

2024 Revision

to the

**North Carolina Estuarine Striped Bass
Fishery Management Plan
Amendment 2**

Prepared By The

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I. ISSUE

The striped bass total allowable landings (TAL) in the Albemarle Sound Management Area (ASMA) and Roanoke River Management Area (RRMA) must be reduced to meet compliance with the North Carolina Estuarine Striped Bass Fishery Management Plan (FMP) Amendment 2 and the Atlantic States Marine Fisheries Commission (ASMFC) Amendment 7 to the Interstate FMP for Atlantic Striped Bass. The required TAL reduction is based on results of the 2022 update to the Albemarle-Roanoke (A-R) striped bass benchmark stock assessment that indicates overfishing is still occurring in the terminal year (2021) of the assessment and the stock continues to be overfished. (Lee et al. 2022). An additional concern is the seven consecutive years (2017–2023) of very poor A-R stock spawning success. The North Carolina Division of Marine Fisheries (DMF) and an external peer review panel of experts concluded the stock assessment update is suitable for management use and represents the current stock status. The peer review panel recognized factors in addition to fishing mortality are likely contributing to the chronic poor recruitment observed since the early 2000s and the current low abundance of the stock. Contributing factors may include river flow, water quality, water temperatures, habitat conditions, predation (i.e. blue catfish), and competition for food. This Revision applies only to management of the A-R striped bass stock in the Albemarle Sound and Roanoke River Management Areas.

II. ORIGINATION

North Carolina Division of Marine Fisheries, Wildlife Resources Commission (WRC), Inland Fisheries Division, and results of the 2022 update to the 2020 A-R striped bass benchmark stock assessment.

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 migratory stock complex compared to the Chesapeake Bay, Delaware River, and Hudson River stocks (ASMFC 2022; Berggren and Lieberman 1978; Callihan et al. 2014). Due to the non-migratory behavior of striped bass stocks south of the ASMA, the striped bass stocks within the Central Southern Management Area (CSMA) are not included in the management program for ASMFC's Interstate FMP for Atlantic Striped Bass.

The ASMFC Atlantic Striped Bass Management Board approved Amendment 7 to the Interstate FMP for Atlantic Striped Bass in May 2022. Amendment 7 maintains the provision to use DMF A-R stock assessments to determine fishing mortality (F) and spawning stock biomass (SSB) biological reference points (BRPs) specifically for the A-R stock. The ASMFC Striped Bass

Technical Committee (TC) continues to monitor the contribution of the A-R stock to the coastal migratory population and make recommendations to the Board regarding future management.

In the fall of 2022, the 2020 A-R striped bass benchmark stock assessment (last year of data was 2017) was updated with data through 2021. This update to the 2020 stock assessment was completed to determine if management action taken through the November 2020 Revision to the North Carolina Striped Bass FMP Amendment 1 had the intended effect of ending overfishing and achieving F equal to or below the F_{Target} (NCDMF 2020). Results of the stock assessment update indicate that the F_{Target} was not achieved; the stock remained in an overfished condition and overfishing was still occurring (Table 1).

Table 1. Biological reference points for the Albemarle Sound-Roanoke River striped bass stock and the point estimate from the terminal year (2021) of the assessment. Source: Lee et al. 2022.

Metric	Target	Threshold	2021 Value	Status
Fishing Mortality	0.14	0.20	0.77	Overfishing
Female Spawning Stock Biomass	163.62 metric tons (mt) (360,720 lb)	124.87 mt (275,286 lb)	16.13 mt (35,566 lb)	Overfished

Under Amendment 2, adaptive management requires a reduction in the TAL to a level that is projected to lower F to the F_{Target} (NCDMF 2022). A reduction in total removals of 75% relative to total removals in 2021 is needed to reduce F to the F_{Target} . The new TAL of 8,349 pounds (Table 2) was calculated after accounting for anticipated recreational and commercial dead discards (estimate was 9,833 pounds of dead discards for 2021). This action of reducing the TAL maintains compliance with Amendment 2 to the North Carolina Estuarine Striped Bass FMP and ASMFC's Amendment 7 to the Interstate FMP for Atlantic Striped Bass.

Table 2. Total allowable landings (lb) for the Albemarle Sound-Roanoke River striped bass stock, 1991–2024.

