November 2020 Revision

to

Amendment 1

to the

North Carolina Estuarine Striped Bass Fishery Management Plan

Prepared By The

North Carolina Department of Environmental Quality
Division of Marine Fisheries
3441 Arendell Street
P.O. Box 769
Morehead City, NC 28557

and

North Carolina Wildlife Resources Commission
Inland Fisheries Division
1751 Varsity Drive
Raleigh, NC 27606

November 2020 Revision

to

Amendment 1

to the

North Carolina Estuarine Striped Bass

Fishery Management Plan

Effective Jan. 1, 2021

I. ISSUE

Requirement to reduce the striped bass total allowable landings (TAL) in the Albemarle Sound and Roanoke River Management Areas to remain in compliance with Amendment 1 to the North Carolina Estuarine Striped Bass Fishery Management Plan (FMP) and the Atlantic States Marine Fisheries Commission (ASMFC) Addendum IV to Amendment 6 to the Interstate FMP for Atlantic Striped Bass. The reduction in TAL is required based on results of the 2020 Albemarle-Roanoke (A-R) striped bass benchmark stock assessment that indicates the stock is overfished and overfishing is occurring in the terminal year (2017) of the assessment (Lee et al. 2020).

II. ORIGINATION

North Carolina Division of Marine Fisheries (NCDMF) staff and North Carolina Wildlife Resources Commission (NCWRC), Inland Fisheries Division staff.

III. BACKGROUND

Atlantic striped bass from Maine through North Carolina are managed under the jurisdiction of the ASMFC since Congress passed the Atlantic Striped Bass Conservation Act in 1984. The A-R striped bass stock is migratory at older ages but contributes minimally to the overall Atlantic striped bass stock complex compared to the Chesapeake Bay, Delaware, and Hudson stocks (ASMFC 2003; Berggren and Lieberman 1978; Callihan et al. 2014). Due to the non-migratory behavior of striped bass stocks south of the Albemarle Sound Management Area (ASMA), the striped bass stocks within the Central Southern Management Area (CSMA) are not included in ASMFC's Interstate FMP for Atlantic striped bass.

The ASMFC Atlantic Striped Bass Management Board approved Addendum IV to Amendment 6 to the Interstate FMP for Atlantic Striped Bass in October 2014 (ASMFC 2014). Through this addendum the ASMFC Atlantic Striped Bass Technical Committee determined it was most biologically appropriate to use NCDMF's A-R stock assessment to determine appropriate fishing mortality (F) and spawning stock biomass (SSB) biological reference points (BRPs) specifically for the A-R stock rather than using the same BRPs as the Chesapeake Bay.

Future A-R benchmark stock assessments and updates will recalculate BRPs accordingly based on additional years of harvest, discard data, and indices of relative abundance added to the model. The ASMFC Atlantic Striped Bass Technical Committee and Management Board will continue to review each NCDMF A-R striped bass benchmark stock assessment for approval for management use as a point of compliance.

The 2020 A-R striped bass benchmark stock assessment was conducted to inform development of Amendment 2 to the North Carolina Estuarine Striped Bass FMP, which is currently underway. The A-R stock assessment is periodically undertaken for management purposes to reassess the stock status relative to the BRPs. This is generally undertaken when the ASMFC Striped Bass Technical Committee assesses the coast-wide stock or when the NCDMF initiates an amendment to the North Carolina Estuarine Striped Bass FMP.

The 2020 A-R striped bass benchmark stock assessment was completed in August 2020 (Lee et al. 2020). The assessment went through a multi-day peer review process in which NCDMF staff presented the assessment to three external experts on striped bass and marine fisheries modeling techniques. The external peer review is the standard process to review marine fisheries stock assessments throughout the world. The 2020 benchmark assessment was approved for management use by the peer reviewers for at least the next five years. The NCDMF also approved it for management use.

