reproduction of the North Carolina spotted seatrout stock.
5. Evaluate, enhance, and initiate studies to increase understanding of spotted seatrout biology and population dynamics in North Carolina.
6. Promote public awareness regarding the status and management of the North Carolina spotted seatrout stock.

STATUS OF THE STOCK

Life history

Spotted seatrout range from Massachusetts to southern Florida and the Bahamas on the U.S. Atlantic Coast and continue through the Gulf of Mexico to the Yucatan Peninsula, Mexico (Murphy et al. 2006). They inhabit shallow coastal and estuarine waters throughout their range and are considered a euryhaline species (Deaton et al. 2010). In North Carolina, the current state record was recorded at 12.3 pounds in 1961. The maximum reported age of spotted seatrout is 9 years in North Carolina for both male and female fish (NCDMF 2012). Most spotted seatrout in North Carolina are mature by age 1 and 7.9 inches for males and 9.6 inches for females. All males are mature at 12 inches and females at 15 inches. Spawning in North Carolina occurs from April to October with peak spawn around May (Burns 1996). Spawning occurs within the first few hours after sunset (Luczkovich et al. 1999) and a single fish is capable of spawning multiple times (batch spawners) throughout the season. In Florida, it has been observed that during peak spawning, spotted seatrout older than 3 years old may spawn every two days while younger fish may spawn as frequently as every four days (Roumillat and Brouwer 2004). Estimates of the number of eggs a female can produce in a year from the Southeast and Gulf Coasts vary, based on size and age and range, from 3 million to 20 million per year (Nieland et al. 2002; Roumillat and Brouwer 2004; Murphy et al. 2011).

Stock Status

The 2014 North Carolina spotted seatrout stock assessment (NCDMF 2014b) indicated that the spotted seatrout stock in North Carolina and Virginia is not overfished and overfishing in not occurring. Reference points (SSB and F) for determining stock status were calculated from the assessment using the SPR thresholds (20% SPR) and targets (30%SPR) defined in the spotted seatrout FMP (NCDMF 2012). The model estimated $SSB_{20\%}$ at 394 metric tons and $SSB_{30\%}$ at 623 metric tons with a model terminal year (2012) SSB estimate of 2,513,270 pounds. Based on these results, the stock is not currently overfished ($SSB_{2012} < SSB_{20\%}$) and has not been overfished during the 1991 to 2012 time period (Figure 1). Fishing mortality reference points estimated from the model were $F_{20\%}$ at 0.656 and $F_{30\%}$ at 0.422 with a terminal year estimate of F at 0.401, close to the F target, but still below, suggesting that overfishing is not occurring ($F_{2012} < F_{20\%}$; Figure 2).

Stock Assessment

The 2014 assessment of the spotted seatrout in North Carolina and Virginia was conducted using a Stock Synthesis model that incorporated data collected from commercial and recreational fisheries, two fishery-independent surveys, and a tagging study (NCDMF 2014b). This approach differs from the previous NCDMF assessment of spotted seatrout, which was applied to data available from 1991 through 2008. The previous assessment used the ASAP2 statistical catch-at-age model and data more limited in both area and time. The previous model relied primarily upon fishery-dependent data, one fishery-independent index, and included age data only from the North Carolina portion of the stock.

The Stock Synthesis model has been thoroughly vetted through the stock assessment community and peer reviewed literature. The time period used for the assessment was 1991 through 2012 and relied on expanded fishery-independent data sources, including age data from the Virginia portion of the stock, a juvenile abundance index, and tag-return data from research conducted by North Carolina State University (Ellis 2015). The fishing year was changed from a calendar year to a biological year (defined as March 1 through February 28 or 29) to allow the model to incorporate cold stun mortalities within a single fishing year instead of across two calendar years. The maximum age was decreased from 12 years (previous assessment) to nine as the 12-year maximum was based on scale ages not otoliths. Only ages derived from otoliths were used in the current assessment.

Tagging data from Ellis' (2015) study was included in the model but did not have a significant influence on results. Multiple model configurations were attempted to account for varying natural mortality ranging from direct tagging estimates to estimates based on water temperature correlations: however, no model configuration incorporating varying natural mortality would produce results (converge). Ellis' (2015) data did provide further evidence of the highs and lows associated with spotted seatrout natural mortalities and the need for a custom model that can incorporate these highly variable mortality rates. The NCDMF recognized the need to develop a model that will accept variable natural mortality estimates. Developing a custom model that can incorporate variable natural mortality was added as a research recommendation and the NCDMF will continue to investigate this during the next benchmark assessment.

The results of this assessment suggest the age structure of the spotted seatrout stock has been expanding during the last decade. However, an abrupt decline is evident in the model's estimate of recruitment after 2010, although this is not mirrored in the empirical survey data. Spawning stock biomass (SSB) increased to its maximum in 2007 but has since declined to close to the time series average. In 2012, estimated SSB was 2,513,270 pounds, which is greater than the currently defined threshold for assessing whether the stock is overfished (SSB30%=868,621 pounds; Figure 1). Fishing mortality has varied without apparent trend, but periods of high fishing mortality seem to coincide with the decline in spawning stock biomass and may be attributed to cold stun events. The 2012 estimate of fishing mortality was 0.40, which is less than the fishing mortality threshold (F20%=0.66), indicating that the stock is not experiencing overfishing; however, the 2012 estimate of fishing mortality (0.40) is very near the target fishing mortality of F30%=0.42 (Figure 2).

A benchmark stock assessment for spotted seatrout will begin in 2019 coinciding with the scheduled plan review.

STATUS OF THE FISHERY

Current Regulations

The NCDMF currently allows the recreational harvest of spotted seatrout seven days per week with a minimum size limit of 14-inches total length (TL) and a daily bag limit of four fish. The commercial harvest is limited to a daily limit of 75 fish with a minimum size limit of 14-inches TL). It is unlawful for a commercial fishing operation to possess or sell spotted seatrout for commercial purposes taken from Joint Fishing Waters of the state from midnight on Friday to midnight on Sunday each week; the Albemarle and Currituck sounds are exempt from this weekend closure. In the event of a catastrophic cold stun, the NCDMF has the authority to close the fishery until the following spawning period. In 2018, the spotted seatrout commercial and recreational fishery was closed from January 5 through June 15 by proclamation due to a coast-wide cold stun event.

Commercial Landings

Annual landings have been variable throughout the time series (Table 1; Figure 3). Commercial landings in 2018 (128,922 pounds) declined by 57% compared to the previous year (299,911 pounds; Table 1; Figure 3). This sharp decline in commercial landings is most likely due to the fishery closure from January through mid-June. During the early to mid-1990s, landings in the ocean and estuarine areas were more similar than in the remainder of the time series (1995-2018) in which estuarine landings have dominated. The primary gear of harvest are estuarine gill nets (set, drift, and run around).

Recreational Landings

Recreational fishing activity is monitored through the Marine Recreational Information Program. In this report, estimates across all years have been updated and are now based on the MRIP new Fishing Effort Survey-based calibrated estimates. For more information on MRIP methodology changes see https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

Recreational harvest of spotted seatrout estimated by MRIP (Type A + B1) in 2018 was 658,555 pounds (PSE = 18.4%) and 449,473 fish (PSE = 18.6%), much lower than the time series averages of 1,423,709 pounds and 920,763 fish (Table 1; Figure 3). Estimated recreational releases in 2018 (15,245,249 fish) were well above the time series average of 2,847,400 fish (Table 1).

The North Carolina Saltwater Fishing Tournament recognizes anglers for landing and/or releasing fish of exceptional size or rarity by issuing citations that document the capture for the angler. Citations awarded through the North Carolina Saltwater Fishing Tournament for spotted seatrout have varied by year throughout the time series, averaging 325 citations (Table 2; Figure 4). The number of awarded citations in 2018 decreased from the previous year from 464 to 198. The number of release citations (fish over 24 inches that are released) awarded also decreased from

previous year's count, but comprised the largest percent of the spotted seatrout citations (37%) since spotted seatrout release citations began in 2008 (Table 2).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fish houses are sampled monthly to provide length, weight, and age data. This information is used to characterize the commercial fishery for stock assessments and to monitor trends in the size and age of fish being removed from the stock. The average sizes of fish landed by the commercial fishery are typically larger than the recreational fishery and is primarily driven by the larger maximum size observed in the commercial landings (Table 3; Figure 5). The number of fish sampled by division staff at commercial fish houses has varied over time due to annual variability in landings of the fishery, however; mean, minimum, and maximum lengths of spotted seatrout have not varied much between years for the commercial fishery (Table 3; Figure 6). The bulk of spotted seatrout landings by the commercial fishery come from the ocean and estuarine gill net fishery (96%) with gigs (1%) and all other gears (3%) accounting for the rest.