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
2015–2020	275,000	137,500	68,750	68,750
2021–2023	51,216	25,608	12,804	12,804
2024–	8,349	4,175	2,087	2,087

Strategies for the Albemarle Sound-Roanoke River stock currently in place under Amendment 2 to the North Carolina Estuarine Striped Bass FMP:

Sustainable harvest: Albemarle Sound-Roanoke River Stock

1. Manage for sustainable harvest through harvest restrictions
 - A. Continue to use stock assessments and stock assessment projections to determine the TAL that achieves a sustainable harvest for the A-R stock.

2. Management of striped bass harvest in the commercial fishery as a bycatch fishery
 - A. Status quo: continue managing the ASMA striped bass fishery as a bycatch fishery.
3. Accountability Measures to Address TAL Overages
 - D. If the landings in any one of the management areas' three fisheries (RRMA recreational, ASMA recreational, and ASMA commercial) exceeds their allocated TAL in a calendar year, any landings in excess of their allocated TAL will be deducted from that fisheries' allocated TAL the next calendar year.
If paybacks to a fishery exceed the next year's allocated TAL for that fishery, paybacks will be required in subsequent years to meet the full reduction amount; in situations where a fisheries allocated TAL has been reduced from a previous year's overage, if the reduced TAL is exceeded, any required paybacks the subsequent year are reduced from the fisheries' original allocated TAL, not from the reduced TAL.
4. Size limits to expand the age structure of the stock
 - C. In the ASMA, implement a harvest slot of a minimum size of 18-inches TL to not greater than 25-inches TL in the commercial and recreational sectors.
 - E. In the RRMA, maintain current harvest slot limit of a minimum size of 18-inches TL to not greater than 22-inches TL with no harvest allowed on fish greater than 22 inches TL.
5. Gear modifications and area closures to reduce striped bass discard mortality.
 - A. Status quo-continue to allow commercial harvest of striped bass with gill nets in joint and coastal waters of the ASMA and continue recreational harvest and catch-and-release fishing in the ASMA and RRMA, including striped bass spawning grounds in the Roanoke River. The requirement that from April 1 through June 30, only a single barbless hook or lure with single barbless hook (or hook with barb bent down) may be used in the inland waters of the Roanoke River upstream of U.S. Highway 258 Bridge will remain in effect.
 - E. Implement a requirement to use non-offset barbless circle hooks when fishing with live or natural bait in the inland waters of the Roanoke River (upstream of Hwy 258 bridge) from May 1* through June 30.
6. Adaptive management
 - Use peer reviewed stock assessments and updates to recalculate the BRPs and/or TAL. The current TAL of 51,216 lb remains in place until a new TAL is determined. Stock assessments will be updated at least once between benchmarks. Increases or decreases in the TAL will be implemented through Adaptive Management. A harvest moratorium could be necessary if stock assessment results calculate a TAL that is too low to effectively manage, and/or the stock continues to experience spawning failures.
 - Use estimates of F from stock assessments to compare to the F BRP and if F exceeds the F_{Target} reduce the TAL to achieve the F_{Target} through Adaptive Management.

**** The management strategy contained in Amendment 2 and approved by the MFC in November of 2022 stated May 1 through June 30 (5. E.). However, the WRC approved a more restrictive time frame to coincide with the existing barbless hook requirement in 5. A., which is April 1 through June 30.***

IV. AUTHORITY

The existing North Carolina fisheries management system grants rule-making authority over estuarine striped bass to the North Carolina Marine Fisheries Commission (MFC) and the North Carolina Wildlife Resources Commission within their respective jurisdictions. Further, the MFC, in rule, has delegated specified proclamation authority to the DMF Director. The WRC has

authority to issue limited proclamations for striped bass harvest seasons and has delegated this authority to the WRC Executive Director.

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

15A NCAC 03M .0201	STRIPED BASS REQUIREMENTS: GENERAL
15A NCAC 03M .0202	STRIPED BASS SEASON, SIZE AND HARVEST LIMIT: INTERNAL WATERS
15A NCAC 03M .0512	COMPLIANCE WITH FISHERY MANAGEMENT PLANS
15A NCAC 03Q .0107	SPECIAL REGULATIONS: JOINT FISHING WATERS
15A NCAC 03Q .0108	MANAGEMENT RESPONSIBILITY FOR ESTUARINE STRIPED BASS IN JOINT FISHING 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 FISHING 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 2022 update to the A-R striped bass stock assessment indicate the stock continues to be overfished with overfishing occurring (Lee et. al 2022). The estimate of F in the terminal year of the assessment (2021) was 0.77, above the $F_{Threshold}$ of 0.20 and the F_{Target} of 0.14 (Table 1; Figure 1). The estimate of SSB was 35,553 lb, below the $SSB_{Threshold}$ of 275,286 lb (Table 1; Figure 2). Female SSB has declined steadily from a high of 762,977 lb in 2000 to a low of 35,566 lb in 2021. Results of the assessment also show a period of strong recruitment (the number of age-0 fish coming into the stock each year) from 1993 to 2000, then a period of much lower recruitment from 2002 to present (Figure 2). This lower recruitment has contributed to the decline in SSB since 2004. Average recruitment during 1993–2000 was 1,085,707 age-0 fish per year while average recruitment for 2001–2021 was 333,735 age-0 fish per year. Average recruitment during the last 10 years of the stock assessment update (2012–2021) was 214,728 age-0 fish per year.

