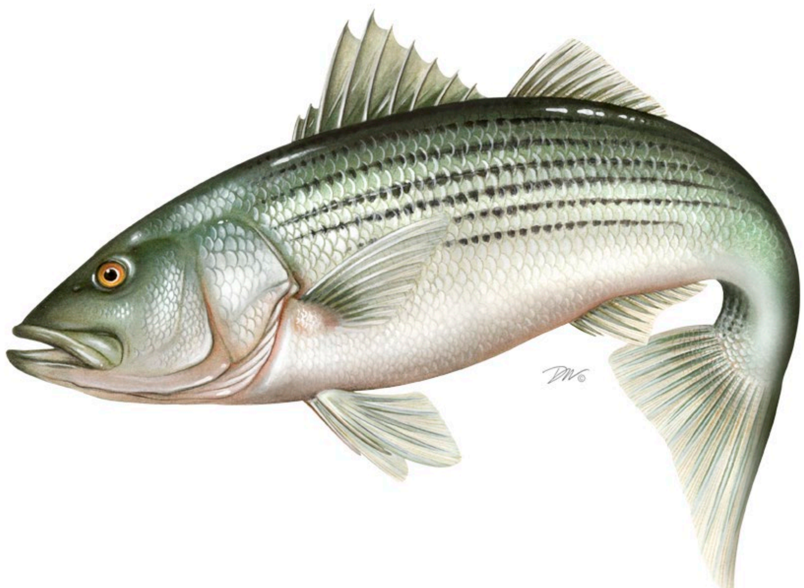
Atlantic States Marine Fisheries Commission

Amendment 7 to the Interstate Fishery Management Plan for Atlantic Striped Bass



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Sustainable and Cooperative Management of Atlantic Coastal Fisheries

Amendment 7 to the Interstate Fishery Management Plan for
Atlantic Striped Bass

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EXECUTIVE SUMMARY

Statement of the Problem

The status and understanding of the striped bass stock and fishery has changed considerably since adoption of the last Amendment (Amendment 6) to the Interstate Fishery Management Plan (FMP) for Atlantic striped bass in 2003. The results of the 2018 Benchmark Stock Assessment in particular led the Atlantic Striped Bass Management Board (Board) to discuss a number of significant issues facing striped bass management. The 2018 Benchmark Stock Assessment indicated the striped bass stock has been overfished since 2013 and experiencing overfishing, which changed perception of stock status. In August 2020, the Board initiated development of Amendment 7 to the FMP to update the management program to better align with current fishery needs and priorities, and build upon the action of Addendum VI to Amendment 6 to address overfishing and initiate rebuilding. Amendment 7 addresses management triggers, recreational release mortality, stock rebuilding plan, and conservation equivalency (CE).

Management Unit

The management unit includes all coastal migratory striped bass stocks on the East Coast of the United States, excluding the exclusive economic zone (3-200 nautical miles offshore), which is managed separately by the National Marine Fisheries Service (NMFS). The coastal migratory striped bass stocks occur in the coastal and estuarine areas of all states and jurisdictions from Maine through North Carolina.

Striped bass in the Chesapeake Bay are part of the coastal migratory stock and are assessed as part of the coastal migratory striped bass management unit. However, Amendment 7 implements a separate management program for the Chesapeake Bay due to the size availability of striped bass in this area.

The Albemarle Sound-Roanoke River (Albemarle-Roanoke) stock is currently assessed and managed separately by the State of North Carolina under the auspices of the Atlantic States Marine Fisheries Commission (Commission or ASMFC). The Albemarle-Roanoke stock is not included in the coastwide assessment and management program because it contributes minimally to the coastal migratory stock.

Description of the Resource

Atlantic coast migratory striped bass live along the eastern coast of North America from the St. Lawrence River in Canada to the Roanoke River and other tributaries of Albemarle Sound in North Carolina. Historical tagging data suggest stocks that occupy coastal rivers from the Tar-Pamlico River in North Carolina south to the St. Johns River in Florida do not undertake extensive Atlantic Ocean migrations when compared with stocks from the Roanoke River north.

Atlantic striped bass are anadromous, meaning they spend most of their adult life in ocean waters, but return to their natal rivers to spawn in the spring. The rivers that feed into the

Chesapeake Bay and the Delaware and Hudson Rivers are the major spawning grounds for the coastal migratory population. Female striped bass typically grow larger and heavier than males. One source of natural mortality is disease, particularly mycobacteriosis in Chesapeake Bay striped bass. Additionally, striped bass exhibit a number of characteristics potentially increasing their vulnerability to climate change effects, including complexity of reproductive strategy, short duration aggregate spawning, sensitivity to temperature, prey-specificity, and specific larval requirements.

Young-of-year striped bass feed primarily on small invertebrates and as they get older, they start eating fish and larger invertebrates. Adult striped bass consume a variety of species, including Atlantic menhaden, herring, bay anchovies, blue crabs, and lobster. As young-of-year and juveniles, striped bass are consumed by adult fish like bluefish, weakfish, and even other striped bass, and larger striped bass may be eaten by sharks or birds.

Description of the Fishery

The Atlantic striped bass fishery is predominantly recreational with the recreational sector accounting for over 80% of total removals by number each year since 1985. In 2020, total removals were estimated at 5.1 million fish.

Commercial striped bass fisheries operate in the several states and the primary gear types for the commercial fisheries are gill nets, hook and line, and pound nets/other fixed gears. The commercial fishery is managed by a quota system with two regional quotas; one for Chesapeake Bay and one for the ocean, which includes other bays, inland rivers, and estuaries. Commercial landings in 2020 were estimated at 3.6 million pounds (577,363 fish). Commercial discards are estimated to account for <2% of total removals per year since 2003. The majority of commercial harvest comes from Chesapeake Bay.

The recreational fishery is comprised of private and for-hire components. The recreational sector operates in state waters across the entire management unit (Maine through North Carolina) and uses hook and line almost exclusively. The recreational fishery is managed via bag and size limits and therefore recreational catch and harvest vary from year to year with changes in angler effort and the size and availability of fish. In 2020, recreational harvest was estimated at 14.9 million pounds (1.7 million fish). A large proportion of recreational harvest comes from Chesapeake Bay and the majority of recreational harvest in the ocean fishery comes from Massachusetts, New York, and New Jersey.

The vast majority of recreational striped bass catch is released alive either due to angler preference or regulation; roughly 90% annually since 1990. Based on peer-reviewed literature, a 9% release mortality rate is used to estimate the number of fish that die as a consequence of being caught and released. In 2020, recreational anglers caught and released an estimated 30.7 million fish, of which 2.76 million (9%) are assumed to have died; this represents 54% of total striped bass removals (total commercial and recreational) in 2020.

Goals and Objectives

The goal of Amendment 7 to the FMP is to perpetuate, through cooperative interstate fishery management, migratory stocks of striped bass; to allow commercial and recreational fisheries consistent with the long-term maintenance of a broad age structure, a self-sustaining spawning stock; and also to provide for the restoration and maintenance of their essential habitat.

In support of this goal, the following objectives are specified:

1. Manage striped bass fisheries under a control rule designed to maintain stock size at or above the target female spawning stock biomass level and a level of fishing mortality at or below the target exploitation rate
2. Manage fishing mortality to maintain an age structure that provides adequate spawning potential to sustain long-term abundance of striped bass populations
3. Provide a management plan that strives, to the extent practical, to maintain coastwide consistency of implemented measures, while allowing the states defined flexibility to implement alternative strategies that accomplish the objectives of the FMP
4. Foster quality and economically-viable recreational, for-hire, and commercial fisheries
5. Maximize cost effectiveness of current information gathering and prioritize state obligations in order to minimize costs of monitoring and management
6. Adopt a long-term management regime that minimizes or eliminates the need to make annual changes or modifications to management measures
7. Establish a fishing mortality target that will result in a net increase in the abundance (pounds) of age 15 and older striped bass in the population, relative to the 2000 estimate

Reference Points

The status of the Atlantic striped bass stock will be determined with respect to its biological reference points through the stock assessment: fishing mortality rate (F) and female spawning stock biomass (SSB). The SSB target and threshold are based on the weight of sexually mature females in the striped bass population. The 1995 estimate of female SSB is used as the SSB threshold because many stock characteristics, such as an expanded age structure, were reached by this year, and this is also the year the stock was declared recovered. The female SSB target is equal to 125% of the female SSB threshold. The striped bass population is considered overfished when the female SSB falls below the SSB threshold level.

F-based reference points are designed to manage the rate at which individual striped bass die because of fishing. The F target and threshold are the values of F estimated to achieve the respective SSB target and threshold over the long-term. If the current F exceeds its threshold, then overfishing is occurring. This means the rate at which striped bass are dying because of fishing (i.e., harvest and dead discards) exceeds the stock’s ability to maintain itself at the SSB threshold.