Recreational catch is almost exclusively hook-and-line with few fish being landed by gigs. The average size of fish measured from the recreational fishery has been increasing from 2010 to 2017, most likely due to the increase in the minimum size limit from 12-inches to 14-inches in late 2009 (Table 3; Figure 7). However, the average size of fish caught by the recreational fishery in 2018 was 15.7 inches, which is a decline from the 2010-2017 average size of 17.0 inches. A majority (40%) of the spotted seatrout sampled in 2018 were at the minimum size limit of 14 inches (Figure 5). The maximum size of spotted seatrout in 2018 was 23.3 inches, a decrease of 1.6 inches over the eight-year average. This decrease observed in average size caught and maximum size caught in 2018 may be at least partially due to the cold stun event that occurred in January 2018, which caused high spotted seatrout mortality coast-wide in North Carolina.

Fishery-Independent Monitoring

The NCDMF utilizes numerous independent monitoring programs to provide indices of juvenile (Program 120) and adult (Program 915) abundance to include in stock assessments. Program 120, the North Carolina Estuarine Trawl Survey, is a fishery independent multispecies monitoring program that has been ongoing since 1971 in the months of May, June and July. One of the key objectives of this program is to provide a long-term database of annual juvenile recruitment for economically important species. This survey samples a fixed set of 104 core stations with additional stations as needed. The core stations are sampled from western Albemarle Sound south to the South Carolina border each year without deviation two times in the months of May and June. An additional set of 27 spotted seatrout juvenile stations in Pamlico Sound and its major tributaries were added in 2004, and are sampled during the months of June and July. Data from the seatrout specific stations are used to generate an index of relative abundance of age zero spotted seatrout, calculated as a Catch Per Unit Effort (CPUE) or the average number of fish per tow. The resulting CPUE index for the time series is variable with no significant trends in CPUE and peaks in 2006, 2008, 2012, 2013, and 2018 suggesting relatively

higher recruitment in those years (Figure 8). The Program 120 CPUE in 2018 was 2.98, which was above the time series average of 2.19. Spikes in the juvenile index are often observed in years after severe cold stun events.

The NCDMF started a fishery independent gill net survey (Program 915) in 2001 to generate a long-term database of age composition and to develop indices of abundance for numerous commercial and recreationally important finfish species, including spotted seatrout. The survey utilizes a stratified random sampling scheme of multi-mesh gill nets designed to characterize the size and age distribution for key estuarine species in Pamlico Sound and help managers assess the spotted seatrout stocks without relying solely on commercial and recreational fishery dependent data. Three regions that encompass most of the estuarine waters in North Carolina are sampled monthly from February to December. Pamlico Sound stations include waters on the backside of the barrier islands and the bays of Hyde and Dare counties. CPUE from Pamlico Sound has remained relatively steady, with a time series high in 2017 and a slight decrease in 2018 (Figure 9). Central river stations that include Pamlico, Pungo and Neuse rivers have had an overall declining trend in CPUE since 2012, with CPUE in 2018 the lowest since 2005 (Figure 10). Spotted seatrout CPUE in the Cape Fear and New rivers has declined in the past two years, reaching the second lowest CPUE in 2018 since sampling began in 2008 (Figure 11). The declines in CPUE of spotted seatrout observed in 2018 in all areas sampled by P915 is most likely due to mortality from the coast-wide January 2018 cold stun event.

Spotted seatrout age samples are collected from numerous NCDMF fishery independent and dependent sources. To date, a total of 17,770 otoliths from spotted seatrout have been aged since 1991 (Table 4). With the exception of 2003, the minimum age of sampled spotted seatrout has been age zero for every year the NCDMF has recorded this information. Maximum ages have varied every year and has ranged from age five to age nine. Modal ages, which give an indication of the age of the largest cohort in the fishery, has mostly been age one. Spotted seatrout length-at-age was summarized based on all available age data (1991-2018; Figure 12). Average growth of spotted seatrout slows down around age-4, but fish as large as 24 inches have the potential to be young of the year (age-0), demonstrating the species' fast growth.

MANAGEMENT STRATEGY

Reduce F to maintain a 20% spawning potential ratio which will increase the likelihood of sustainability through an expanded age structure and an increase in the spawning stock biomass. This strategy should provide a greater cushion for the population that would likely lead to faster recovery of the population after cold stun events, which can lead to mass mortalities in the winter months potentially affecting the number of mature fish available to spawn the following spring. Consider revising reference points after the stock is reassessed in the next plan review based on the response of the population to the management measures selected in the initial FMP. The Director will maintain authority to intervene in the event of a catastrophic cold stun event and do what is necessary in terms of temporary closures by waterbody (Table 5 and 6).

RESEARCH NEEDS

The following research needs were compiled from those listed in the 2012 North Carolina Spotted Seatrout FMP. Improved management of spotted seatrout is dependent upon research needs being met. Research needs are not listed in order of priority.

- Develop a juvenile abundance index to gain a better understanding of a stock recruitment relationship – (ongoing, using program 120 since 2004)
- Research the feasibility of including measures of temperature or salinity into the stock recruitment relationship – (not completed)
- Determine batch fecundity estimates for North Carolina spotted seatrout – (not conducted)
- Size specific fecundity estimates for North Carolina spotted seatrout – (not conducted)
- Area specific spawning surveys could help in the delineation of area specific closures to protect females in spawning condition – (not completed)
- Investigation of the relationship of temperature with both adult and juvenile mortality – (started in 2015, monitoring temperatures in over wintering habitat of spotted seatrout: CRFL project 2F40-F024)
- Incorporate cold stun event information into the modeling of the population – (unsuccessfully attempted using stock synthesis model, will be investigated further during next benchmark stock assessment)
- Estimate or develop a model to predict the impact of cold stun events on local and statewide spotted seatrout abundance – (unsuccessfully attempted using stock synthesis model, will be investigated further during next benchmark stock assessment).
- Obtain samples (length, age, weight, quantification) of the cold stun events as they occur – (obtained samples in 2001, 2014, and 2015; length, weight, sex, age; unable to quantify extent of kills)
- Define overwintering habitat requirements of spotted seatrout – (not conducted)
- Determine factors that are most likely to influence the severity of cold stun events in North Carolina, and separate into low and high salinity areas – (Tim Ellis and the spotted seatrout Plan Development Team worked on this but were unable to incorporate into models; Ellis et. al (2017))
- Investigate the distribution of spotted seatrout in nursery and non-nursery areas – (not completed)
- Further research on the possible influences of salinity on release mortality of spotted seatrout – (ongoing; CRFL project 2F40-F017, evaluation of tagging and discard mortality component)
- Survey of fishing effort in creeks with conflict complaints – (not completed)
- Determine targeted species in nursery areas and creeks with conflict complaints – (not completed)
- Microchemistry, genetic, or tagging studies are needed to verify migration patterns, mixing rates, or origins of spotted seatrout between North Carolina and Virginia – (Tim Ellis data (2008-2013); CRFL project 2F40-F017, NC Multi Species Tagging Study 2014 – present; NCSU study CRFL grant 2F40-F022)
- Tagging studies to verify estimates of natural and fishing mortality – (Tim Ellis data (2008-2013); CRFL project 2F40-F017, NC Multi Species Tagging Study 2014 – present)

- Tagging studies to determine if there are localized populations within the state of North Carolina (e.g., a southern and northern stock) – (Tim Ellis data (2008-2013); CRFL project 2F40-F017, NC Multi Species Tagging Study 2014 - present)
- A longer time series and additional sources of fishery-independent information – (longer series available as well as Program 915 survey for rivers and southern portion of state)
- Increased observer coverage in a variety of commercial fisheries over a wider area – (ongoing)
- Expand nursery sampling to include SAV bed sampling in high and low salinity areas during the months of July through September – (not completed)
- Evaluate the role of shell hash and shell bottom in spotted seatrout recruitment and survival, particularly where SAV is absent – (not completed)
- Evaluate the role of SAV in the spawning success of spotted seatrout – (not completed)

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATIONS

The Marine Fisheries Commission approved the 2017 FMP schedule in August 2017, which included a schedule change for spotted seatrout to begin in 2019, two years later than originally planned. This was due to staff workload for the review of the Southern Flounder Fishery Management Plan, the early review of the Estuarine Striped Bass Fishery Management plan, and the unscheduled review of the Blue Crab and Shrimp Fishery Management Plans. The review started in July 2019.