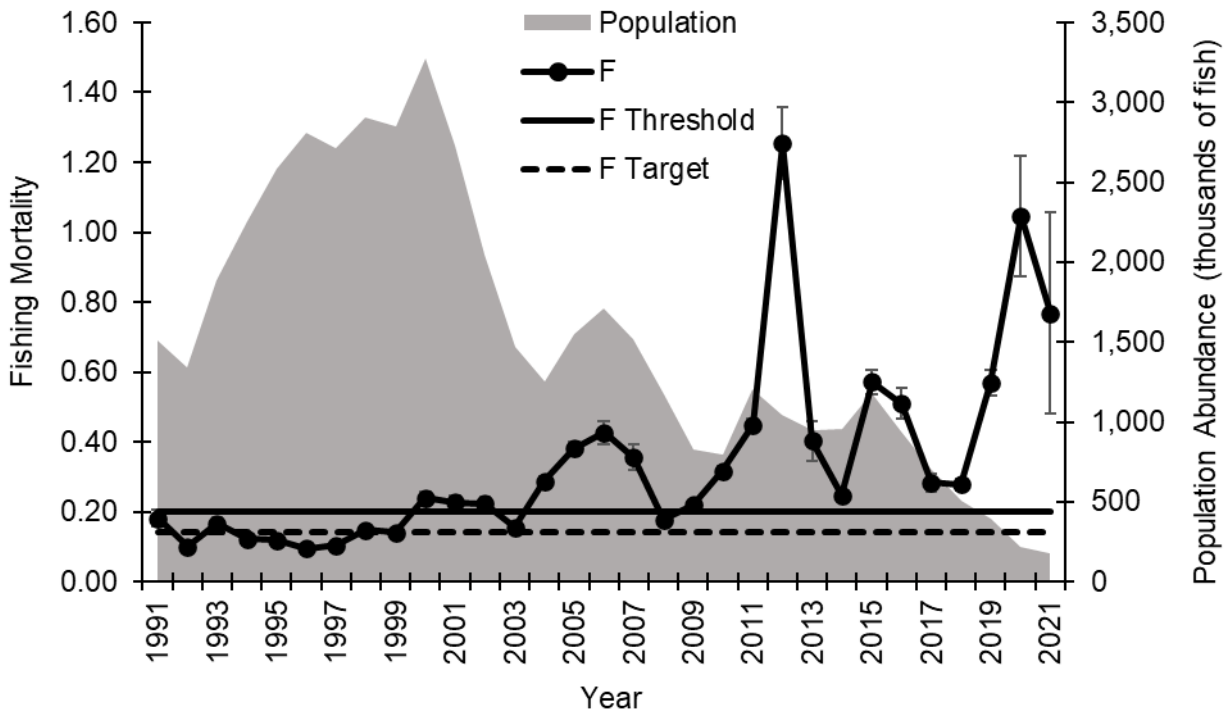


Figure 1. Estimates of fishing mortality (F) and total population abundance for the Albemarle Sound-Roanoke River striped bass stock, 1991–2021. Source: Lee et al. 2022