The management program is designed to achieve the target F and SSB levels. SSB and F reference points are defined for the coastwide population, which includes the Chesapeake Bay, Hudson River and Delaware River/Bay stocks. These reference points are consistent with those accepted in the 2018 Striped Bass Benchmark Assessment and Peer Review Report.

Monitoring Program Specifications

In order to achieve the goals and objectives of Amendment 7, the collection and maintenance of quality data are necessary. States are required to collect data on commercial and recreational catch and effort, as well as implement a mandatory tagging program for all commercially harvested striped bass. Some states are also required to collect biological information through fishery-dependent and fishery-independent programs, including young-of-the-year surveys and SSB surveys.

Management Triggers

The management triggers are intended to keep the Board accountable and determine when the Board is required make management adjustments based on levels of F, female SSB, and juvenile abundance indices (young-of-the-year data). There are five management triggers related to the F threshold, F target, SSB threshold, SSB target, and recruitment trigger (based on the juvenile abundance indices).

Recreational Management Measures

Recreational Size Limits, Bag Limit, and Seasons

Ocean recreational fisheries are constrained by a one fish bag limit and a slot limit of 28 inches to less than 35 inches. Chesapeake Bay recreational fisheries are constrained by a one fish bag limit and a minimum size of 18 inches. All bag limits are per person per day. All minimum and maximum size limits are in total length. States are required to maintain the same seasons that were in place in 2017. Some states have implemented alternative recreational size limits, bag limits, and seasons through CE, which are maintained through current CE programs and state implementation plans from Addendum VI to Amendment 6, which were approved in 2020.

Measures to Address Recreational Release Mortality

The use of circle hooks is required when recreationally fishing for striped bass with bait, which is defined as any marine or aquatic organism live or dead, whole or parts thereof. This shall not apply to any artificial lure with bait attached. It shall be unlawful for any person to gaff or attempt to gaff any striped bass at any time when fishing recreationally. Striped bass caught on any unapproved method of take must be returned to the water immediately without unnecessary injury.

States are encouraged to develop public education and outreach campaigns on the benefits of circle hooks. It is also recommended states continue to promote best striped bass handling and release practices through public education and outreach campaigns.

Commercial Management Measures

Commercial Size Limits

All commercial fisheries are required to maintain their 2017 commercial fisheries size limits. Some states have implemented alternative commercial size limits through CE, which are maintained through current (approved in 2020) CE programs and state implementation plans from Addendum VI to Amendment 6.

Quota Allocation

Amendment 7 maintains the commercial quotas established in Addendum VI to Amendment 6, which includes an ocean region quota by state and a Chesapeake Bay quota allocated to Maryland, Virginia, and the Potomac River Fisheries Commission per the jurisdictions' mutual agreement. In the event a state exceeds its allocation, the amount in excess of its annual quota is deducted from the state's allowable quota in the following year. Commercial quota transfers are not permitted. Some states have implemented adjusted commercial quotas and/or reallocated commercial quota to the recreational sector through CE, which are maintained through current CE programs and state implementation plans from Addendum VI to Amendment 6, which were approved in 2020.

Rebuilding Plan

The 2018 Benchmark Stock Assessment indicated the striped bass stock is overfished and experiencing overfishing relative to the updated reference points defined in the assessment. To address the overfished status, the Board must adjust the striped bass management program to rebuild SSB to the target level in a timeframe not to exceed 10 years, no later than 2029. The 2022 stock assessment will calculate the F rate required to rebuild SSB to the SSB target by no later than 2029 (i.e., F rebuild). For the 2022 stock assessment update, F rebuild will be calculated to achieve the SSB target by no later than 2029 using the low recruitment assumption. If the 2022 stock assessment results indicate the Amendment 7 measures have less than a 50% probability of rebuilding the stock by 2029 (as calculated using the low recruitment assumption) and if the stock assessment indicates at least a 5% reduction in removals is needed to achieve F rebuild, the Board may adjust measures to achieve F rebuild via Board action (change management measures via a motion at a Board meeting).

Habitat Conservation and Restoration Recommendations

Each state should implement protection for striped bass habitat to ensure the sustainability of that portion of the migratory or resident stock. Habitats essential for maintaining striped bass populations include spawning, nursery, wintering areas, and migration corridors. Each state jurisdiction should monitor those habitats located within state waters to ensure adequate water and substrate quality; the quantity, timing, and duration of freshwater flows into spawning and nursery areas; water, substrate quality, and integrity of wintering areas; and open and free access to migration corridors, especially ocean inlets. Federal agencies should work with state partners in addressing these needs in state waters and in the EEZ. State and federal agencies should partner to develop detailed maps of striped bass habitat use, by life stage, to provide a basis for regulatory review of proposed federal or state actions which could adversely affect striped bass populations.

Management Program Equivalency (Conservation Equivalency)
Management program equivalency (also known as "conservation equivalency" or CE) refers to actions taken by a state which differ from the specific requirements of the FMP, but which achieve the same quantified level of conservation for the resource under management. It is the responsibility of the state to demonstrate the proposed management program is equivalent to the FMP standards and consistent with the restrictions and requirements for CE determined by the Board.

Beyond the mandatory default restrictions and requirements for the use of CE outlined in Amendment 7, the Board will determine CE and has final discretion regarding the use of CE and approval of CE programs. The Board may restrict the use of CE on an ad hoc basis for any FMP requirement.

Amendment 7 establishes four default restrictions/requirements for the use of CE. First, CE programs will not be approved for non-quota managed recreational fisheries, with the exception of the Hudson River, Delaware River, and Delaware Bay recreational fisheries, when the stock is at or below the biomass threshold (i.e., overfished). Second, CE proposals cannot use Marine Recreational Information Program (MRIP) estimates associated with a percent standard error (PSE) exceeding 40. PSE is a measure of precision, and higher PSEs indicate the data are less precise. Third, proposed CE programs for non-quota managed fisheries are required to include an uncertainty buffer, which is intended to increase the proposed CE program's probability of achieving equivalency with the FMP standard. The required uncertainty buffer for CE proposals is 10%; however, if a CE proposal uses MRIP estimates with a PSE exceeding 30 (less precise data), then a larger 25% uncertainty buffer is required. Fourth, proposed CE programs for non-quota managed fisheries are required to demonstrate equivalency to the percent reduction/liberalization projected for the FMP standard at the state-specific level. These requirements are intended to minimize the risks due to uncertainty when CE is used.

De minimis
States may apply for *de minimis* status if, for the last two years, their combined average commercial and recreational landings (by weight) constitute less than 1% of the average coastwide commercial and recreational landings for the same two-year period.

Adaptive Management
The Board may vary the requirements specified in this Amendment as a part of adaptive management in order to conserve the Atlantic striped bass resource. The process and elements that can be modified by adaptive management are listed in *Section 4.7*.

Compliance Schedule and Compliance Reports
All provisions of Amendment 7 are effective May 5, 2022 except for gear restrictions. States must implement new gear restrictions by January 1, 2023. Each state must submit to the Commission an annual report concerning its Atlantic striped bass fisheries and management program for the previous year, no later than June 15th.

TABLE OF CONTENTS

1.0 INTRODUCTION

The Atlantic States Marine Fisheries Commission (ASMFC), under the authority of the Atlantic Coastal Fisheries Cooperative Management Act, is responsible for managing Atlantic striped bass *(Morone saxatilis)* in state waters (0-3 miles) along the Atlantic coast. The states and jurisdictions of Maine through North Carolina, including Pennsylvania, the District of Columbia, and the Potomac River Fisheries Commission (PRFC), participate in the management of this species as part of the Commission's Atlantic Striped Bass Management Board (Board). Amendment 7 to the Interstate Fishery Management Plan (FMP) for Atlantic Striped Bass replaces Amendment 6 (2003) and its Addenda I – VI. Management authority in the exclusive economic zone (3-200 miles from shore) lies with the National Marine Fisheries Service (NMFS).

1.1 BACKGROUND INFORMATION

Since Amendment 6 was adopted in 2003, the status and understanding of the striped bass stock and fishery has changed considerably. The results of the 2018 Benchmark Stock Assessment (NEFSC 2019) in particular led the Board to discuss a number of significant issues facing striped bass management. The 2018 Benchmark Stock Assessment indicated the striped bass stock has been overfished since 2013 and is experiencing overfishing, which changed perception of stock status. The Board accepted the assessment for management use in 2019; management triggers established through Amendment 6 tripped at that time, requiring the Board to take action to address both overfishing and the overfished status.

In April 2020, the Board implemented Addendum VI to end overfishing. In August 2020, the Board initiated development of Amendment 7 to the FMP to update the management program to better align with current fishery needs and priorities, and build upon the action of Addendum VI to address overfishing and initiate rebuilding.