LITERATURE CITED

ASMFC (Atlantic States Marine Fisheries Commission). 1990. Proceedings of the Atlantic States Marine Fisheries Commission 49th annual meeting—Interstate Fisheries Management Plan Policy Board meeting. ASMFC, Washington, District of Columbia. 15 pp.

ASMFC. 2011. Omnibus Amendment to the Interstate Fishery Management Plans For Spanish Mackerel, Spot, and Spotted Seatrout. Fisheries Management Report. Atlantic States Marine Fisheries Commission. Washington, District of Columbia. 143 pp.

Burns, B. 1996. Life history and population dynamics of spotted seatrout (*Cynoscion nebulosus*) in North Carolina. Life History of Selected Marine Recreational Fishes in North Carolina Completion Report Grant F-43 Study 4. NC DNR. Morehead City, NC 29 pp.

Deaton, A. S., W. S. Chappell, K. Hart, J. O'Neal, and B. Boutin. 2010. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, North Carolina. 628 p.

Ellis, T. A. 2014. Mortality and movement of Spotted Seatrout at its Northern Latitudinal Limits. Dissertation. North Carolina State University. Raleigh, North Carolina. 258 pp.

Ellis, T. A., J. A. Buckel, J. E. Hightower, and S. J. Poland. 2017. Relating cold tolerance to winterkill for spotted seatrout at its northern latitudinal limits. Journal of Experimental Marine Biology and Ecology 490: 42-51.

Luczkovich, J. J. R. C. Pullinger, S. E. Johnson and M. W. Sprague. 1999. Identifying the critical spawning habitats of sciaenids using passive acoustics. Transactions of the American Fisheries Society, 137: 576–605.

Manooch III, C.S. 1984. Fisherman's guide: fishes of the southeastern United States. Raver and Manooch Partnership, Morehead City, NC. 362 p.

Murphy, M. D., C. B. Guenther, and B. Mahmoudi. 2006. An assessment of the status of spotted seatrout in Florida waters through 2005. Florida Fish and Wildlife Conservation Commission. Fish and Wildlife Research Institute St. Petersburg, FL.

Murphy, M. D., D. Chagaris, and D. Addis. 2011. An assessment of the status of spotted seatrout in Florida waters through 2009. Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute In-House Report 2011.

NCDMF (North Carolina Division of Marine Fisheries). 2012. North Carolina spotted seatrout fishery management plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries, Morehead City, North Carolina. 344 pp.

NCDMF. 2014a. Supplement A to the North Carolina spotted seatrout fishery management plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, North Carolina. 9 pp.

NCDMF. 2014b. Stock Assessment of Spotted Seatrout, *Cynosion nebulosus*, in Virginia and North Carolina Waters. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, North Carolina. 142 pp.

NCDMF. 2015. Fishery Management Plan for Interjurisdictional Fisheries: Information Update. North Carolina Department of Environmental Quality. North Carolina Division of Marine Fisheries. Morehead City, North Carolina. 85 pp.

Nieland, D.L., R.G. Thomas, and C.A. Wilson. 2002. Age, growth, and reproduction of spotted seatrout in Barataria Bay, Louisiana. Transactions of the American Fisheries Society 131: 245-259.

Roumillat, W. A. and M. Brouwer. 2004. Reproductive dynamics of female spotted seatrout (*Cynoscion nebulosus*) in South Carolina, Fishery Bulletin 102:473-487 (2004).

TABLES

Table 1. Recreational harvest (number of fish released and weight in pounds) and releases (number of fish) and commercial harvest (weight in pounds) of spotted seatrout from North Carolina for the period 1991 - 2018.

	Recreational				
	Numbers		Weight (lb)		
Year	Landed	# Released	Landed	Commercial Weight (lb)	Total Weight (lb)
1991	988,049	719,372	1,360,530	660,662	2,021,192
1992	908,233	476,405	1,390,746	526,271	1,917,017
1993	569,327	542,137	857,720	449,886	1,307,606
1994	798,937	601,148	1,207,520	412,358	1,619,878
1995	863,057	764,503	1,221,065	574,296	1,795,361
1996	575,357	1,028,974	699,078	226,580	925,658
1997	779,611	480,093	1,025,110	232,497	1,257,607
1998	702,274	351,114	1,125,898	307,671	1,433,569
1999	1,080,411	1,168,909	1,878,913	546,675	2,425,588
2000	728,906	645,107	1,095,729	376,574	1,472,303
2001	499,556	1,210,336	659,893	105,714	765,607
2002	746,908	1,829,880	957,824	175,555	1,133,379
2003	388,715	903,292	515,678	181,462	697,140
2004	560,834	934,206	728,027	130,961	858,988
2005	1,517,647	3,744,921	1,695,036	129,855	1,824,891
2006	1,444,778	2,722,351	2,034,469	312,624	2,347,093
2007	1,241,296	3,558,110	1,998,275	374,722	2,372,997
2008	1,372,973	4,509,440	2,114,130	304,430	2,418,560
2009	1,857,890	5,369,092	2,878,160	320,247	3,198,407
2010	630,748	8,034,670	1,277,174	202,647	1,479,821
2011	723,502	7,486,377	1,353,388	75,239	1,428,627
2012	1,602,836	4,967,987	2,720,028	265,016	2,985,044
2013	1,107,957	4,312,436	1,881,881	367,648	2,249,529
2014	725,086	3,950,447	1,451,592	242,245	1,693,837
2015	249,260	4,883,109	430,579	128,762	559,341
2016	978,624	6,533,887	1,724,492	254,590	1,979,082
2017	1,217,834	5,151,510	2,157,198	299,911	2,457,109
2018	449,473	15,245,249	658,555	128,922	787,477
Average	903,931	3,290,181	1,396,382	296,929	1,693,311

Table 2. Total number of awarded citations for spotted seatrout (>24 inches total length for release or > five pounds landed) from the North Carolina Saltwater Fishing Tournament for the time period 1991-2018.

Year	Total Citations	Release Citations[+]	% Release
1991	185		0
1992	203		0
1993	12		0
1994	237		0
1995	483		0
1996	132		0
1997	125		0
1998	332		0
1999	695		0
2000	511		0
2001	518		0
2002	353		0
2003	328		0
2004	378		0
2005	290		0
2006	686		0
2007	1,000		0
2008	428	5	1
2009	434	14	3
2010	168	16	10
2011	37	3	8
2012	143	5	3
2013	162	21	13
2014	197	18	9
2015	176	16	9
2016	214	44	21
2017	464	81	17
2018	198	73	37

[+] Spotted seatrout release citations (fish released greater than 24 inches total length) began in 2008.

Table 3. Mean, minimum, and maximum lengths (fork length, inches) of spotted seatrout measured from the commercial and recreational fisheries for the period 1991-2018.