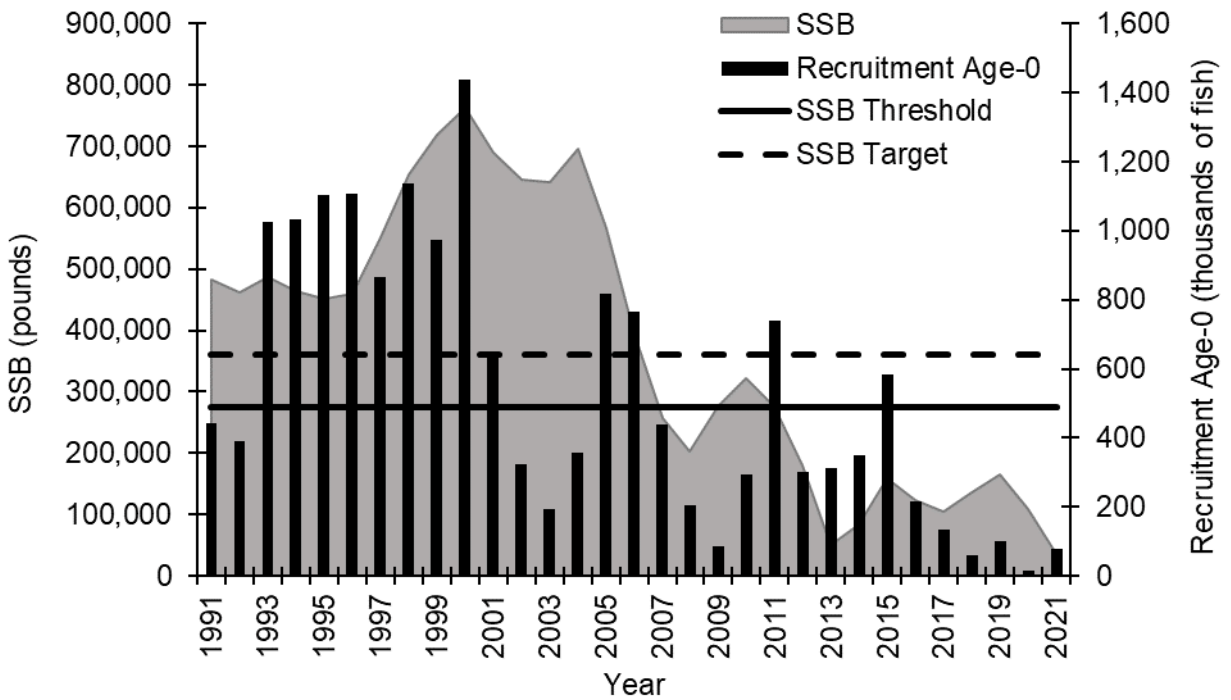


Figure 2. Estimates of spawning stock biomass (SSB) and recruitment of age-0 fish coming into the population each year for the Albemarle Sound-Roanoke River striped bass stock, 1991–2021. Source: Lee et al. 2022.

While fishing mortality is a primary contributing factor in both the decline in SSB and recruitment, environmental factors contribute to poor spawning success and can further exacerbate SSB decline. The environmental impact on spawning success is most evident when poor recruitment occurs during periods of high biomass. For example, appropriate river flow during the spawning period has long been recognized as an important factor in A-R striped bass spawning success (Hassler et. al 1981; Rulifson and Manooch 1990). Low to moderate flows (within a range of 6,000-8,000 cubic feet per second) have been identified as favorable for strong year-class production, while high flows (~12,000 cubic feet per second or greater) are unfavorable to the formation of strong year classes. It should be noted that while optimal flow increases the likelihood of a successful spawn, it does not always guarantee one will occur. The peer reviewers of the 2022 assessment update recognized poor recruitment with the stock cannot be fully explained by overfishing alone. They prioritized further exploration of environmental factors and their impact on spawning success. They noted potential factors limiting recruitment such as river flow, water quality, water temperatures and habitat conditions (Lee et. al 2022).

In addition to the quantitative stock assessment, similar negative trends in abundance are also evident in the available DMF and WRC juvenile and adult fishery-independent surveys used to monitor the A-R striped bass stock. Of particular concern is the trend in the juvenile abundance index (JAI) from the striped bass juvenile survey in the western Albemarle Sound. The survey measures the relative abundance of young-of-year (age-0) fish spawned each spring and is a good predictor of year class strength (Figure 3). The ASMFC Striped Bass Technical Committee has also established a spawning failure threshold (1.33 average fish per tow) for this survey. The JAI value has been below the spawning failure threshold for each year since 2018, and the 2017 value was only slightly above the threshold. The only other time the stock has experienced this many years of consecutive spawning failures was in the late 1970s through the 1980s when the stock was at very low levels of abundance and the abundance of older fish in the population was also at very low levels (Figure 3).