Results from the 2020 benchmark assessment indicate the A-R striped bass stock is overfished and overfishing is occurring relative to the updated BRPs, which are based on spawning potential ratio (SPR) thresholds of $F_{35\%SPR}$ and $SSB_{35\%SPR}$ and targets of $F_{45\%SPR}$ and $SSB_{45\%SPR}$ (Table 1) (Lee et al. 2020). The *F* estimate in the terminal year (2017) of the assessment was 0.27, above the $F_{35\%SPR\ Threshold}$ of 0.18, meaning overfishing is occurring. Female SSB was estimated at 78,576 lb, below the $SSB_{35\%SPR\ Threshold}$ of 267,390 lb, indicating the stock is overfished (Table 1). Adaptive management measures in Amendment 1 to the North Carolina Estuarine Striped Bass FMP (NCDMF 2013) are a mechanism to maintain a sustainable harvest. Sustainable harvest is defined in North Carolina General Statute 113-129(14a) as "the amount of fish that can be taken from a fishery on a continuing basis without reducing the stock biomass of the fishery or causing the fishery to become overfished." With overfishing occurring in the terminal year of the assessment (2017), adaptive management measures contained in Amendment 1 are required to be implemented to reduce the TAL to a level that is projected to lower *F* to the $F_{45\%SPR\ Target}$, a 47.6 % reduction in *F* (Table 1) (NCDMF 2013). This action maintains compliance with Amendment 1 to the North Carolina Estuarine Striped Bass FMP and ASMFC's Addendum IV to Amendment 6 to the Interstate FMP for Atlantic Striped Bass.

Until adoption of Amendment 2 or another revision, the A-R striped bass stock is managed through Amendment 1 to the North Carolina Estuarine Striped Bass FMP and the November 2014 Revision to Amendment 1. The following management strategies are in place for the ASMA and RRMA by these documents:

Strategies currently in place under the November 2014 Revision to Amendment 1 and Amendment 1 to the North Carolina Estuarine Striped Bass FMP:

A-R stock has been managed with a TAL since 1991

- Maintain current TAL of 275,000 lb
- The TAL will continue to be split evenly between commercial and recreational sectors
- ASMA commercial TAL = 137,500 lb
- ASMA recreational TAL = 68,750 lb
- RRMA recreational TAL = 68,750 lb

ASMA Commercial Harvest (TAL = 137,500 lb)

- 18-inch total length (TL) minimum size limit (ASMFC compliance requirement)
- Continue to operate as a bycatch fishery
- Spring season, anytime between Jan. 1–April 30
- Fall season, anytime between Oct. 1–Dec. 31
- Daily trip limits for striped bass
- Maintain gill-net mesh size and yardage restrictions
- Maintain seasonal and area closures
- Maintain attendance requirements for small mesh nets (mid-May through late November)

ASMA Recreational Harvest (TAL = 68,750 lb)

- 18-inch TL minimum size limit
- Daily creel limit (can be adjusted as necessary to keep harvest below the TAL)
- Open 7 days a week all season (can be adjusted as necessary to keep harvest below the TAL)
- Spring season, anytime between Jan. 1–April 30
- Fall season, anytime between Oct. 1–Dec. 31

RRMA Recreational Harvest (TAL = 68,750 lb)

- 18-inch TL minimum size limit
- Protective slot (no harvest): 22–27 inches TL
- 2 fish daily creel, only one of which can be greater than 27 inches TL
- Harvest season in entire river opens on March 1 and closes on April 30 by rule since 2008
- Single barbless hook regulation from April 1–June 30 in Inland waters above the US 258 Bridge

Management of TALs for ASMA and RRMA

- BRPs (*F* and SSB) for the A-R stock will be determined through North Carolina A-R striped bass benchmark stock assessments, which must be approved by the ASMFC Atlantic Striped Bass Management Board
- Short-term Overages: if the harvest point estimate exceeds the total TAL by 10% in a single year, overage is deducted from the next year and restrictive measures implemented in the responsible fishery(ies)
- Long-term Overages: five-year running average of harvest point estimate exceeds the five-year running average of the total TAL harvest by 2%, the responsible fishery exceeding the harvest limit will be reduced by the amount of the overage for the next five years.
  Should the target *F* be exceeded, then restrictive measures will be imposed to reduce *F* to the target level

IV. AUTHORITY

North Carolina's existing fisheries management system is powerful and flexible, with rule-making authority granted to the North Carolina Marine Fisheries Commission (NCMFC) and the NCWRC within their respective jurisdictions. Further, the NCMFC has delegated specified proclamation authority to the NCDMF Director in its rules. The NCWRC has authority to issue limited proclamations and may delegate this authority to the NCWRC Executive Director.