In February 2021, the Board approved for public comment the Public Information Document (PID) for Draft Amendment 7. Public comment was received and hearings were held between February and April 2021. At its May 2021 meeting, the Board tasked the Plan Development Team (PDT) with developing Draft Amendment 7 and provided additional guidance to the PDT at the August and October 2021 Board meetings. In January 2022, the Board approved Draft Amendment 7 for public comment to address management triggers (*Section 4.1* Management Triggers); recreational release mortality (*Section 4.2.2* Measures to Address Recreational Release Mortality); stock rebuilding plan (*Section 4.4* Rebuilding Plan); and conservation equivalency (*Section 4.6.2* Management Program Equivalency). Public comment was received and hearings were held between February and April 2022. The Board met in May 2022 to select final measures for the Amendment, and Amendment 7 was approved by the Commission on May 5, 2022.

1.1.1 Statement of Problem

1.1.1.1 Management Triggers

The management triggers are intended to keep the Board accountable and determine when the Board is required make management adjustments based on levels of fishing mortality (F), female spawning stock biomass (SSB), and young-of-the-year indices. The management triggers were initially developed at a time when the stock was thought to be at historic high abundance and well above the female SSB target. However, as perceptions of stock status and fishery performance have changed, shortfalls with how the management triggers are designed have emerged. When female SSB is below the target level, the variable nature of F can result in a continued need for management action. The shorter timetables for corrective action are also in conflict with the desire for management stability. As a consequence, the Board has sometimes been criticized for considering changes to the management program before the stock has a chance to respond to the most recent management changes. Furthermore, the use of point estimates in decision-making does not account for an inherent level of uncertainty. Lastly, the observed long period of below average recruitment which contributed to recent declines in biomass raised questions about the recruitment-based trigger (based on the young-of-the-year indices) and whether it is designed appropriately.

1.1.1.2 Recreational Release Mortality

Recreational release mortality constitutes a large component of annual F—the largest component from 2017 through 2020—because the striped bass fishery is predominantly recreational and an overwhelming majority of the catch is released alive, either due to cultural preferences (i.e., fishing with the intent to catch and release striped bass) or regulation (e.g., the fish is not of legal size). Some stakeholders value the ability to harvest striped bass, while others value the experience of fishing for striped bass regardless of whether they are able to retain fish. The current management program, which primarily uses bag limits and size limits to constrain recreational harvest, is not designed to control fishing effort which makes it difficult to control overall F. While the acceptable proportion of recreational release mortality in total removals should reflect the management objectives for the fishery, efforts to reduce overall F through harvest reductions may be of limited use unless recreational release mortality can be addressed.

1.1.1.3 Stock Rebuilding and Low Recruitment

The Board expressed concern about recent low recruitment estimates and the potential impact of low recruitment levels on the ability of the striped bass stock to rebuild by 2029. If rebuilding measures are implemented based on the standard recruitment method from the stock assessment but recruitment remains lower than average in the future, the population may not be able to rebuild to the female SSB target by 2029. The next stock assessment update (expected in 2022) will calculate the F rate required to rebuild the stock by 2029, and those rebuilding calculations could take into account different assumptions about future recruitment.

1.1.1.4 Management Program Equivalency (Conservation Equivalency)
There is an essential tension between managing the striped bass fishery on a coastwide basis while affording states the flexibility to deviate from the FMP standard through conservation equivalency (CE). [1] There is value in allowing states to implement alternative regulations tailored to the needs of their fisheries; however, this creates regulatory inconsistency among states and within shared waterbodies with associated challenges (e.g., enforcement). It is difficult to evaluate the effectiveness of CE programs and their equivalency to the FMP standard once implemented due to the challenge of separating the performance of management measures and outside variables (like angler behavior and availability of fish). Concerns were raised that some alternative measures implemented through CE could potentially undermine management objectives. And finally, there has also been limited guidance on how and when CE should be pursued, particularly when the stock is overfished and rebuilding is required, and how "equivalency" is defined.

1.1.2 Benefits of Implementation

The status and understanding of the striped bass resource and fishery has changed considerably since implementation of Amendment 6 in 2003. Reevaluation of striped bass management processes, specifically management triggers and CE, and consideration of recreational fishery measures to address release mortality will support stock rebuilding and promote the sustainable management of the striped bass resource and fishery moving forward.

1.1.2.1 Ecological Benefits
Striped bass play an important ecological role in coastal marine ecosystems. Managers and stakeholders have expressed interest in the role of striped bass in the ecosystem from both a top-down perspective (as a predator that could affect other species) and a bottom-up perspective (as a consumer affected by prey availability). Young-of-year striped bass feed primarily on small invertebrates, and as they age, they start eating fish and larger invertebrates, including Atlantic menhaden, herring, bay anchovies, blue crabs, and lobster. Striped bass are also preyed on by other species; as young-of-year and juveniles, they are consumed by adult fish like bluefish, weakfish, and even other striped bass. Sustainable management of striped bass will contribute to maintaining a balanced marine ecosystem.

1.1.2.2 Social/Economic Benefits
Rebuilding the Atlantic striped bass population will enhance the economic and social benefits attributable to this population in the ASMFC member states. Economic benefits of a rebuilt stock would include increased use values (e.g., consumptive and non-consumptive use values related to commercial and recreational fishing) and non-use values (e.g., existence values) for current and future generations. There are many potential socioeconomic impacts that could result from changes in striped bass management, notably potential implementation of seasonal

[1] FMP standard refers to a management measure specified in the FMP.

closures. These potential changes may result in short-term negative impacts to recreational angler welfare. However, the net positive long-term social and economic benefits stemming from stock recovery and subsequent catch increases in successive years will likely outweigh the short-term impacts. Potential restrictions on how and when states can pursue CE programs could result in socioeconomic impacts if there is less flexibility to implement alternative regulations tailored to the needs of each state's fisheries.

1.2 DESCRIPTION OF THE RESOURCE

1.2.1 Species Life History

1.2.1.1 Stock Structure and Geographic Range

Atlantic coastal migratory striped bass inhabit estuaries and the Atlantic Ocean along the eastern coast of North America from the St. Lawrence River in Canada to the Roanoke River and other tributaries of Albemarle and Pamlico Sounds in North Carolina (Merriman, 1941). Some individuals from longer river systems within this range may not undergo coastal migrations, but rather restrict their migrations to within the river and estuary (Morris et al., 2003; Zlokovitz et al., 2003). Stocks which occupy coastal rivers from the Tar-Pamlico River in North Carolina south to the St. Johns River in Florida are primarily endemic and riverine and do not presently undertake extensive Atlantic Ocean migrations as do stocks from the Roanoke River north (Richkus, 1990), based on tagging studies (Callihan et al., 2014; Callihan et al., 2015). Striped bass are also naturally found in the Gulf of Mexico from the western coast of Florida to Louisiana (Merriman, 1941; Musick et al., 1997). Striped bass were introduced to the Pacific coast using transplants from the Atlantic coast in 1879 as well as into rivers, lakes, and reservoirs throughout the US and foreign countries such as Russia, France, and Portugal (Hill et al., 1989).

The anadromous populations of striped bass on the Atlantic coast are primarily the product of four distinct spawning stocks: an Albemarle Sound-Roanoke River stock, a Chesapeake Bay stock, a Delaware River stock, and a Hudson River stock (ASMFC 1998). The Atlantic coast fisheries rely primarily on production from the spawning populations in the Chesapeake Bay and in the Hudson and Delaware rivers. Historically, tagging data indicated very little mixing between the Albemarle Sound-Roanoke River stock and so that stock is managed and assessed separately from the coastal stock.

The Chesapeake Bay stock of striped bass is widely regarded as the largest of the four major spawning stocks (Goodyear et al. 1985; Kohlenstein 1980; Fabrizio 1987). Recent tag-recovery studies in the Rappahannock River and upper Chesapeake Bay show that larger and older (ages 7+) female striped bass, after spawning, move more extensively along the Atlantic coast than stripers from the Hudson River stock (ASMFC 2004).

Striped bass abundance in the Delaware River, as measured by juvenile seine surveys, rose steadily following pollution abatement during the mid-1980s and peaked in abundance in 2003 and 2004. Like the Chesapeake Bay and Hudson stocks, spawning in the Delaware River begins during early April and extends through mid-June (ASMFC 1990). Recent tagging studies in the Delaware River show that larger and older (ages 7+) female striped bass undergo extensive migration northward into New England from July to November that spatially overlap the migratory range of Chesapeake Bay striped bass (ASMFC 2004).