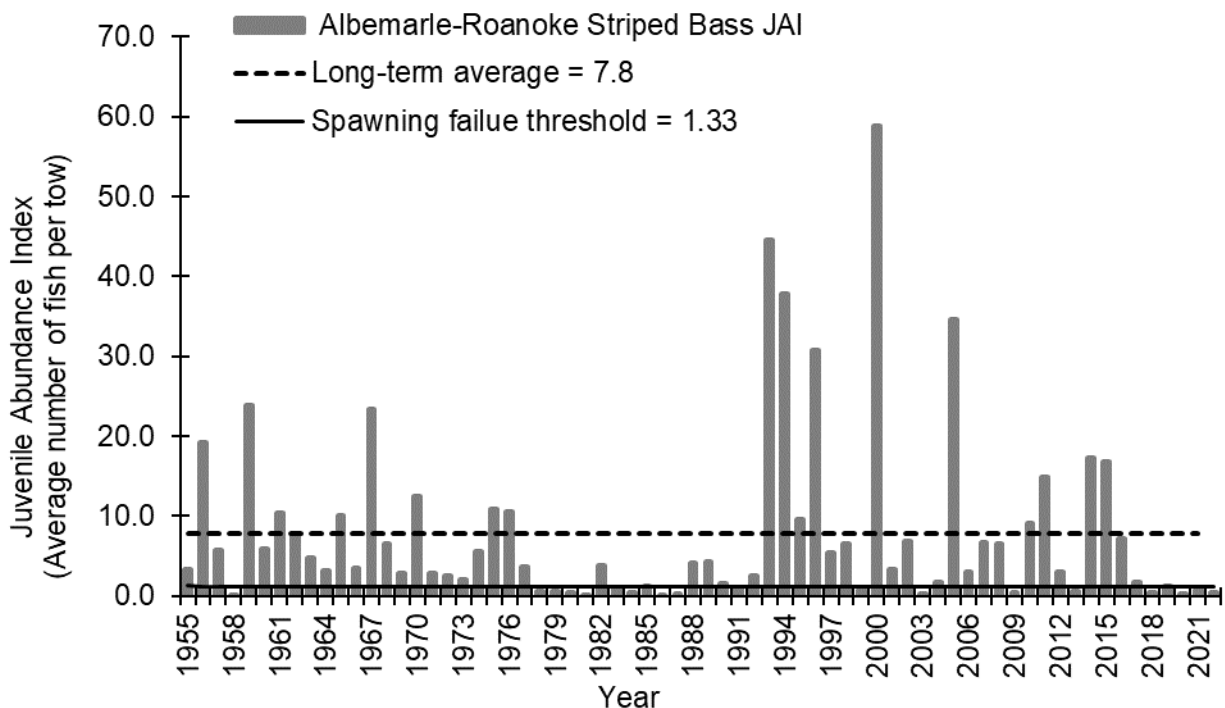


Figure 3. Juvenile abundance index (JAI) of Albemarle Sound-Roanoke River striped bass from the NCDMF juvenile trawl survey, western Albemarle Sound, NC, 1955–2022.

In addition to recruitment concerns, both DMF gill-net surveys (Figure 4) and the WRC electrofishing survey (Figure 5) show declining trends, especially in older fish. In recent years relative abundance in these surveys is similar or below levels observed when the stock was severely depressed in the early 1990s (Figures 4 and 5).