	Commercial				Recreational			
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured	Mean Length	Minimum Length	Maximum Length	Total Number Measured
1991	14.4	7.7	28.7	1,207	15.1	4.9	31.9	745
1992	16.0	8.4	27.9	1,791	15.6	5.1	24.2	543
1993	16.3	8.5	29.7	1,898	15.7	9.3	25.0	485
1994	15.6	7.0	29.1	1,224	16.0	10.6	24.0	1,076
1995	17.1	8.5	29.1	2,728	15.6	8.5	31.6	853
1996	16.0	7.0	27.6	748	14.6	8.9	24.3	307
1997	14.9	8.1	29.9	4,155	15.3	8.9	23.1	622
1998	14.5	8.0	29.9	4,698	16.4	11.0	36.5	551
1999	15.6	7.6	30.2	6,167	16.4	11.6	26.8	699
2000	17.5	6.0	30.7	2,901	15.6	11.3	25.2	330
2001	16.3	7.6	30.7	1,595	14.8	11.5	26.0	326
2002	16.1	8.0	28.9	3,897	14.9	11.8	24.8	283
2003	17.2	9.5	29.6	2,305	14.6	9.9	25.0	130
2004	16.6	9.0	27.9	2,676	15.3	8.9	22.5	294
2005	16.8	8.5	27.5	2,429	14.2	8.7	25.2	664
2006	16.3	8.9	29.3	6,493	15.5	10.1	25.9	706
2007	17.3	9.6	31.0	8,455	15.9	10.8	27.7	521
2008	17.0	7.3	30.3	5,877	15.6	11.5	26.5	790
2009	16.7	5.4	29.5	6,631	16.0	9.1	26.0	779
2010	17.5	11.4	30.9	4,060	17.5	12.4	24.8	336
2011	16.6	8.8	27.8	1,274	17.0	12.3	24.2	638
2012	16.5	7.4	31.1	4,822	16.5	13.0	24.1	939
2013	16.7	8.7	28.5	6,144	16.8	10.1	23.5	865
2014	17.3	5.5	28.3	3,321	17.6	13.1	26.0	381
2015	18.3	8.9	30.9	2,676	16.9	12.8	25.0	154
2016	17.3	9.4	31.7	3,025	16.8	13.0	25.2	647
2017	17.6	7.6	32.9	3,066	17.0	11.6	25.8	864
2018	17.2	10.5	28.0	1,180	15.7	9.3	23.3	274

Table 4. Modal age, minimum age, maximum age, and number aged for spotted seatrout collected through NCDMF sampling programs from 1991 through 2018.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
1991	1	0	7	679
1992	1	0	6	572
1993	1	0	6	645
1994	1	0	9	688
1995	1	0	5	623
1996	1	0	6	734
1997	1	0	6	710
1998	1	0	9	765
1999	1	0	6	869
2000	1	0	7	566
2001	1	0	5	425
2002	1	0	7	713
2003	1	1	7	405
2004	1	0	6	598
2005	1	0	5	727
2006	1	0	8	970
2007	2	0	8	702
2008	1	0	7	616
2009	2	0	6	660
2010	1	0	6	623
2011	1	0	6	421
2012	1	0	5	593
2013	2	0	5	635
2014	1	0	7	530
2015	2	0	5	448
2016	1	0	5	456
2017	1	0	7	881
2018	1	0	5	516

Table 5. Summary of the NCMFC management strategies and their implementation status for the 2012 N.C. Spotted Seatrout FMP.

Management Strategy	Implementation Status
50% reduction in harvest needed, six fish bag limit, 14-inch minimum size limit, and weekend closure for commercial gears year round (no possession on weekends).	Accomplished; Proclamation authority
A maximum of two fish over 24 inches for recreational fishermen	Proclamation authority
The small mesh gill net attendance requirement is extended to include weekends, December through February	Accomplished
Development of a mutual aid agreement between NCDMF Marine Patrol and WRC Wildlife Enforcement Officers for Inland fishing waters	Accomplished
Move forward with the mediation policy process to resolve conflict between spotted seatrout fishermen	Conflict resolution process established under Rule 15A NCAC 03I .0122.
Remain status quo with the assumption that the Director will intervene in the event of a catastrophic event and do what is necessary in terms of temporary closures by water body	Repealed Rule 15A NCAC 03M .0504 and used proclamation authority in 15A NCAC 03M .0512; Beginning in May 2017 re-established spotted seatrout Rule 15A NCAC 03M .0522 due to ASMFC considering retiring Interstate Spotted Seatrout FMP
More extensive research on cold stun events by NCDMF, Universities, etc.	Ongoing

Table 6. Summary of the NCMFC management strategies and their implementation status for Supplement A to the 2012 N.C. Spotted Seatrout FMP adopted in 2014.

Management Strategy	Implementation Status
2014: 14-inch minimum size limit, four recreational bag limit, 75 fish commercial trip limit, no gill nets in joint waters on weekends, unlawful for a commercial operation to possess or sell spotted seatrout taken from joint waters on weekends.	Proclamation authority
2014: 14-inch minimum size limit, three fish recreational bag limit with a December 15- January 31 closure, 25 fish commercial trip limit (no closure)	Delay in management strategy
If a cold stun occurs close spotted seatrout harvest through June 1 and retain four fish recreational bag limit and 75 fish commercial trip limit	Proclamation authority
Revisit the Spotted Seatrout FMP in three years to determine if sustainable harvest measures are working	On schedule to begin July 2017*

* The NCMFC approved the 2017 FMP schedule in August 2017, which included a schedule change for spotted seatrout to begin in 2019, two years later than originally planned.

FIGURES

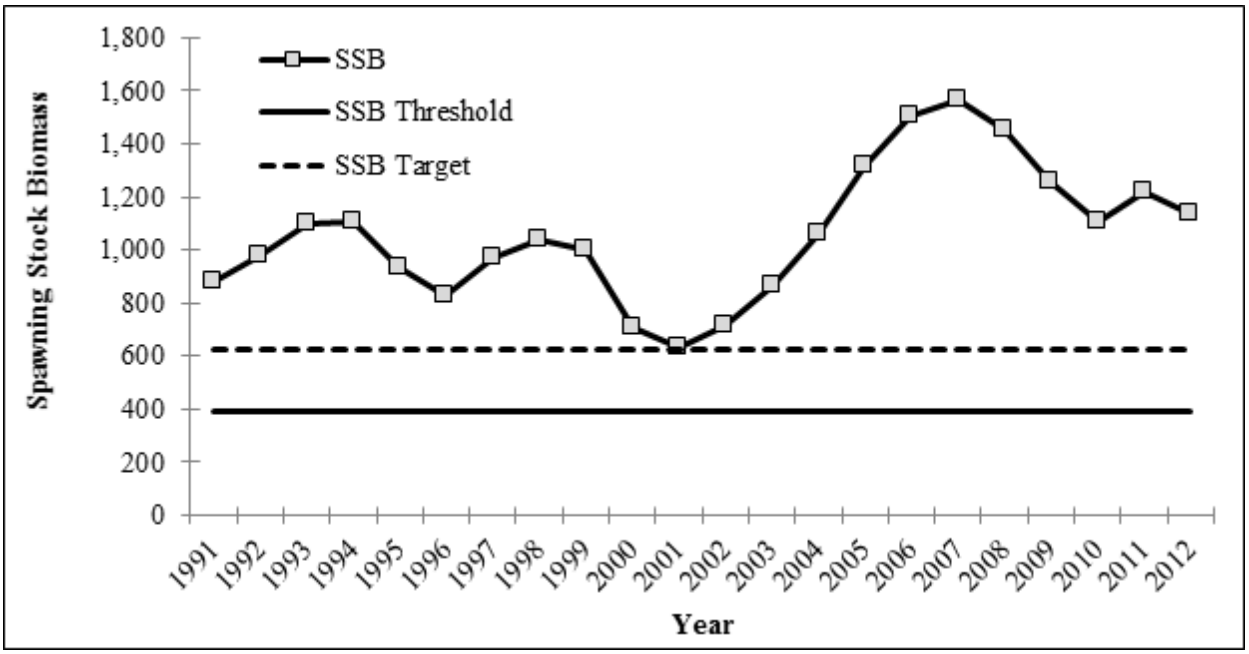

Figure 1. Annual predicted spawning stock biomass compared to estimated $SSB_{Threshold}$ ($SSB_{20\%}$) and SSB_{Target} ($SSB_{30\%}$), 1991-2012. 2012 is the terminal year for the last spotted seatrout stock assessment (NCDMF 2014).