Proclamation Authority for the ASMA, RRMA, and CSMA striped bass stocks:

The NCMFC can regulate fishing times, areas, fishing gear, seasons, size limits, and quantities of fish harvested and possessed in joint and coastal waters (G.S. 113-182 and 143B-289.52). The NCMFC can delegate the authority to implement its regulations for fisheries as set forth in NCMFC rules "which may be affected by variable conditions" to the Director of the NCDMF who may then issue public notices called "proclamations" (G.S. 113-221.1 and 143B-289.52). The NCWRC has authority to license and regulate all fishing activities in inland waters, and the NCWRC also has proclamation authority, which may be delegated to the Executive Director, to suspend or extend seasons for taking of striped bass in inland and joint waters of coastal rivers and their tributaries (G.S. 113-292). Thus, all necessary authority needed for management of the striped bass fisheries is available through the existing state fishery management process.

It should also be noted that under the provisions of the North Carolina Estuarine Striped Bass FMP Amendment 1 the NCDMF Director maintains proclamation authority to establish seasons, authorize or restrict fishing methods and gear, limit quantities taken or possessed, and restrict fishing areas as deemed necessary to maintain a sustainable harvest. The NCWRC Executive Director maintains proclamation authority to establish seasons.

N.C. General Statutes

G.S. 113-134.	RULES
G.S. 113-182.	REGULATION OF FISHING AND FISHERIES
G.S. 113-182.1.	FISHERY MANAGEMENT PLANS
G.S. 113-221.1.	PROCLAMATIONS; EMERGENCY REVIEW
G.S. 113-292.	AUTHORITY OF THE WILDLIFE RESOURCES COMMISSION IN REGULATION OF INLAND FISHING AND THE INTRODUCTION OF EXOTIC SPECIES.
G.S. 143B-289.52.	MARINE FISHERIES COMMISSION—POWERS AND DUTIES

N.C. Marine Fisheries Commission Rules 2020 and N.C. Wildlife Resources Commission Rules 2020 (15A NCAC)

15A NCAC 03M .0201	GENERAL
15A NCAC 03M .0202	SEASON, SIZE AND HARVEST LIMIT: INTERNAL COASTAL WATERS
15A NCAC 03M .0512	COMPLIANCE WITH FISHERY MANAGEMENT PLANS
15A NCAC 03Q .0107	SPECIAL REGULATIONS: JOINT WATERS

15A NCAC 03Q .0108	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT WATERS
15A NCAC 03Q .0109	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 03R .0201	STRIPED BASS MANAGEMENT AREAS
15A NCAC 10C .0110	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT WATERS
15A NCAC 10C .0111	IMPLEMENTATION OF ESTUARINE STRIPED BASS MANAGEMENT PLANS: RECREATIONAL FISHING
15A NCAC 10C .0301	INLAND GAME FISHES DESIGNATED
15A NCAC 10C .0314	STRIPED BASS

V. DISCUSSION

Results from the 2020 A-R striped bass benchmark stock assessment indicate the stock is overfished and overfishing is occurring (Lee et. al 2020). The estimate of F in the terminal year of the assessment (2017) was 0.27, above the $F_{35\%SPR\ Threshold}$ of 0.18 (Figure 1) and the estimate of SSB was 78,576 lb, below the $SSB_{35\%SPR\ Threshold}$ of 267,390 lb (Figure 2). Estimates of F have been above the $F_{35\%SPR\ Threshold}$ in 24 out of the 27 years of the time period of the assessment (Figure 1). Female SSB has declined steadily from a high of 587,516 lb in 2000 to a low of 45,418 lb in 2013. Female SSB increased through 2015 to 167,053 lb and has declined since (Figure 2). Results of the assessment also show a period of strong recruitment (as measured by the number of age-0 fish coming into the stock each year) from 1993 to 2000, then a period of much lower recruitment from 2001 to 2017, which has contributed to the decline in SSB since 2003. Average recruitment from 1993-2000 was 1,127,646 age-0 fish per year while average recruitment for years 2001-2017 was 428,796 age-0 fish per year (Figure 2).

Several years of poor recruitment occurred from 2001–2004 at a time when SSB was at high levels, indicating factors other than abundance of SSB may be contributing to poor spawning success in some years. Appropriate river flow during the spawning period has long been recognized as an important factor in spawning success for A-R striped bass (Hassler et. al 1981; Rulifson and Manooch 1990). Low to moderate flows have been identified as favorable to strong year-class production while high flows (10,000 cubic feet per second or greater) are unfavorable to the formation of strong year classes. The peer reviewers of the 2020 benchmark assessment recognized the importance of river flow on recruitment and noted declining recruitment in the time series does not appear to result solely from reduced abundance due to harvest (Lee et. al 2020).