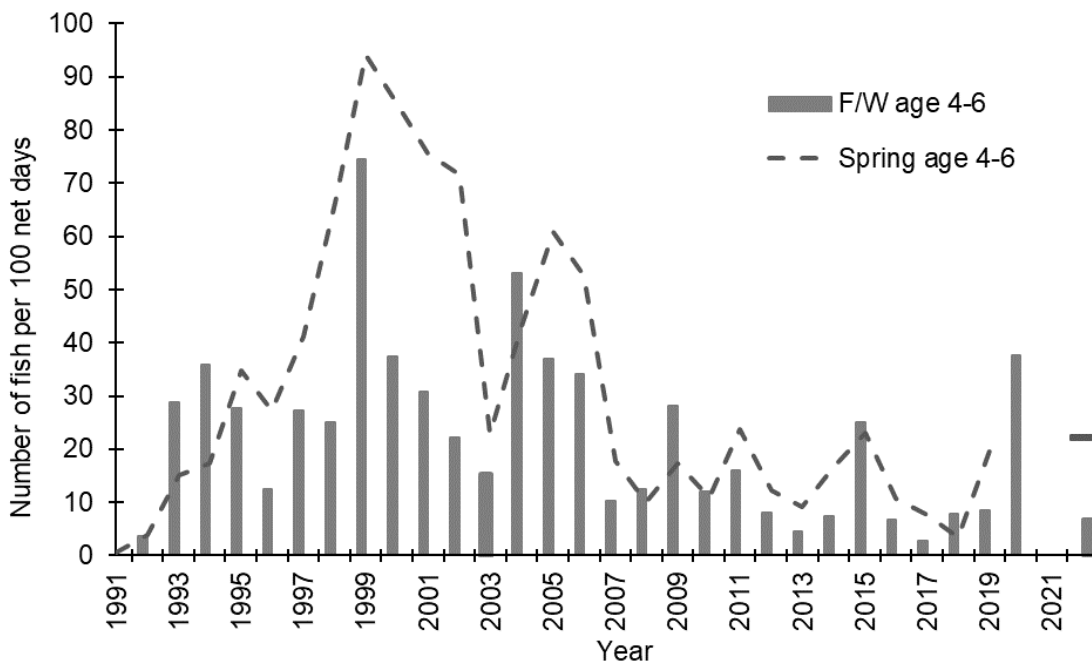


Figure 4. Relative abundance of age 4–6 Albemarle Sound-Roanoke River striped bass from the DMF fall/winter and spring independent gill net surveys, Albemarle Sound area, NC, 1991–2022.

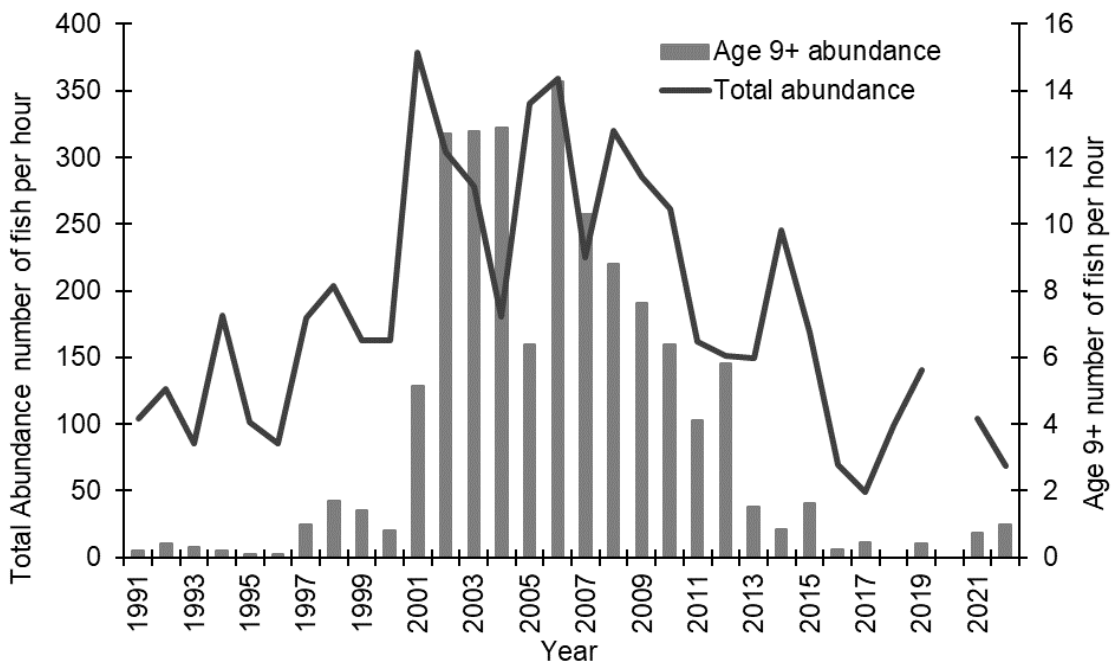


Figure 5. Total relative abundance and age 9+ relative abundance of Albemarle Sound-Roanoke River striped bass from the WRC spawning grounds electrofishing survey, Roanoke River near Weldon, NC, 1991–2022.

Declines in landings also support the precipitous decline in stock abundance and poor recruitment indicated by the assessment and fishery independent indices. Since the early 2000s, landings in both the recreational and commercial sectors have rarely achieved the available TAL, indicating a decline in availability of fish to the fishery. From 2004 through 2014 the TAL of 550,000 pounds was never caught. Total combined landings from both the ASMA and RRMA did not exceed 460,853 lb, averaging 235,278 lb per year with a low of 108,432 lb in 2013 (Figure 6). For the years 2005–2013, the commercial sector did not reach their TAL once. 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 during 2014–2017. Harvest in all sectors increased in 2017, with the commercial sector reaching the TAL in 2019 causing the DMF to close the fall commercial harvest season before Dec. 31 for the first time since 2010. This increase in harvest was likely due to the above-average year classes produced in 2014 and 2015 (Figure 6).