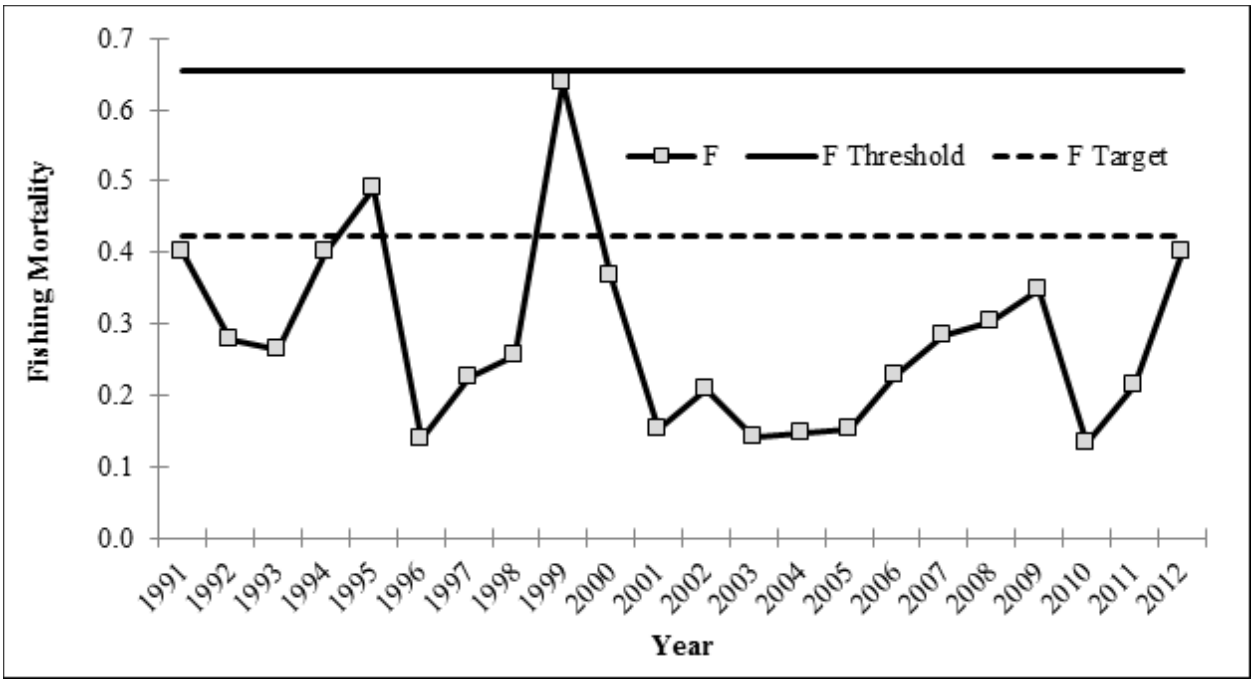

Figure 2. Annual predicted fishing mortality rates (numbers-weighted, ages 1–4) compared to estimated $F_{\text{Threshold}}$ ($F_{20\%}$) and F_{Target} ($F_{30\%}$), 1991-2012. 2012 is the terminal year for the last spotted seatrout stock assessment (NCDMF 2014).

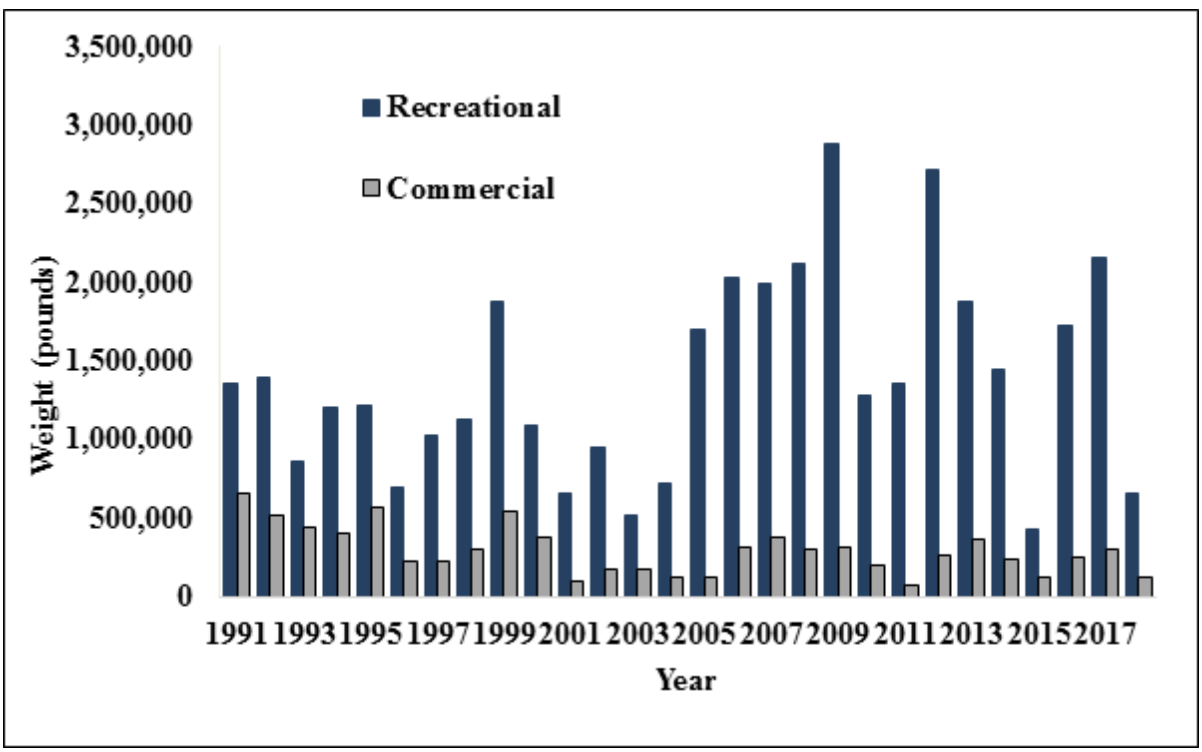

Figure 3. Commercial landings (pounds) reported through the North Carolina Trip Ticket Program and recreational landings (Type A + B1; pounds) and releases (Type B2; number of fish) estimated from the Marine Recreational Information Program survey for North Carolina from 1991 - 2018.

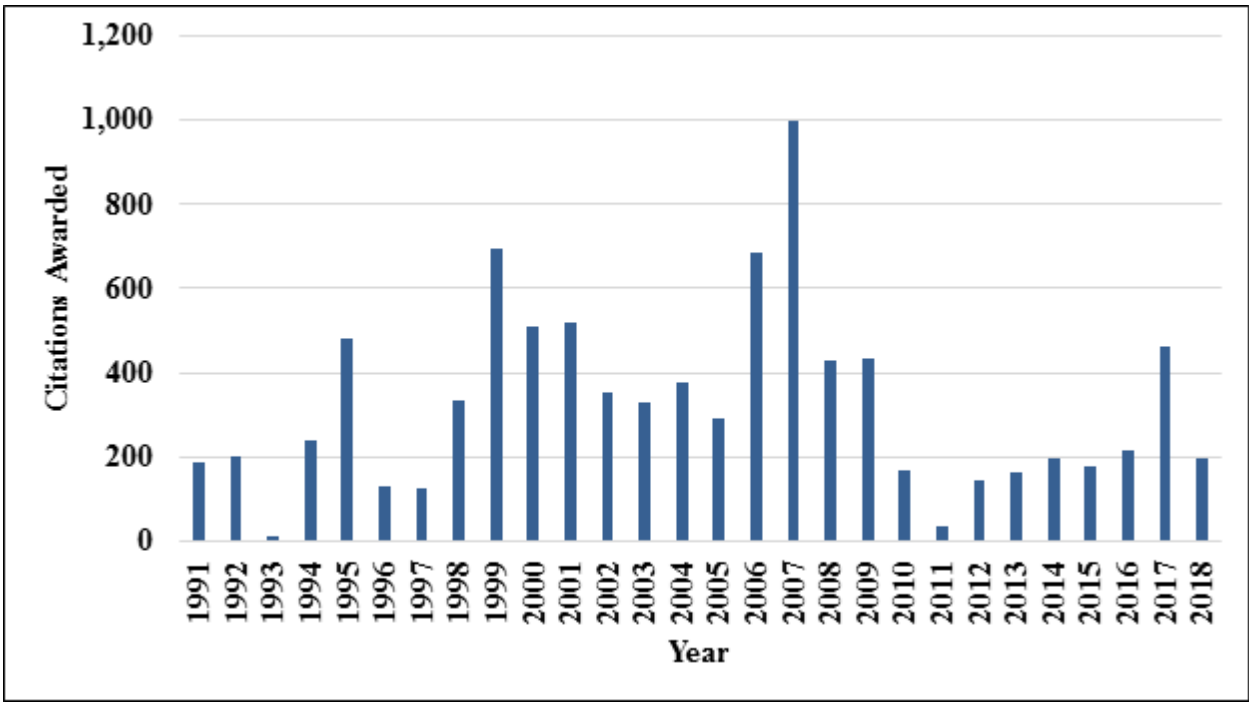

Figure 4. North Carolina Saltwater Fishing Tournament citations awarded for spotted seatrout from 1991 to 2018. Citations are awarded for spotted seatrout >24 inches total length for release or > five pounds landed.