1.2.1.2 Age and Growth

Generally, longevity of striped bass has been estimated as 30 years, although a striped bass was aged to 31 years based on otoliths (Secor 2000). This longevity suggests striped bass populations can persist during long periods of poor recruitment due to a long reproductive lifespan. In general, the maximum ages observed have increased since 1995 when the striped bass fisheries reopened. From 1995 to 2016, the maximum observed female age increased from 16 to 31, with the oldest fish caught in Chesapeake Bay, Virginia, in 2014. During the same period, the maximum observed male age increased from 16 to 24 with the oldest fish caught in Chesapeake Bay, Virginia, in 2011.

As a relatively long-lived species, striped bass are capable of attaining moderately large size, reaching as much as 125 pounds (57 kg) (Tresselt 1952). Growth rates of striped bass are variable, depending on season, age, sex, competition and location. For example, a 35 inch (889 mm) striped bass can be 7 to 15 years of age and a 10-pound (4.5 kg) striped bass can be 6 to 16 years old (ODU CQFE 2006). Growth occurs during the seven-month period between April and October. Within this time frame, striped bass stop feeding for a brief period just before and during spawning, but feeding continues during the upriver spawning migration and begins again soon after spawning (Trent and Hassler 1966). Growth rates and maximum size are significantly different for males and females. Both sexes grow at the same rate until 3 years old; beginning at age-4, females grow faster than males. Females grow to a considerably larger size than males; striped bass over about 30 pounds (14 kg) are almost exclusively female (Bigelow and Schroeder 1953).

1.2.1.3 Spawning and Reproduction

Atlantic striped bass are anadromous, meaning they spend most of their adult life in ocean waters, but return to their natal rivers to spawn in the spring. The rivers that feed into the Chesapeake Bay and the Delaware and Hudson Rivers are the major spawning grounds for the coastal migratory population. The spawning season along the Atlantic coast usually extends from April to June and is governed largely by water temperature (Smith and Wells 1977) and the number of mature ova in female striped bass varies by age, weight, and fork length. Studies have found that older fish produce more eggs than younger fish and heavier fish produce more eggs than smaller fish (Jackson and Tiller 1952; Raney 1952; Goodyear 1984; Mihursky 1987; Richards et al. 2003; Sadler et al. 2006; Gervasi et al. 2019). Newly hatched bass larvae remain in fresh or slightly brackish water until they are about 12 to 15 mm long and move in small schools toward shallow protected shorelines, where they remain until fall. Over the winter, the young concentrate in deep water of rivers.

The 2018 Benchmark Stock Assessment used maturity-at-age values derived from an updated dataset with samples from multiple states along the coast, which estimated that 89% of females are mature by age-8 and 100% are mature by age-9. There are indications that some older striped bass may not spawn every year (Raney 1952) and Jackson and Tiller (1952) reported curtailment of spawning in about 1/3 of the fish age-10 and older taken from Chesapeake Bay, though they also found striped bass up to age-14 in spawning condition.

Striped bass, like many fish populations, shows high interannual variability in recruitment. Environmental effects have been shown to be correlated with recruitment success in striped bass, including over-winter temperatures, hydrological conditions, and zooplankton prey availability (Hurst and Conover 1998; Martino and Houde 2010 and 2012). However, Martino and Houde (2012) found density-dependent effects on growth and mortality in the upper Chesapeake Bay for age-0 striped bass, where growth rates were higher and mortality rates lower in years with lower juvenile density.

1.2.1.4 Mortality

Because striped bass are a long-lived species, this suggests natural mortality is relatively low. One increasing source of natural mortality is disease. Mycobacteriosis was first detected in the Chesapeake Bay in 1997 (Heckert et al 2001; Rhodes et al. 2001) and may have been apparent in Chesapeake Bay striped bass as early as 1984 (Jacobs et al. 2009a). A rise in *mycobacterium* infection in the Chesapeake Bay could be causing increases in natural mortality (Pieper 2006; Ottinger and Jacobs 2006). Vogelbein et al. (2006) hypothesized that increased natural mortality could be associated with elevated nutrient inputs to the Chesapeake Bay contributing to eutrophication and suboptimal, stressful habitat for striped bass; or, the increased natural mortality could be associated with low abundance of Atlantic menhaden and reductions in Chesapeake Bay forage species resulting in starvation.

Prevalence of *mycobacterium* infection ranges from ~50% (Overton et al. 2003) to 75% with molecular techniques (Kaattari et al. 2005) and is dependent on the age class sampled, with prevalence increasing with age to approximately age 5 and then decreasing in older ages (Kaattari et al. 2005; Gauthier et al. 2008). Mycobacteriosis appears to be much less prevalent in other producer areas such as the Delaware Bay (Ottinger et al. 2006) and the Albemarle Sound-Roanoke River (Overton et al. 2006; Matsche et al. 2010). Although fish who are infected with the disease show overall decreased health (Overton et al. 2003), the slow progression of the disease may take years to become lethal in infected fish, thus allowing for multiple spawning opportunities, making determination of the population level impacts of the disease difficult (Jacobs et al. 2009b). In the most recent study, Groner et al. (2018) suggested disease-associated mortality will likely increase with warming temperatures in the Chesapeake Bay.

Striped bass exhibit a number of characteristics identified by NOAA as increasing their vulnerability to climate change effects, including complexity of reproductive strategy, short duration aggregate spawning, sensitivity to temperature, prey-specificity, and specific larval requirements (Morrison et al. 2015). Temperature is correlated with or impacts a number of aspects of striped bass biology, including time to hatch and egg and larval mortality (Massoudieh et al. 2011); larval growth length and yolk utilization (Peterson et al. 2017); activity levels and metabolic rate (Hollema et al. 2017); consumption, and growth (Secor et al.

2000); and growth and mortality in striped bass larvae (Secor et al. 2017). See *Section 1.4.3* for details on climate change impacts to striped bass habitat.

1.2.1.5 Ecological Roles

Young-of-year striped bass feed primarily on small invertebrates like amphipods, bristle worms, and mysid shrimp. As they get older, they start eating fish and larger invertebrates (starting around age-2). Adult striped bass consume a variety of species, including Atlantic menhaden, herring, bay anchovies, blue crabs, and lobster (Schaefer 1970; Hartman and Brandt 1995; Walter et al. 2003; Rudershausen et al. 2005; Ferry and Mather 2012). Their diet varies depending on how big they are, what season it is, where they are feeding, and how abundant their different prey species are (Walter and Austin 2003; Overton et al. 2009). Striped bass are also preyed on by other species. As young-of-year and juveniles, they are consumed by adult fish like bluefish, weakfish, and even other striped bass, and larger striped bass may be eaten by sharks or birds like bald eagles and osprey (ASMFC 2011).

Managers and stakeholders have expressed interest in the role of striped bass in the ecosystem from both a top-down perspective (as a predator that could affect other species) and a bottom-up perspective (as a consumer that was affected by prey availability). The high abundance of striped bass in the late 1990s and early 2000s led to concerns that striped bass could have a negative impact on other species that they preyed on, like shad and river herring, or that they competed with for food, like weakfish (Uphoff 2003; Davis et al. 2012). Declines in striped bass condition and the increasing prevalence of mycobacteriosis in Chesapeake Bay raised concerns that the depletion of key prey species like Atlantic menhaden were negatively affecting striped bass (Jacobs et al. 2009; Overton et al. 2003).

In August 2020, ASMFC adopted an ecosystem approach for the management of Atlantic menhaden using ecological reference points (ERPs) for menhaden management. Ecological modeling indicated striped bass were one of the most sensitive species to menhaden abundance. Therefore, the ERP values that sustained striped bass would likely provide sufficient forage for other predators under current ecosystem conditions. ERPs for the management of Atlantic menhaden are as follows:

- ERP target: The maximum fishing mortality rate on Atlantic menhaden that sustains Atlantic striped bass at their biomass target when striped bass are fished at their F target
- ERP threshold: The maximum fishing mortality rate on Atlantic menhaden that keeps Atlantic striped bass at their biomass threshold when striped bass are fished at their fishing mortality rate target.

These ERPs allow ASMFC to take into account menhaden's role as a forage fish, especially its importance to striped bass, when setting harvest limits for menhaden. However, the biological reference points for striped bass are still set using single-species modeling. ASMFC is working on refining the ERP model and improving the understanding of the role of striped bass in the ecosystem beyond the relationship with menhaden.