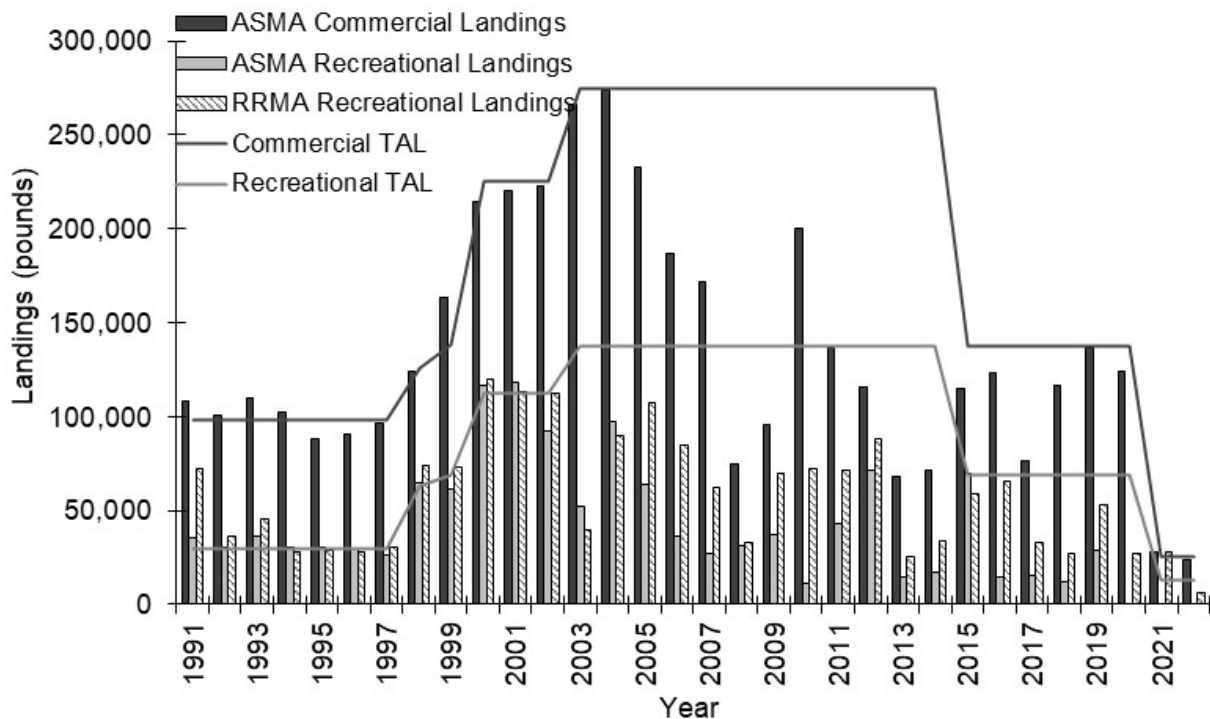


Figure 6. Striped bass landings from the Albemarle Sound Management Area commercial and recreational sectors and Roanoke River Management Area recreational sector and the total allowable landings, 1991–2022.

Reductions in the TAL to lower F to the F_{Target} reference point value

The 2022 update to the A-R striped bass benchmark stock assessment requires a 75% reduction in total removals relative to total removals in 2021 (the last year of data in the stock assessment update) to reduce F to the F_{Target} . After accounting for recreational and commercial dead discards (estimate was 9,833 pounds of dead discards for 2021) the new TAL is 8,349 pounds. The individual TAL for each sector is: ASMA commercial TAL = 4,175 pounds; ASMA recreational TAL = 2,089 pounds; RRMA recreational TAL = 2,089 pounds.

VI. AMENDMENT 2 ADAPTIVE MANAGEMENT REVISION TO THE TOTAL ALLOWABLE LANDINGS

Amendment 2 to the North Carolina Estuarine Striped Bass FMP, in conjunction with the North Carolina FMP for Interjurisdictional Fisheries, sets the framework for management changes in

response to the current stock status (Figure 7). This document will be incorporated into Amendment 2 as the November 2023 Revision to the North Carolina Estuarine Striped Bass FMP.