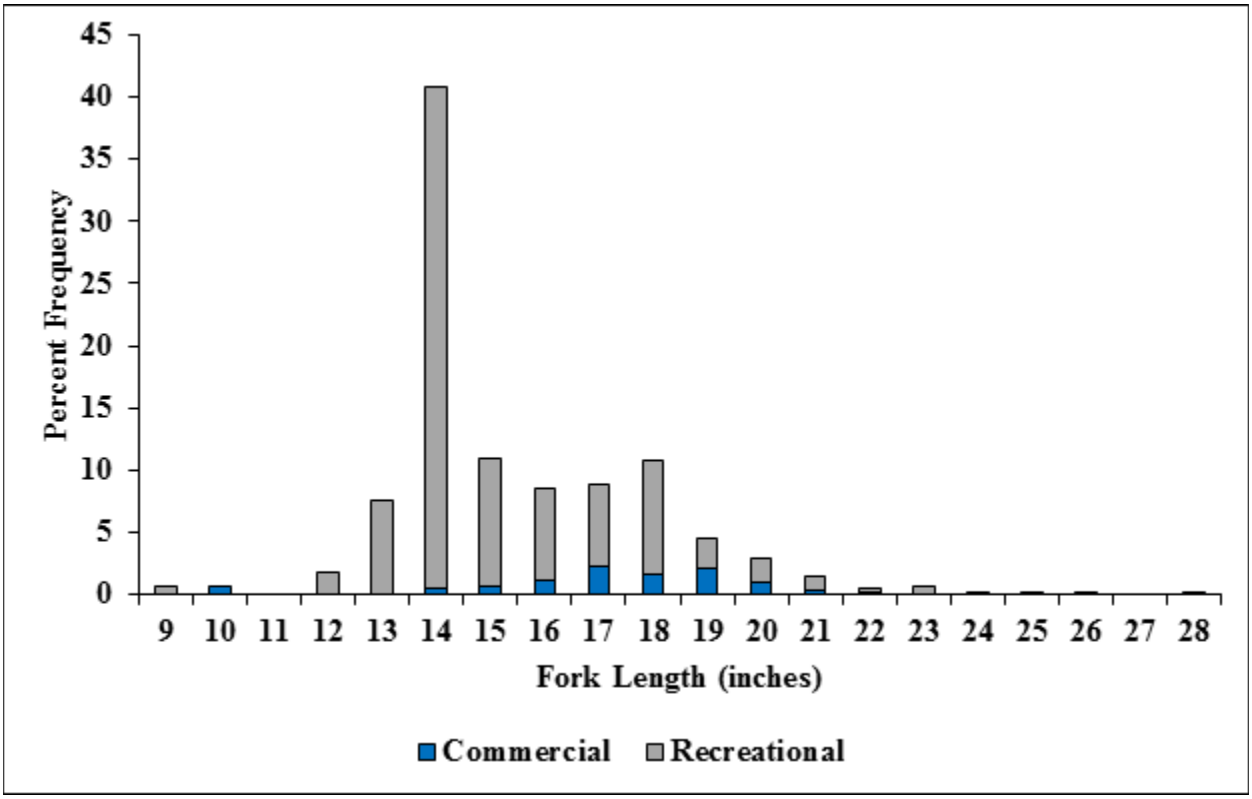

Figure 5. Commercial and recreational length frequency distribution from spotted seatrout harvested in 2018.

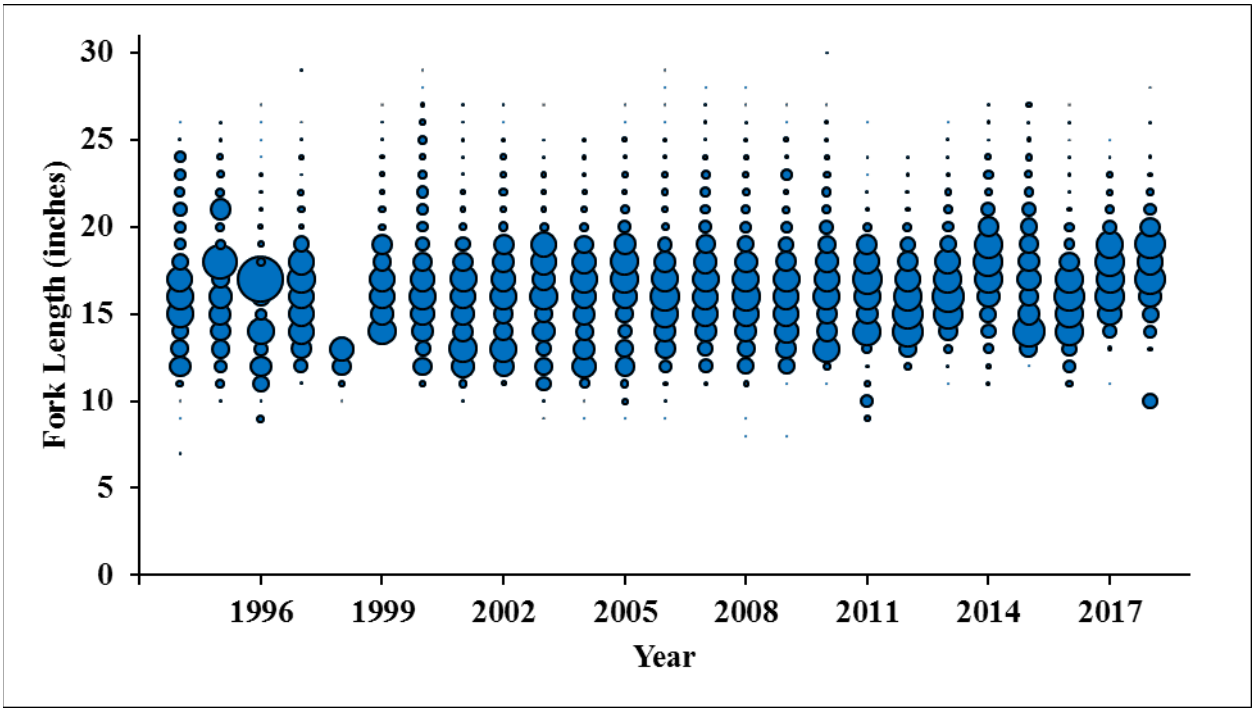

Figure 6. Commercial length frequency (fork length, inches) of spotted seatrout harvested from 1994 to 2018. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