1.2.2 Stock Assessment Summary

The 2018 Benchmark Stock Assessment (NEFSC 2019) provides the most recent status of the coastwide striped bass stock for use in fisheries management. The assessment was peer-reviewed at the 66th Northeast Regional Stock Assessment Review Committee (SARC) meeting in November 2018 and approved by the Board for management use in May 2019. The accepted assessment model is a forward projecting statistical catch-at-age (SCA) model which uses catch-at-age data and fishery-dependent and -independent survey indices to produce annual estimates of recruitment, annual F rates, and selectivity parameters in order to calculate abundance and female SSB through the assessment terminal year of 2017. As a complement to the SCA model, an instantaneous tag return model (IRCR) was run on data from the U.S. Fish and Wildlife Service (USFWS) coastwide striped bass tagging program through the 2017 tagging year. The IRCR model makes inferences using the numbers of tagged fish that have been recaptured to the numbers of fish that were originally tagged over time to estimate the survival rate of striped bass from year-to-year, F rates and natural mortality rates.

The 2018 Benchmark Stock Assessment was the first assessment for striped bass to use the improved MRIP survey methods to estimate recreational fishery catches. The new time series of recreational catch estimates is on average 2.3 times higher than the values used in previous stock assessments, resulting in higher estimates of stock size. Although the magnitude of these estimates has changed, the overall trend throughout time remains similar for both harvest and total catch (released fish + harvested fish).

1.2.2.1 Abundance and Structure
Striped bass abundance (age-1+) increased steadily from 1982 through 1997 when it peaked around 420 million fish. Total abundance fluctuated without trend through 2004 and from 2005-2009, total abundance declined to around 189 million fish. Total abundance increased to 351 million fish by 2016 before dropping to 249 million fish in 2017. The increase in 2012 was due primarily to the abundant 2011 year class from Chesapeake Bay. Abundance of age-8+ striped bass (representing mature fish) increased steadily through 2004. Between 2004 and 2011, age-8+ abundance oscillated followed by a decline since 2011. Age-8+ abundance in 2017 was estimated at 6.7 million fish, a value near the 30th percentile of the time-series.

1.2.2.2 Fishing Mortality
The current single-stock SCA model separates fishery removals into an ocean fleet and a Chesapeake Bay fleet, but there is one set of coastwide F reference points. The ocean fleet includes removals from ocean waters and other areas such as Delaware Bay and Long Island Sound. Fully-recruited F in 2017 for the Chesapeake Bay and Ocean fleets was 0.068 and 0.262, respectively. Total F has been at or above the threshold in 13 of the last 15 years of the assessment (2003-2017) and was estimated to be 0.31 in 2017.

1.2.2.3 Recruitment
Striped bass experienced a period of strong recruitment (age-1 fish entering the population) from 1994-2004, followed by a period of lower recruitment from 2005-2011 (although not as

low as the early 1980s, when the stock was considered collapsed). This period of low recruitment contributed to the decline in female SSB that the stock has experienced since 2010. Recruitment of age-1 fish was high in 2012, 2015, and 2016 (corresponding to strong 2011, 2014, and 2015 year classes), but estimates of age-1 striped bass were below the long-term average in 2013, 2014, and 2017. Recruitment in 2017 was estimated at 108.8 million age-1 fish, below the time series average of 140.9 million fish.

1.2.2.4 Female Spawning Stock Biomass (SSB)
Female SSB peaked in 2003 and has been declining since then; female SSB has been below the threshold level since 2013. Female SSB grew steadily from 1986 through 1996 after which female SSB dropped to just below levels observed in 1995. Female SSB grew steadily between 1999 and 2003 when it peaked around 114,000 thousand metric tons and has generally declined since then.

1.2.2.5 Two-Stock Model Development
Although the coastwide F reference points include the effects of harvesting smaller striped bass in the Chesapeake Bay (and in other areas like the Delaware Bay and Hudson River), they do not reflect the heavily male-skewed sex ratio in the Chesapeake Bay catch. During the 2018 Benchmark Stock Assessment, the current single-stock SCA model was modified into a competing two-stock SCA model; a Chesapeake Bay stock and a mixed ocean stock which included all other stock components of the population. The intent of the two-stock model approach was to develop separate reference points for the Chesapeake Bay stock and the ocean region (which includes the Delaware Bay/Hudson River stock complex); however, this model requires further testing and was not approved for management by the SARC-66 peer review panel.

1.2.3 Current Stock Status

The current stock status determination is based on the 2018 Atlantic Striped Bass Benchmark Stock Assessment (NEFSC 2019). The results of the 2018 Benchmark Stock Assessment indicate that the Atlantic striped bass stock is overfished and overfishing is occurring (Figures 3-4). Female SSB in 2017 was estimated at 68,576 metric tons (151 million pounds), which is below the female SSB threshold of 91,436 metric tons (202 million pounds) (Figure 3). Total F in 2017 was estimated at 0.31, which is above the F threshold of 0.24 (Figure 4). The reference points currently used for management are based on stock conditions in 1995, the year the stock was declared rebuilt. The biomass threshold is the level of female SSB in 1995, the biomass target is 125% of the threshold, and the F threshold and target are the levels of F projected to achieve the biomass reference points over the long-term, respectively. The specific values of these reference points change when the time series of female SSB is updated with each iteration of the stock assessment model.

1.3 DESCRIPTION OF THE FISHERY

The Atlantic striped bass fishery is predominantly recreational with the recreational sector accounting for over 80% of total removals by number each year since 1985 (Tables 8-9; Figure 7). In 2019, total removals (commercial and recreational combined, including harvest and dead releases) were estimated at 5.5 million fish; the recreational sector accounted for 87% of total removals by number. In 2020, total removals were estimated at 5.1 million fish; the recreational sector accounted for 87% of total removals by number (Tables 8-9).

1.3.1 Commercial Fishery

Commercial striped bass fisheries operate in the waters of Massachusetts, Rhode Island, New York, Delaware, Maryland, the Potomac River Fisheries Commission, Maryland, Virginia, and North Carolina (Figure 8). The primary gear types for the commercial fisheries are gill nets, hook and line, and pound nets/other fixed gears. Additional gears used in the commercial fishery include haul seines and trawls.

The commercial fishery is managed via a quota system resulting in relatively stable landings since Amendment 6 (approved in 2003; implemented in 2004). From 2004 to 2014, coastwide commercial harvest averaged 6.8 million pounds (942,922 fish) annually (Table 10). From 2015-2019, commercial landings decreased to an average of 4.7 million pounds (619,716 fish) due to implementation of Addendum IV and a reduction in the commercial quota. Commercial landings in 2020 were estimated at 3.6 million pounds (577,363 fish). Commercial discards are estimated to account for <2% of total removals per year since 2003 (Tables 8-9). In 2019, commercial removals (landings plus commercial discards) accounted for 13.5% of total removals (commercial plus recreational) in numbers of fish, and 12.6% of total removals in 2020.

There are two sets of quota allocations; one to all states (Maine through North Carolina, excluding Pennsylvania) for harvest in the ocean, and a second allocation to Maryland, PRFC, and Virginia for harvest in Chesapeake Bay. The ocean region quota is based on average landings during the 1970s and the Chesapeake Bay quota changed annually under a harvest control rule until implementation of a static quota in 2015 through Addendum IV. Although the regional quota allocations are about equal, the majority of commercial harvest comes from Chesapeake Bay; roughly 60% by weight and 80% in numbers of fish since 1990 (ASMFC 2021). The differences between landings in weight and in numbers of fish are primarily attributed to the availability of smaller fish and lower size limits in Chesapeake Bay relative to the ocean fishery. Additionally, the ocean fishery tends to underutilize its allocations due to lack of availability in state waters (particularly off of North Carolina) and because commercial fishing is not allowed in some states (Maine, New Hampshire, Connecticut and New Jersey). Furthermore, the underage has increased in recent years since migratory striped bass have not been available to the ocean fishery in North Carolina resulting in zero harvest since 2012 (North Carolina holds 13% of the ocean quota).

1.3.2 Recreational Fishery

The recreational fishery is comprised of private and for-hire components. The private component includes anglers fishing from shore (including all land-based structures) and private/rental boats. The for-hire component is composed of charter boats and headboats (also called party boats). Although charter boats tend to be smaller than headboats, the key distinction between the two types of operations is how the fee is typically determined. On a charter boat trip, the fee charged is for the entire vessel, regardless of how many passengers are carried, whereas the fee charged for a headboat trip is paid per individual angler.

The recreational sector operates in state waters across the entire management unit (Maine through North Carolina) and uses hook and line almost exclusively. The recreational fishery is managed via bag and size limits and therefore recreational catch and harvest vary from year to year with changes in angler effort and the size and availability of fish.

Recreational harvest of striped bass follows a similar trend to the commercial harvest. Since 1984 when recreational harvest was lowest (2.4 million pounds; 264,004 fish), recreational harvest has increased reaching a peak by weight in 2013 at 65 million pounds, and by numbers of fish in 2010 at 5.4 million fish (Table 10). Between 2004 and 2014, recreational harvest remained at a steady level averaging 54.8 million pounds (4.6 million fish) per year. Following the implementation of the size and bag limit changes in the recreational fisheries in Addendum IV due to declining biomass, recreational harvest decreased to an average of 33.6 million pounds (2.8 million fish). In 2020, recreational harvest was estimated at 14.9 million pounds (1.7 million fish).