A TAL of 8,349 pounds divided among three harvest sectors is too low to effectively manage and emphasizes the need to prioritize stock recovery over a very limited recreational fishery and commercial bycatch fishery. At such a low allowable TAL, either sector could harvest their entire TAL in one day. In addition, any harvest season for striped bass will result in additional dead discards from both the commercial and recreational sectors. With the stock abundance at the lowest level in the stock assessment time series, compounded by the recent consecutive years of recruitment failure, it is necessary to reduce fishing mortality on the stock to provide the greatest potential for stock recovery and allow as many females to return to the spawning grounds each year.

Therefore, effective January 1, 2024, a harvest moratorium is required until the population improves to a level capable of supporting sustainable harvest. This revision and all other management strategies contained in Amendment 2 will remain in effect until further changes are implemented through the adaptive management framework of the North Carolina Estuarine Striped Bass FMP Amendment 2 and its Revisions. Adaptive management in Amendment 2 provides the management framework and is illustrated below in Figure 7.

VII. A-R STOCK EVALUATION AND STOCKING STRATEGY

The 2022 stock assessment update (data through 2021) satisfies the Adaptive Management strategy adopted through Amendment 2 that states “*stock assessments will be updated at least once between benchmarks*”. All DMF and WRC juvenile and adult fishery-independent surveys used to monitor the A-R striped bass stock are updated annually through the Division of Marine Fisheries, Fishery Management Plan Review, and are available on the Division’s website each August. These include the WRC’s electrofishing spawning stock survey and the DMF’s fall/winter overwintering gill net survey, spring spawning stock gill net survey, and the juvenile abundance survey. Through these surveys the relative abundance of year classes and the age and length structure of the stock will be evaluated annually to determine if improvements in the stock condition are occurring.

To address the concern with consecutive years of recruitment failure since 2017, stocking will be used to supplement natural production. The A-R striped bass broodstock progeny will be raised at hatcheries and stocked into the western Albemarle Sound nursery area during at least 2023–2025. Success of stocked fish will be evaluated using genetic markers unique to the broodstock of the stocked individuals. Annual determination for the number of fish stocked into which coastal system will occur through the North Carolina Interjurisdictional Fisheries Cooperative Work Plan. The annual work plan is a cooperative agreement between the U.S. Fish and Wildlife Service, Edenton National Fish Hatchery; the WRC, Inland Fisheries Division; and the North Carolina Department of Environmental Quality, DMF. The purpose of the annual work plan is to coordinate management of various anadromous fish species (including striped bass, American shad, and river herring) between the three agencies, including annual stocking of striped bass in coastal rivers. Results of the A-R stocking strategy will be evaluated annually. Genetic samples will be collected through at least 2030.

AMENDMENT 2: APPROVED NOVEMBER 2022

Adaptive Management

- Use peer reviewed stock assessments and updates to recalculate the BRPs and/or TAL. The current TAL of 51,216 lb remains in place until a new TAL is determined. Stock assessments will be updated at least once between benchmarks. Increases or decreases in the TAL will be implemented through Adaptive Management. A harvest moratorium could be necessary if stock assessment results calculate a TAL that is too low to effectively manage, and/or the stock continues to experience spawning failures.
- Use estimates of F from stock assessments to compare to the F BRP and if F exceeds the F_{Target} reduce the TAL to achieve the F_{Target} through Adaptive Management.

2022 Stock Assessment Results (data through terminal year 2021):

- F exceeding F_{Target}
- New TAL = 8,349 pounds
- 2022: another year of spawning failure (2018–2022)
- 2023: preliminary data indicate another year of spawning failure

2023 Revision to Amendment 2 to document adaptive management changes

- New TAL of 8,349 pounds is too low to effectively manage.
- Implement harvest moratorium due to low TAL, low SSB estimates, and six consecutive years of spawning failures.

Annual updates to all survey data through DMF Fishery Management Plan Review. Review trends in data and conduct stock assessment when necessary.

INTERJURISDICTIONAL FISHERIES COOPERATIVE WORK PLAN (USFWS, NCWRC, NCDMF)

- 2023–2025: Stock hatchery raised striped bass in western Albemarle Sound to bolster wild population
- 2023–2030: Use genetic markers to determine percent contribution of hatchery fish to wild population
- 2025: Evaluate; continue stocking if deemed necessary

Figure 7. Schematic of Adaptive Management framework under Amendment 2.

VII. REFERENCES CITED

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