Concerning trends are also evident in all the juvenile and adult fishery-independent surveys of relative abundance conducted by the NCDMF and NCWRC to monitor the A-R striped bass stock. Both NCDMF gill-net surveys and the NCWRC electrofishing survey show declining trends, especially in the number of older fish, in recent years below levels of abundance observed when the stock was severely depressed in the early 1990s. Harvest from all sectors since about 2005 have shown similar declining trends as total abundance estimates from the stock assessment, which indicate a declining trend in total abundance since the early 2000s (Figures 1 and 3).

Since the TAL increase to 550,000 lb in 2003 (Table 2, Figure 3), total combined landings from all fisheries in the ASMA and RRMA have not exceeded 460,853 lb and have averaged 235,278 lb per year with a low of 108,432 lb in 2013 (Figure 3). For the years 2005–2013, the commercial sector did not reach their TAL. Estimates of total abundance from the stock assessment (Figure 1), suggest the reason for the decline in harvest was likely a decline in overall stock abundance due to poor recruitment (Figure 2). Even since the 2014 reduction in the TAL to 275,000 lb the commercial and recreational sectors in the ASMA did not reach the TAL from 2014–2017. Harvest in all sectors has increased since 2017, with the commercial sector reaching the TAL in 2019 causing the NCDMF to close the fall commercial harvest season before Dec. 31 for the first time since 2010. This increase in harvest is likely due to the above-average year classes produced in 2014 and 2015 (Figure 2). The fisheries are primarily composed of fish age 3–6 so the indication of good recruitment in the fishery as seen in landings is offset by 2–4 years as the new recruits grow and begin to enter the fisheries.

Since the early 2000s the recreational sectors have only approached their TAL in 2015 and 2016 (Figure 3). Harvest in the recreational sectors consists primarily of fish age 3–5. Even with an increase in the daily creel limit in the ASMA from two fish per person per day to three fish per person per day in the fall of 2006 through the fall of 2015, harvest was still below the TAL in all years except 2015. The daily creel limit was reduced back to two fish per person per day in the spring of 2016.

Recreational harvest in the RRMA is more controlled by the daily creel limit than in the ASMA. The Roanoke River is a smaller body of water and striped bass congregate in large numbers throughout the river on their way to and while on the spawning grounds. Because the fish are moving through the system for spawning activity in a more compressed area, recreational anglers tend to release more legal sized fish than anglers in the ASMA. An increase in the daily creel limit in the RRMA to more than two fish per person per day would likely result in the TAL being exceeded in most years in the RRMA.

Reductions in the TAL to lower *F* to the target reference point value

Adaptive management in Amendment 1 to the North Carolina Estuarine Striped Bass FMP states "should the target *F* be exceeded, then restrictive measures will be imposed to reduce *F* to the target level". Amendment 1 does not specify a time frame to bring *F* back to the target. Total removals in 2017 included 119,244 lb of harvest and 23,795 lb of dead discards. Assuming the same level of discards, landings will need to be reduced by 57% compared to 2017 landings to lower *F* to the target of $F_{45\%SPR}$ of 0.13. This 57% reduction from 2017 landings equates to a new overall TAL of 51,216 lb. for the ASMA and RRMA. As with all fisheries, the A-R stock recovery under the new TAL is subject to other factors. Future spawning success and subsequent recruitment levels are the main area of uncertainty. If the stock experiences even a few good years of recruitment, stock abundance can increase quickly under low levels of harvest. Given the new TAL reflects the target *F* reference point and not the threshold *F*, it does provide some amount of buffer for changing circumstances and provides a constant level of constrained harvest while Amendment 2 is developed to address long-term management needs.

There are several management measures available through proclamations or rules that allow the NCDMF and NCWRC to keep harvest levels below the proposed TAL in the ASMA and RRMA. For the commercial fishery these include daily reporting of landings by striped bass dealers for daily monitoring of harvest, mandatory tagging of all striped bass sold, adjusting the daily possession limit, adjusting the opening and closing of the season, area closures, and gill-net yardage restrictions. For the ASMA and RRMA recreational fisheries, measures include a creel survey that allows for weekly estimates of harvest, adjusting the daily possession limit, adjusting the allowable harvest days during the open season, adjusting the opening and closing of the season, and area closures.