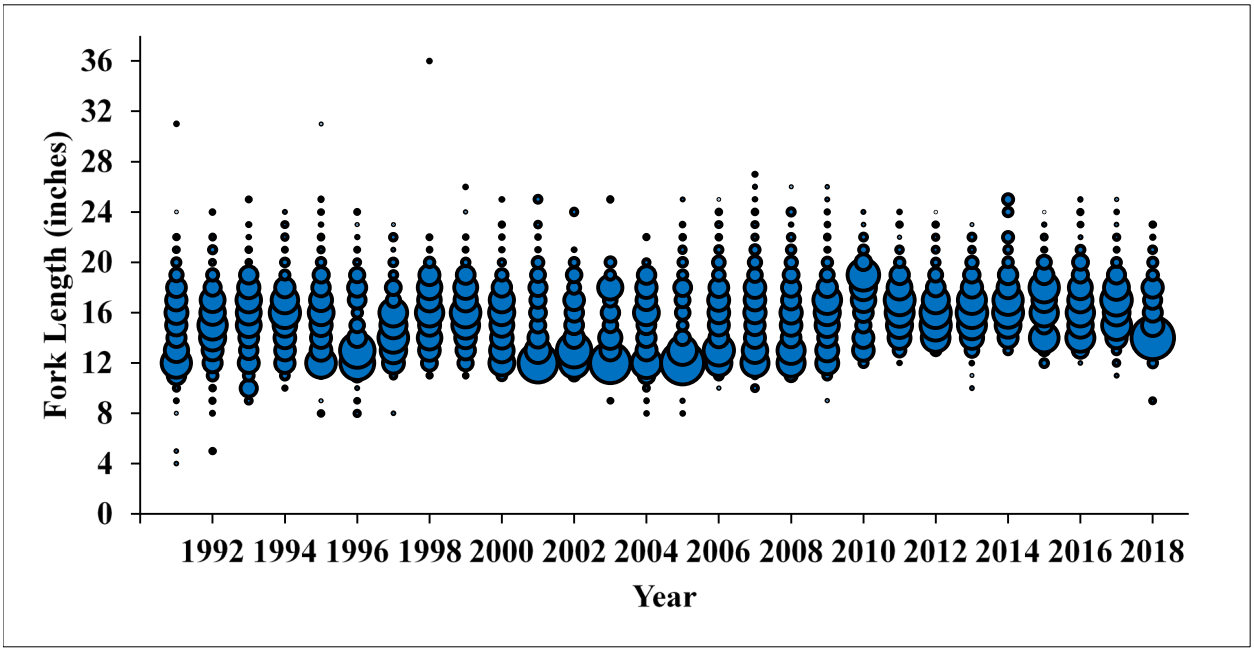

Figure 7. Recreational length frequency (fork length, inches) of spotted seatrout harvested from 1991 to 2018. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

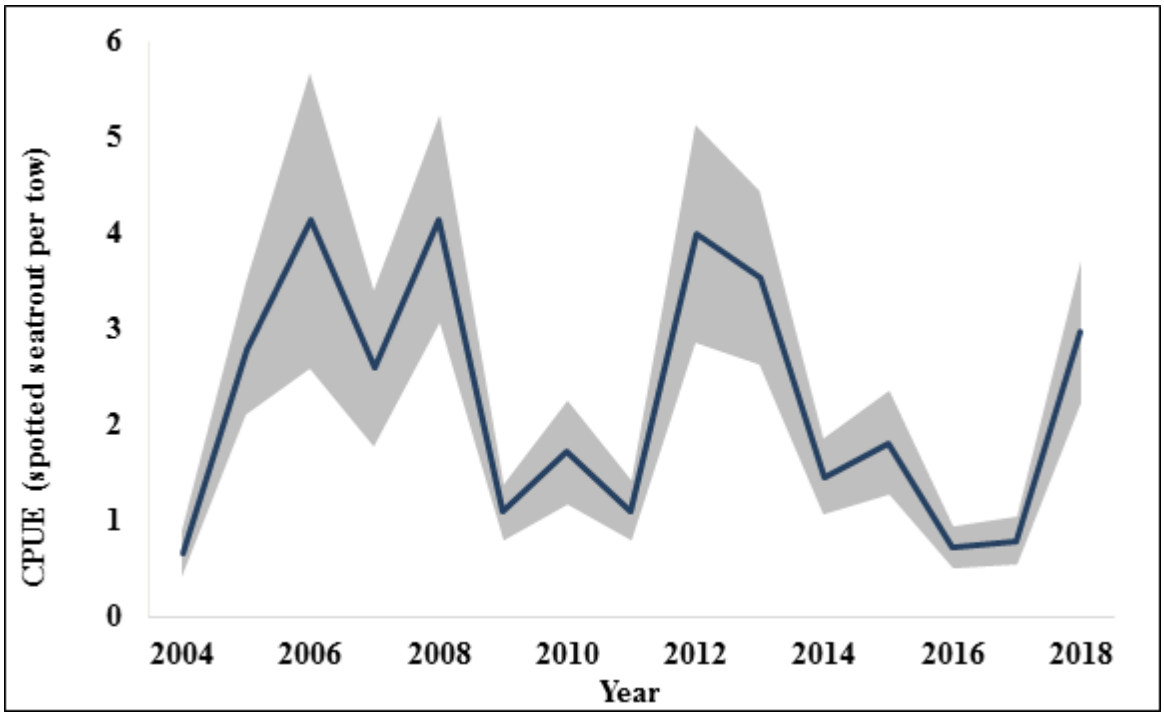

Figure 8. Catch per unit effort (CPUE; fish per-tow) from the North Carolina Estuarine Trawl Survey (Program 120) during June and July, 2004-2018. Error bars represent ± 1 standard error.

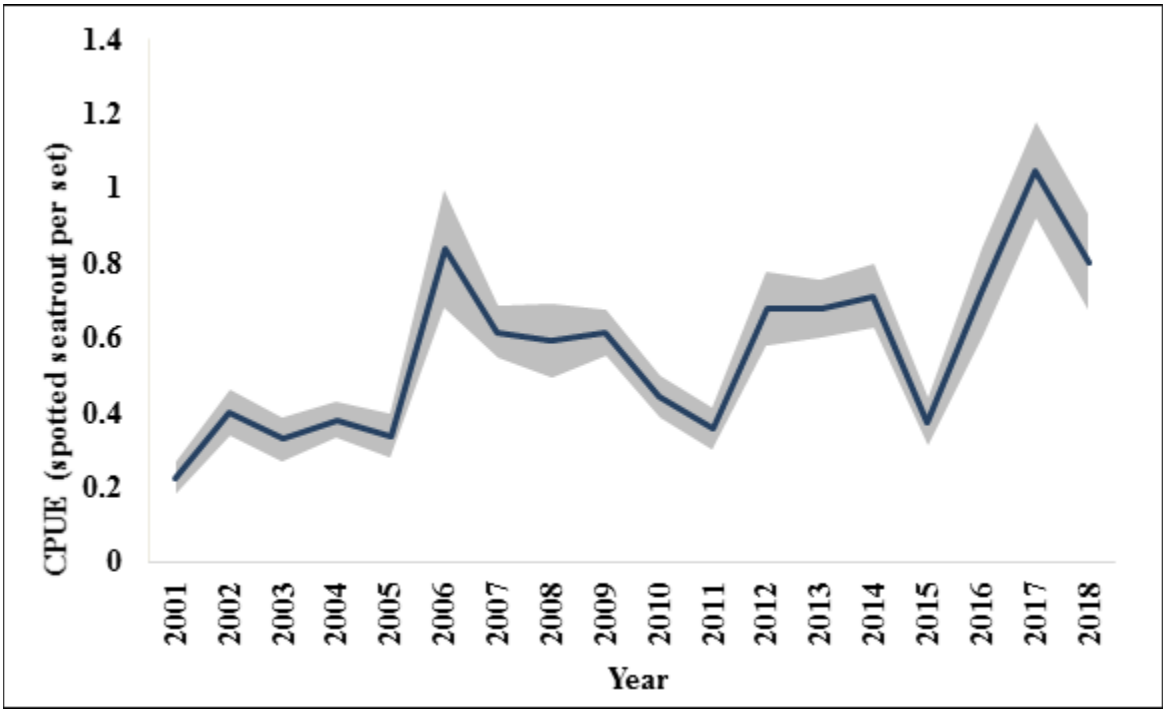

Figure 9. Catch per unit effort (CPUE; fish per station set) of spotted seatrout collected from Program 915 in Pamlico Sound, 2001 - 2018. Error bars represent ± 1 standard error.