A large proportion of recreational harvest comes from Chesapeake Bay. From 2004-2014, 33% of recreational harvest in numbers of fish came from Chesapeake Bay. From 2015-2019, that percentage increased to 43% in numbers of fish, likely as a result of the strong 2011, 2014, and 2015 year classes moving through the fishery. The majority of recreational harvest in the ocean fishery comes from Massachusetts, New York, and New Jersey (ASMFC 2021).

Since 1990, roughly 90% of all striped bass caught recreationally were released alive either due to cultural preferences (i.e., fishing with the intent to catch and release striped bass) or regulation (e.g., the fish is not of legal size, was caught out of season, or the angler already caught the bag limit) (Figure 9). Based on peer-reviewed literature, a 9% release mortality rate is used to estimate the number of fish that die as a consequence of being caught and released (Diodati and Richards 1996). Despite this low rate, the popularity of striped bass as a targeted recreational species means that recreational releases contribute a significant source of mortality to the stock each year. In 2020, recreational anglers caught and released an estimated 30.7 million fish, of which 2.76 million (9%) are assumed to have died; this represents 54% of total striped bass removals (total commercial and recreational) in 2020 (Tables 8-9).

1.3.3 Subsistence Fishing

Data describing the exact magnitude of subsistence fishing, (i.e., catching fish in order to provide necessary food) for striped bass does not exist. However, some anglers, usually fishing from shore, may rely to some degree on striped bass they catch for food. Additionally, the head and carcasses of larger striped bass often discarded by anglers after processing the fillet are highly sought after in some areas.

1.3.4 Non-Consumptive Factors

Catch and release fishing for striped bass is often considered a non-consumptive use of the striped bass resource. A large number of fishermen coastwide target striped bass with the intention of releasing all of the fish that are caught. This practice can take place during no-harvest (i.e., no-take) closures, but is not permitted during no-targeting closures. See *Section 1.3.2* for more details on the number of striped bass released alive.

1.3.5 Interactions with Other Fisheries

In the recreational fishery, anglers targeting striped bass may also be targeting species that commonly occur with striped bass. Or, striped bass anglers may incidentally interact with non-target species. The 2018 Benchmark Stock Assessment (NEFSC 2019) included analysis identifying recreational species that are commonly caught with striped bass in ocean waters (i.e., species that were intercepted at least 100 times over the entire time series) for each state based on private/rental boat trip data that occurred during Waves 3-5 for states from Maine through Virginia. A Jaccard coefficient was calculated for each species, with a higher coefficient indicating the species is caught more often with striped bass. For most states, bluefish or Atlantic mackerel had the highest Jaccard coefficient, meaning it was the species caught most often with striped bass in ocean waters.

Striped bass are caught as bycatch in non-striped bass commercial fisheries. The commercial discard estimates for striped bass incorporate estimated discards from non-striped bass fisheries based on tag return data.

1.4 HABITAT CONSIDERATIONS

1.4.1 Habitat Use and Migration Patterns

Migration of striped bass occurs at adult and juvenile stages. Adults migrate into rivers to spawn in turbulent fresh water upstream of the estuarine turbidity maximum (ETM) and as far as the Fall Zone (transition zone from Coastal Plain to Piedmont provinces) during spring (Greene et al., 2009). Afterwards, migratory adult striped bass return to the ocean, where they travel north along the coast in summer and fall, and south during the winter; non-migratory adult striped bass return downstream to estuarine waters but do not transit coastal waters during the summer, fall, and winter (Greene et al., 2009).

In general, juveniles migrate downstream in summer and fall. Juvenile striped bass migration varies by locations. In Virginia, the movement of young bass during their first summer is downstream into Chesapeake Bay waters of higher salinity (Setzler et al., 1980). In the Hudson River, striped bass begin migrating in July. Migration was documented through an increase in the number of juvenile striped bass caught along the beaches and subsequent decline in the numbers in the channel areas after mid-July. Downstream migration continues through late summer, and by the fall, juveniles start to move into Long Island Sound (Raney, 1952). The ASMFC Striped Bass Technical Committee tracks juvenile abundance, and cohort strength, through sampling to produce annual striped bass juvenile abundance indices (JAIs) in six different nursery areas.

Juvenile striped bass rarely complete coastal migrations. The presence of juveniles <20 cm (ages 0-1) in New Jersey's non-natal estuaries indicates some dispersal from Hudson River, Delaware Bay, and Chesapeake Bay (via C&D Canal) estuaries where they were spawned (Able et al., 2012). Many striped bass inhabiting rivers and associated estuaries undergo evacuation into coastal waters following extreme precipitation events that reduce water temperature, salinity, and dissolved oxygen (Bailey & Secor, 2016); events projected to increase in frequency and intensity due to climate change (USGCRP, 2017). In Chesapeake Bay 50% of females, who grow faster, emigrate to coastal waters by age 3 while a significant proportion of young males remain within the estuary (Kohlenstein, 1981); however, emigration cues are under debate and may be more a function of size than age (Secor et al., 2020). From Cape Hatteras (and in some years, Cape Lookout), North Carolina, to New England, fish may migrate in groups along the coast. They migrate north in the summer and south in the winter, however, the extent of the migration varies between sexes and populations (Hill et al., 1989). Larger bass, typically the females, tend to migrate farther distances. Striped bass historically were not usually found more than 6 to 8 km offshore (Bain & Bain, 1982). In the past decade, large schools have been moving between state waters and federal Exclusive Economic Zone (EEZ) waters during the year (Kneebone et al., 2014) and further offshore during the winter months (ASMFC, MDDNR, NCDMF and USFWS, unpublished data) well out into federal EEZ waters (e.g., 25-30 nm, or 46.3 to 55.6 km). These coastal migrations are not associated with spawning and usually begin in early spring, but this time period can be prolonged by the migration of bass that are spawning.

Some areas along the coast are used as wintering grounds for adult striped bass. Historically the inshore zones between Cape Henry, Virginia, and Cape Lookout, North Carolina, served as the wintering grounds for the migratory segment of the Atlantic coast striped bass population (Setzler et al., 1980). Geographic Information Systems (GIS) analysis of cooperative winter tagging cruise data from 1988-2013 did not detect a northward latitudinal shift in highest percent capture of striped bass, although occurrence of a longitudinal shift was not included in the analysis (Osborne, 2018). However, recent Atlantic coastal striped bass winter sampling coordinated by ASMFC indicated that overwintering striped bass have been encountered north of Chincoteague Inlet, Virginia to Ocean City, Maryland and in offshore areas entering the EEZ. There are three or more groups of fish that are found in nearshore ocean waters of North Carolina, Virginia, and Maryland between the months of November and March, the wintering period. These groups include striped bass from Albemarle and Pamlico Sounds, North Carolina, Chesapeake Bay, and Hudson River (ASMFC, MDDNR, NCDMF and USFWS, unpublished data); and of these, large striped bass spend the summer in New Jersey and north (Holland & Yelverton, 1973; Nelson et al., 2010; Pautzke et al., 2010). Based on tagging studies conducted under the auspices of ASMFC and the Southeast Area Monitoring and Assessment Program (SEAMAP) each winter since 1988, striped bass wintering off North Carolina, Virginia, and Maryland range widely up and down the Atlantic coast, at least as far north as Nova Scotia, and represent all major migratory stocks (US Fish and Wildlife Service, ASMFC, and partners, unpublished data).

1.4.2 Identification and Distribution of Habitat

1.4.2.1 Spawning and Egg Habitat

Striped bass spawn in fresh water or nearly fresh water of Atlantic coast rivers and estuaries. They spawn above the tide in mid-February in Florida but in the St. Lawrence River they spawn in June or July. The bass spawn in turbid areas as far upstream as 320 km from the tidal zone (Hill et al., 1989). The tributaries of the Chesapeake Bay are the primary spawning areas for the migratory stock of striped bass, but other major areas include the Hudson River, Delaware Bay, and the Roanoke River. Prior to spawning, females pause below the salt front (Hocutt et al., 1990) while eggs ripen and water temperature reaches 12-18 degrees Celsius (Secor, 2000) before continuing into freshwater reaches. Spawning is triggered by increased water temperature, occurs between 10 and 24 degrees Celsius, and generally peaks at temperatures between 14 and 19 degrees Celsius (Setzler et al., 1980). Spawning is characterized by brief excursions to the surface by females surrounded by males, accompanied by much splashing. Females release eggs in the water where fertilization occurs (Raney, 1952). Spawning occurs during all hours of day and night (Setzler et al., 1980). Striped bass spawning runs may be blocked when the concentration of total suspended solids exceeds 350 mg/L (Radtke & Turner, 1967).