Starting in January 2021 the above-mentioned management measures will be used to keep harvest below the newly reduced TAL.

The NCDMF and NCWRC members of the FMP Plan Development Team met several times to discuss the issues outlined in this document, and based on those discussions, agreed to set the new TAL for the A-R striped bass stock at 51,216 lb. The following section serves to revise Amendment 1 to the North Carolina Estuarine Striped Bass FMP to reflect the new TAL that will lower *F* to the target level.

VI. TOTAL ALLOWABLE LANDINGS MANAGEMENT REVISION TO AMENDMENT 1 TO THE NORTH CAROLINA ESTUARINE STRIPED BASS FMP

Amendment 1 to the North Carolina Estuarine Striped Bass FMP, in conjunction with the North Carolina FMP for Interjurisdictional Fisheries, provides the framework for the changes in management proposed herein. This document will be incorporated as the November 2020 Revision to Amendment 1 to the North Carolina Estuarine Striped Bass FMP, and replaces the November 2014 Revision to Amendment 1 to the North Carolina Estuarine Striped Bass FMP. It will serve to document the rationale agreed to by the NCDMF and NCWRC for the following management strategy to begin Jan. 1, 2021 and continue until the adoption of Amendment 2.

- Biological Reference Points (*F* and SSB) for the A-R stock will be determined through North Carolina A-R striped bass benchmark stock assessments and updates
- Benchmark assessments will be reviewed by the ASMFC Striped Bass Management Board for approval
- Set the TAL for the A-R stock at 51,216 lb, to be split evenly between the commercial and recreational sectors as follows:
    - ASMA commercial TAL = 25,608 lb
    - ASMA recreational TAL = 12,804 lb
    - RRMA recreational TAL = 12,804 lb

All other management strategies contained in Amendment 1 will remain in force until another North Carolina Estuarine Striped Bass FMP revision is implemented or amendment is adopted.

Table 1. Biological reference points for the Albemarle-Roanoke striped bass stock and the point estimate from the terminal year (2017) of the assessment. Source: Lee et al. 2020

Biological Reference Points		Terminal Year (2017) Estimate
$F_{45\%SPR\ Target}$	0.13	$F = 0.27$
$F_{35\%SPR\ Threshold}$	0.18	
$SSB_{45\%SPR\ Target}$	350,371 lb	SSB = 78,576 lb
$SSB_{35\%SPR\ Threshold}$	267,390 lb	

Table 2. Total allowable landings (lb) for the Albemarle-Roanoke striped bass stock, 1991–2019.

Years	Total Allowable Landings	ASMA Commercial	ASMA Recreational	RRMA Recreational
1991–1997	156,800	98,000	29,400	29,400
1998	250,800	125,400	62,700	62,700
1999	275,880	137,940	68,970	68,970
2000–2002	450,000	225,000	112,500	112,500
2003–2014	550,000	275,000	137,500	137,500
2015–2019	275,000	137,500	68,750	68,750