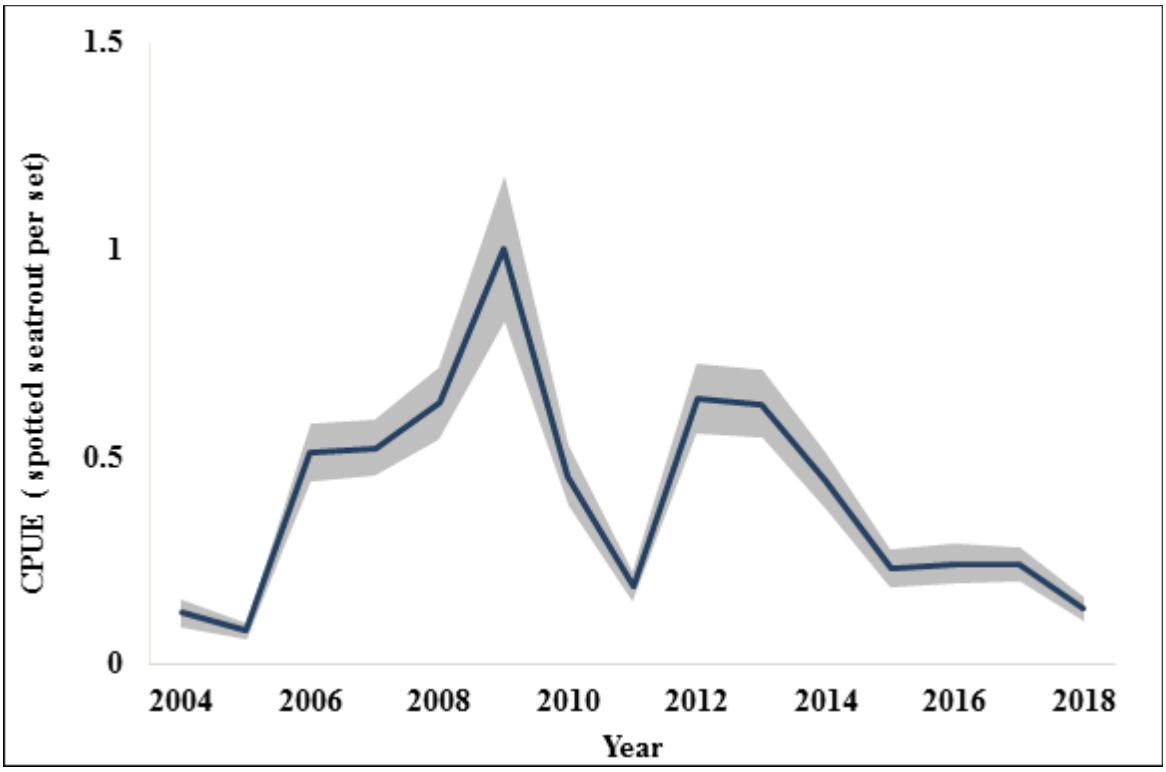

Figure 10. Catch per unit effort (CPUE; fish per station set) of spotted seatrout collected from Program 915 in Pungo, Pamlico, and Neuse rivers, 2004 - 2018. Error bars represent ± 1 standard error.

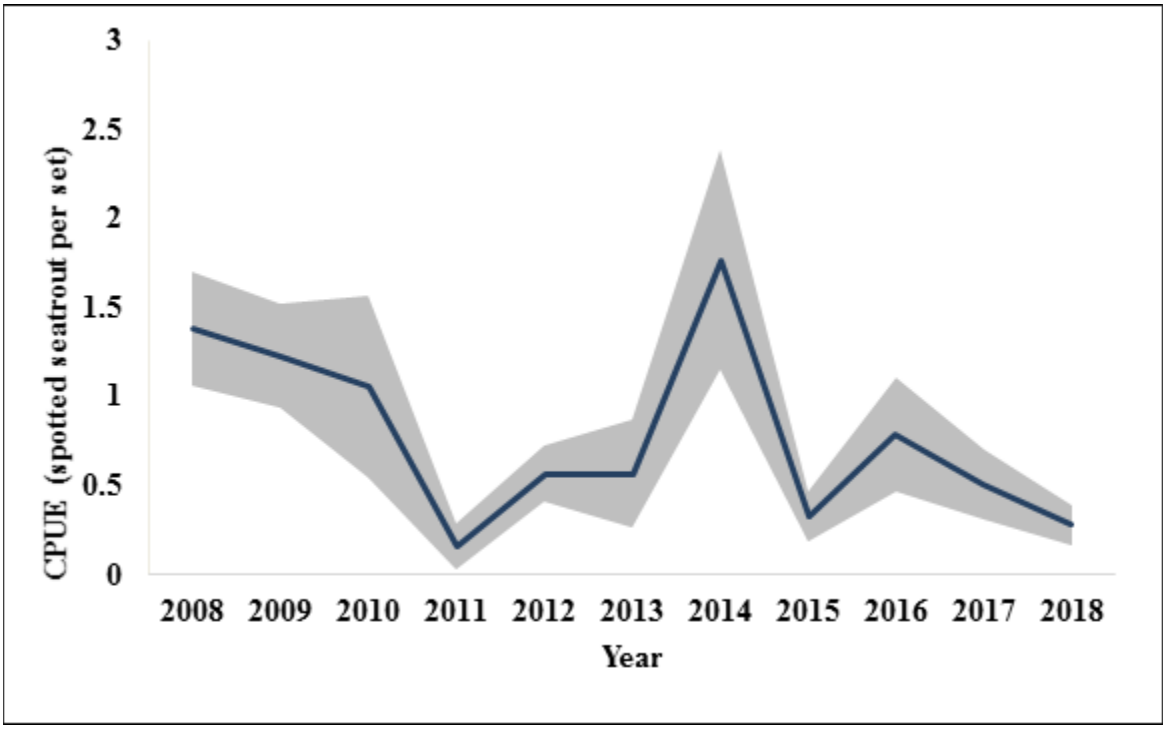

Figure 11. Catch per unit effort (CPUE; fish per station set) of spotted seatrout collected from Program 915 in New and Cape Fear rivers, 2008 - 2018. Error bars represent ± 1 standard error.

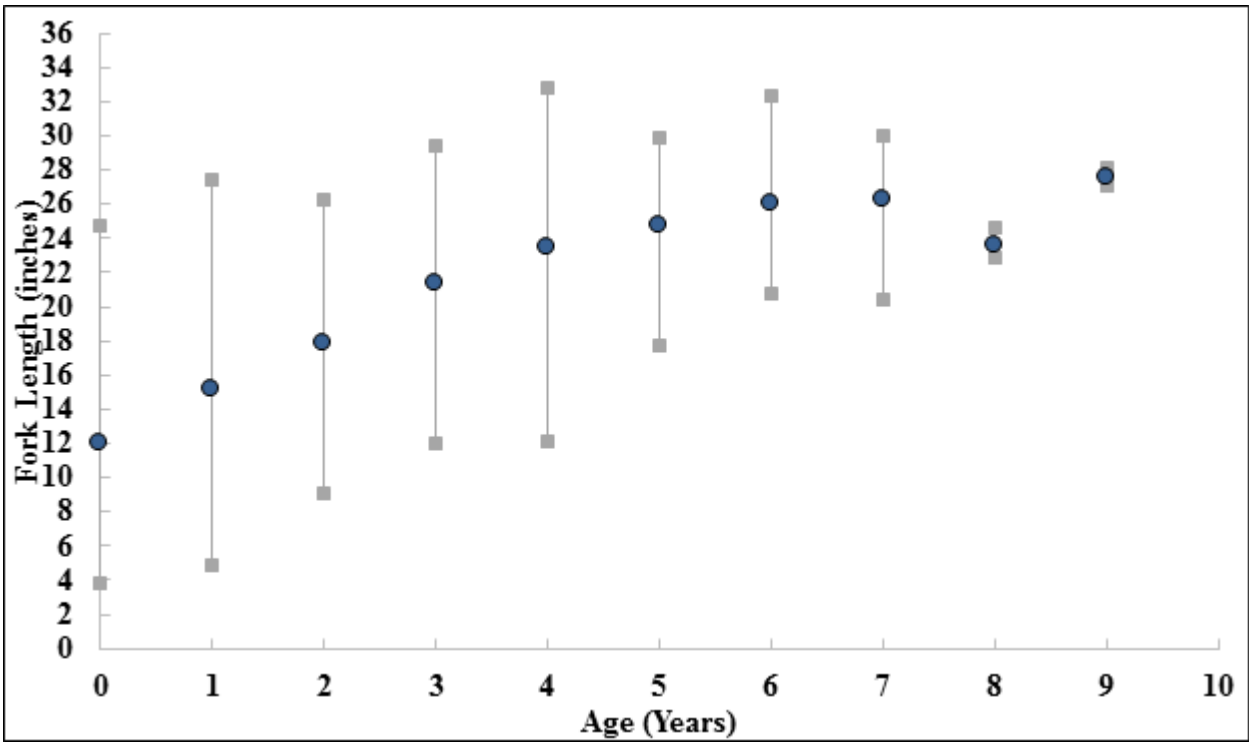

Figure 12. Spotted seatrout length at age based on all age samples collected from 1991 to 2018. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed size for each age.