An egg is only viable for about an hour for fertilization. Following fertilization, the fertilized eggs are spherical, non-adhesive, and semi-buoyant and will harden within one to two hours at 18 degrees Celsius (Hill et al., 1989). Survival of striped bass eggs is dependent on environmental conditions. In general, cooler and wetter winter and spring conditions are favorable. A temperature range of 17-19 degrees Celsius is important for egg survival as well as for maintaining appropriate dissolved oxygen levels (Bain & Bain, 1982), although they can tolerate a temperature range of 14-23 degrees Celsius (Mansueti, 1958). Eggs hatch from about 30 hours at 22 degrees Celsius to about 80 hours at 11 degrees Celsius (Hill et al., 1989). Eggs can tolerate dissolved oxygen levels down to 1.5 mg/L and salinities ranging from 0-10 ppt with 1.5-3 ppt being optimal (Mansueti, 1958). Water currents are an important factor for the survival of the eggs. Minimum water velocity of 30 cm/sec, from either current or tidal flow, is needed to keep the eggs suspended in the water column; the optimum flow rate is 100-200 cm/sec (Mansueti, 1958). An oil globule provides some buoyancy for the egg, and it is larger when water velocity is slower (Albrecht, 1964). Without the buoyancy, the eggs sink to the bottom, where the sediment may smother them. It is possible for the eggs to hatch if the sediment is course and not sticky or muddy, but survival is limited (Bayless, 1972). Suspended sediment loads ≥1,000 mg/L were lethal to striped bass eggs but were tolerant to loads of 0-500 mg/L (Auld & Schubel, 1978).

1.4.2.2 Larvae Habitat

There are three stages of larval development. These are: yolk-sac larvae, finfold larvae, and post-finfold larvae (Hill et al., 1989). The yolk-sac larvae occur right after hatching and the stage usually lasts for about 3 to 9 days. They are 2.0 to 3.7 mm in length and contain an easily identified yolk-sac. Yolk-sac larvae occur in open water at varying depths (Setzler et al., 1980). This phase is finished when the yolk-sac is absorbed. The finfold phase lasts for about 11 days and the striped bass reach a length of 12mm (Setzler et al., 1980). Occurrence of finfold larvae varied with time of day and depth (Hill et al., 1989). The last phase is the post-finfold larvae which lasts for about 20 to 30 days and the larvae reach a length of 20 mm (Bain & Bain, 1982). Post-finfold striped bass larvae are present at varying depths in open waters of estuaries.

Survival of the larvae depends on optimal conditions of three main factors: temperature, salinity, and dissolved oxygen. The optimal temperature for larvae is 18 to 21 degrees Celsius, but temperatures of 12 to 23 degrees Celsius can be tolerated (Bain & Bain, 1982). Studies have shown that striped bass larvae do better and have a higher survival rate when they are in low salinity waters (>0-15 ppt) rather than fresh water (Setzler et al., 1980). Abundance was highest in oligohaline portions of the St. Lawrence Estuary ETM zone; 60 times higher than in tidal fresh water and 330 times higher than in mesohaline ETM waters (Vanalderweireldt et al., 2019). The third factor, dissolved oxygen, is equally critical for larvae as it was for the egg stage. A reduction in the dissolved oxygen level reduces the chances of survival of the larvae (Turner & Farley, 1971), which have a lower limit of 3 mg/L (Chittenden, 1971). Poorly buffered rivers may have significant changes in pH. A pH of 5-6.5 in the absence of contaminants causes significant mortality to 11-13 day old fish and a pH of 5.5 is toxic to 159-day-old fish (Buckler et al., 1987). Another factor that influences the survival of striped bass larvae is turbulence. While at first it is necessary for the larvae to reside in turbulent waters to maintain position, the larvae quickly become motile and then are able to maintain position on their own (Doroshev, 1970). Optimum flow for larvae is 30-100 cm/sec although larvae can survive 0-500 cm/sec (Regan et al., 1968). Suspended sediment loads ≥500 mg/L had a significant negative effect on larval survival (Auld & Schubel, 1978).

1.4.2.3 Juvenile Habitat

Striped bass become juveniles at about 30 mm, when the fins are fully developed. At this point they resemble adults. Temperature tolerance for young-of-year striped bass 20-100 mm ranges from 10-30 degrees Celsius and 18-19 degrees Celsius is optimal (Bogdanov et al., 1967, as cited in Setzler, 1980). Salinity does affect striped bass' capacity to survive low temperatures. Young-of-year striped bass exposed to 5 degrees Celsius water had greater survival across a broad range of salinities (5-35 ppt); however, when exposed to 1 degree Celsius water young-of-year striped bass survival was greater within a narrower salinity range of 10-25 ppt (Hurst & Conover, 2002). Striped bass juveniles exhibit a warmwater fundamental temperature niche (Coutant, 2013); e.g., 80-270 mm (0.25-0.72 kg) fish selected 24-27 degree Celsius water (Coutant et al., 1984) and 430-626 mm (0.91-3.52 kg) fish occupied 20-24 degrees Celsius water

(Coutant & Carroll, 1980). Juveniles can tolerate water up to 30-33.5 degree Celsius provided there is sufficient dissolved oxygen (Coutant, 2013). As the juvenile bass grow, they migrate to nearshore areas and then to higher salinity areas of an estuary (Raney, 1952) usually remaining upstream of polyhaline waters (Able et al., 2012) optimally at 10-20 ppt (Bogdanov et al., 1967, as cited in Setzler, 1980). Young-of-year striped bass are less tolerant of low dissolved oxygen than larvae and egg, having a lower limit of 3 mg/l and optimally ≥6 mg/l (Bogdanov et al., 1967, as cited in Setzler, 1980). Juvenile striped bass often occupy waters having a clean sandy bottom, but they have also been found over gravel beaches, rock bottoms, and soft mud areas suggesting that they do not require specific microhabitat conditions (Bain & Bain, 1982; Hill et al., 1989). Association with emergent marsh banks is common throughout the year and especially during spring and fall and commonly with submerged channel embankments in summer (Able et al., 2012). They are usually found in schools of as many as several thousand fish. However, the location of the schools depends on the age of the fish (Hill et al., 1989) and season. Juveniles 21-46 cm (ages 2-5) were most abundant at depths of 5.5-9.1 m in New Jersey nearshore coastal waters (Able et al., 2012), but during winter in Chesapeake Bay juveniles are known to migrate into holes down to 30.5 m deep (Mansueti, 1954).

1.4.2.4 Adult Habitat

Mature adult striped bass in the migratory contingents leave the estuaries and migrate along the coast where they have lower temperature requirements and comparable dissolved oxygen requirements as juvenile bass (Bain & Bain, 1982). The fundamental thermal niche of striped bass ≥3.1 kg is cool water at 17.5 (mean) to 19 (mode) degrees Celsius (Bettoli, 2005). Temperatures 25-30 degrees Celsius could be tolerated for limited durations provided sufficient dissolved oxygen concentrations were present (>2 mg/l), although condition declined and higher mortality occurred for fish >10 kg (Coutant, 2013). Lower temperature boundary for activity is 0.1-1 degree Celsius; rapid temperature changes can be tolerated (Greene et al., 2009). Striped bass are tolerant of a broad range of salinities (0-35 ppt) and abrupt changes to salinity (Greene et al., 2009). Depths occupied range from 0.6-46 m although straying into deeper waters does occur (Greene et al., 2009). Tagging studies indicate that fish from all stocks range widely along the Atlantic coast, historically generally remaining in state (0-3 miles) waters but more recently in some areas entering the EEZ (3-200 miles; Kneebone et al., 2014; ASMFC, MDDNR, NCDMF and USFWS, unpublished data). GIS analysis of tagging data from 1988-2013 detected a 3-11 m vertical shift to deeper water and a shift to coarser sand grain size associated with the highest percent capture (Osborne, 2018). While in coastal and estuarine waters, striped bass are associated with a variety of habitats including substrates composed of sand, gravel, rock, boulder, eelgrass, and mussel beds; subsurface features such as sand bars, troughs, gullies, and shallow bays; floating rockweed; sandy and rocky shorelines; and in the surf zone (Greene et al., 2009).