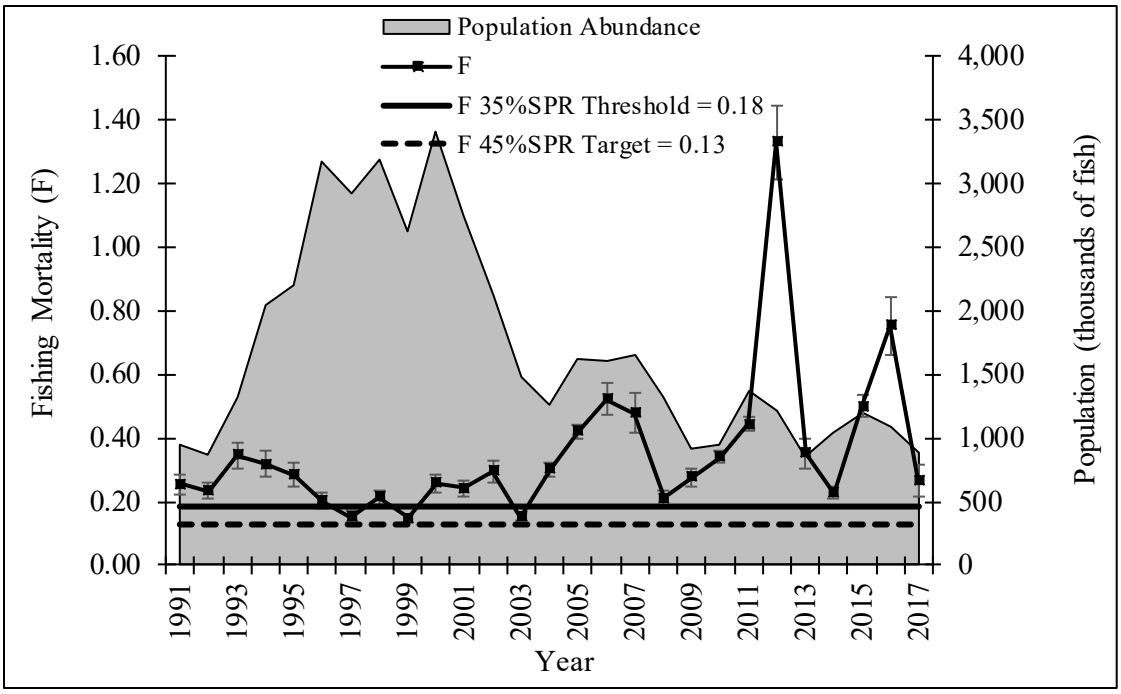

Figure 1. Estimates of fishing mortality (*F*) and population abundance for the Albemarle-Roanoke striped bass stock, 1991–2017. Source: Lee et al. 2020

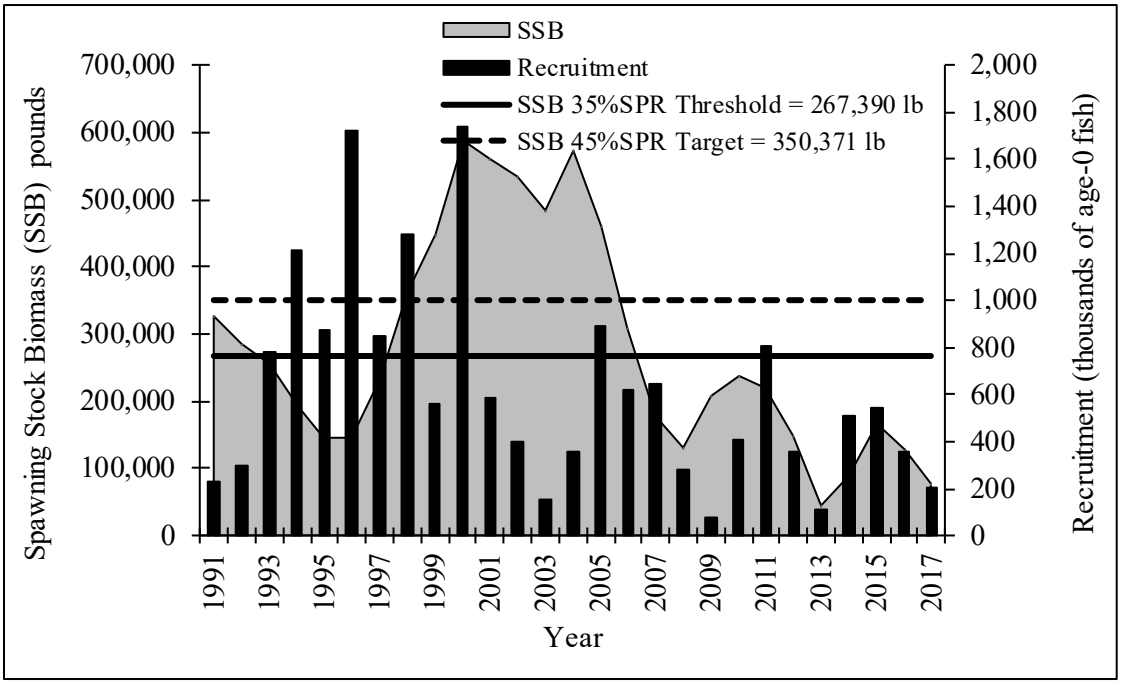

Figure 2. Estimates of spawning stock biomass (SSB) and recruitment of age-0 fish coming into the population each year for the Albemarle-Roanoke striped bass stock, 1991–2017. Source: Lee et al. 2020

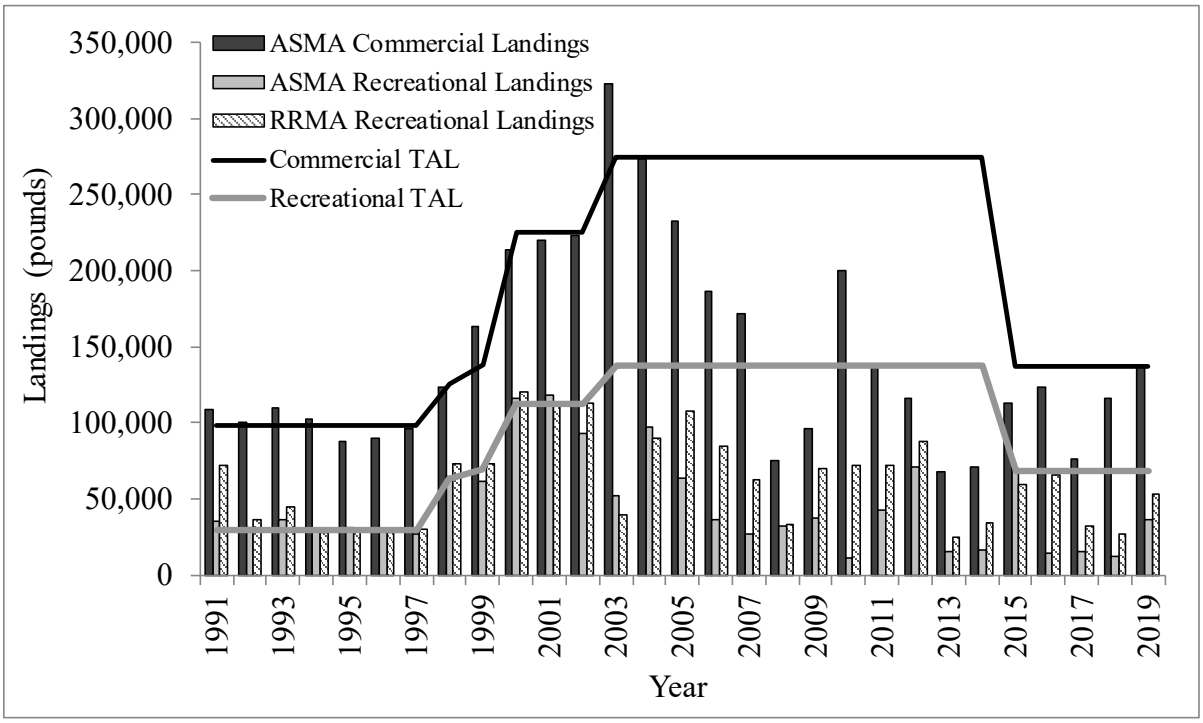

Figure 3. Striped bass landings from the Albemarle Sound Management Area commercial and recreational sectors and Roanoke River Management Area recreational sector and the total allowable landings, 1991–2019.

VII. REFERENCES CITED

Atlantic States Marine Fisheries Commission (ASMFC). 2003. Amendment # 6 to the interstate fishery management plan for Atlantic striped bass. ASMFC, Fisheries Management Report No. 41, Washington, DC. 63 p.

ASMFC. 2014. Addendum IV to Amendment # 6 to the interstate fishery management plan for Atlantic striped bass. ASMFC, Washington, DC. 20 p.

Berggren, T.J., and J.T. Lieberman. 1978. Relative contribution of Hudson, Chesapeake and Roanoke striped bass, *Morone saxatilis*, stocks to the Atlantic coast fishery. Fishery Bulletin 76(2): 335–345.

Callihan, J.L., C.H, Godwin, and J.A. Buckel. 2014. Effects of demography on spatial distribution: Movement patterns of Albemarle-Roanoke striped bass *Morone saxatilis* in relation to their stock recovery. Fishery Bulletin 112:131–143.

NCDMF. 2013. Amendment 1 to the North Carolina estuarine striped bass fishery management plan. North Carolina Department of Environmental and Natural Resources, Division of Marine Fisheries. Morehead City, NC. 826 p.

Lee, L.M., T.D. Teears, Y. Li, S. Darsee, and C. Godwin (editors). 2020. Assessment of the Albemarle Sound-Roanoke River striped bass (*Morone saxatilis*) in North Carolina, 1991–2017. North Carolina Division of Marine Fisheries, NCDMF SAP-SAR-2020-01, Morehead City, North Carolina. 171 p.