1.4.3 Chemical, Biological, and Physical Threats to Striped Bass and Their Habitat

Residual chlorine; chlorinated hydrocarbons such as PCBs; monocyclic aromatic hydrocarbons such as benzene; and metals such as, copper, zinc, cadmium, mercury, and aluminum are known to be toxic to life history stages of striped bass. Residual chlorine causes 50% mortality in eggs when the concentration is 0.22 ppm, and there is 50% mortality in larvae when the concentration is 0.20 ppm (Hill et al., 1989). Chlorine was also observed to be a predominant factor in egg mortality by Hall et al. (1981). Ozone is an effective substitute for chlorine to reduce fouling (Marine Research Incorporated, 1976). Studies have shown that ozone has a detrimental effect on striped bass eggs (Kosak-Channing & Helz, 1979). Eggs exposed to 0.05 mg/L and 0.10 mg/L of ozone in an estuarine environment were delayed in hatching, but only 70% of the eggs hatched in fresh water under the expected time frame. There was 6% mortality when the eggs were exposed to 0.06 mg/L of ozone for 12 hours, but there was 100% mortality when they were exposed for 36 hours. Effects of ozone and chlorine on striped bass eggs are comparable in estuarine waters, but ozone can have more of an effect if discharged in fresh water located near striped bass spawning areas (Hall et al., 1981). Exposure to sublethal levels of benzene for 24 hours increases the respiratory rates of juveniles and if they are exposed for longer periods of time, reversible narcosis can occur (Brocksen & Bailey, 1973). Chronic exposure to benzene can also result in difficulty locating and consuming prey (Korn et al., 1976). When striped bass are exposed to 6.9 ppm of benzene for 24 hours there is 50% mortality in juveniles (Benville & Korn, 1977). Copper and zinc have an effect on yolk-sac larvae, but eggs are unaffected by these metals. Juveniles can develop lesions in their gill tissue as well as impaired respiration when they are exposed to cadmium and mercury. Low pH increases the toxicity of aluminum (Rago, 1992) and high aluminum levels can severely alter epidermal microridge structures in larvae (Rulifson et al., 1986).

Increased attention is focused on emerging contaminants such as endocrine disruptors (pharmaceuticals, pesticides, industrial compounds, and personal care products), microplastics, and automotive derived compounds. Endocrine disruption of striped bass has not been studied; however, it is known to cause increased disease susceptibility, intersex (Blazer et al., 2007), and altered sexual development (Oberdörster & Oliver, 2001) in fishes. Microplastics are known to enter trophic pathways through ingestion (Au et al., 2017; Bergmann et al., 2015; Bour et al., 2020; Parker et al., 2020) as are nanoplastics through inhalation and gill uptake (Tetra Tech, 2020). Modeling efforts are underway to understand trophic pathways of microplastics exposure and accumulation in striped bass; however, study of potential physiological and behavioral effects is lacking (Tetra Tech, 2020). Striped bass response to automotive derived contaminants has not been studied, although road runoff has the capacity to cause abnormal behavior and physiological change (Chow et al., 2019; McIntyre et al., 2018).

Historically, physical threats to striped bass habitat were attributed to channelization, creation of dams, and land reclamation. In coastal regions, 50% of the original estuarine areas important to striped bass have been lost to filling, road construction, or real estate development (Clark, 1967; Kennish, 2002). In the South Atlantic region, dams restrict the upstream migration on the Roanoke, Tar, Neuse, and Pee Dee rivers (Baker, 1968). Efforts have been undertaken to restore access to historical striped bass spawning habitats through the provision of fishways or through removal of impediments to migration. Contemporary threats to striped bass access to spawning and nursery habitat include alteration of river flow regime by consumptive uses such as agriculture and manufacturing as well as dam operation (Cimino et al., 2009). Furthermore, access to aquatic habitats is largely driven by precipitation. Elevated spring precipitation and river flow increases volume of spawning and nursery habitat available to striped bass (Secor et al., 2017). Heavy winter and spring precipitation events in the northeast and eastern US continue to increase in frequency and intensity coupled with a northward shift in the rain-snow transition zone (USGCRP, 2017).

Change in water temperature may be localized such as from industrial discharge or regional resulting from climate change. The localized heated water discharged from many power plants can cause thermal shock in the fish with the severity depending on the life stage (Schubel et al., 1976). Eggs are more sensitive and subject to greatly mortality from the high temperatures. Larvae and juveniles decrease in their susceptibility as they grow older, and there is not usually higher than 50% mortality of thermal shock in adults (Hill et al., 1989). Regionally, climate change has the potential to alter temperature and precipitation dynamics which directly affects timing of spawning migration as well as survival, growth, and habitat suitability throughout the year. In Chesapeake Bay, spawning female striped bass migration was earlier when spring water temperature was warmer (~3 days per 1 degree Celsius increase); this trend was more evident for larger females (Peer & Miller, 2014). Model projections for Hudson River spawning indicate occurrence up to 15 days earlier (Nack et al., 2019). Suitable temperatures, precipitation and flow, and prey availability directly affect larval striped bass survival (Martino & Houde, 2010; Millette et al., 2019); the temporal and spatial match of which are subject to disruption by climate change (Cimino et al., 2009). Increased winter temperatures may facilitate feeding efficiency, increase growth, and improve juvenile overwinter survival (Cimino et al., 2009); conversely warming of summer estuarine waters subjected to decreased dissolved oxygen will reduce available juvenile and adult summer habitat (Constantini et al., 2008). Striped bass occupied normoxic Patuxent River (Chesapeake Bay) waters at supraoptimal temperatures up to 31 degrees Celsius because of higher growth rate potential within the tributary (Kraus et al., 2015). The disease mycobacteriosis coupled with elevated summer sea surface temperature (>26 degree Celsius) appears to have a negative effect on striped bass survival in Chesapeake Bay (Groner et al., 2018). Climate warming conditions that raise estuarine and riverine surface water temperatures above 28 degrees Celsius concurrent with hypoxic bottom waters would expose striped bass to annual summer temperature-oxygen squeeze conditions that could limit growth and production (Constantini et al., 2008).

Since colonial times, conversion of forests and wetlands to agricultural, suburban, and urban uses has contributed to increased eutrophication and resultant hypoxic and anoxic conditions in the Chesapeake Bay watershed (Brush, 2009; Kemp et al., 2005) as has happened in many other watersheds. Hypoxic coastal waters reduce the extent of suitable fish habitat. Temperature-oxygen squeeze habitat conditions have been observed in Chesapeake Bay during summer and fall and where striped bass sought to avoid waters >27 degrees Celsius (Itakura et al., 2021). Hypoxia is common in coastal waters receiving inputs of anthropogenic derived nutrients (Hagy et al., 2004); particularly when those waters have strong density stratification, low tidal energy, and high surface temperatures during seasons where oxygen levels are already low (Breitburg, 2002). A contributing factor to hypoxia is the extent of impervious surface within the watershed where increases in impervious surface are associated with increased probability of hypoxic waters and reduced likelihood of young-of-year striped bass presence (Uphoff et al., 2011). In

Chesapeake Bay, the volume of suitable juvenile and adult striped bass summer habitat has contracted as the volume of hypoxic water has increased (Cimino et al., 2009). Expansive hypoxia coupled with warming water temperatures due to climate change will further reduce future summer habitat available to striped bass (Coutant, 1990).

Conversion of forested and wetland areas to agricultural, suburban, and urban uses are known to affect aquatic systems through increase of factors such as runoff volume and intensity; physical instability, erosion, and sedimentation; thermal pollution; contaminant loads including endocrine disruptors and microplastics; road salt; nutrients through nonpoint and direct discharges, sewage leaks and spills, and stormwater runoff; and disruption of organic matter dynamics. Watershed development associated with urban sprawl and population growth has resulted in significant impairment of striped bass habitat in Chesapeake Bay due to sedimentation, eutrophication, contaminants, flow alteration, and thermal pollution (Cimino et al., 2009). Increased urbanization is associated with increased mobilization of contaminants in runoff (Kaushal et al., 2020) which will be exacerbated by increasingly common and intense rain events. Percent impervious surface is a commonly used indicator of watershed development whereby 10% is a threshold for aquatic ecosystem deterioration (Cappiella & Brown 2001; Beach 2002). In essence, a watershed's percent impervious surface is a catchall index of aquatic habitat condition. Watershed percent impervious surface has been used to assess suitability of striped bass spawning and nursery habitat in Chesapeake Bay tributaries (Uphoff et al., 2011; Uphoff et al., 2020).

1.4.4 Habitat Management as an Element of Ecosystem Management

Migratory striped bass require a broad geographic range to complete their life cycle; consequently, the ecosystems used are vast and variable and the cooperative management approach embodied by ASMFC is necessary. Attempts to incorporate ecosystem management into fisheries management are increasing. Ecosystem management can be interpreted as a) the consideration of how the harvest of one species might impact other species in an ecosystem and incorporating that relationship in management decisions and b) the incorporation of the protection and enhancement of habitat features that contribute to fish production into the fishery management process. While the implementation of multispecies management is increasingly common, incorporation of habitat condition in the management framework and decision-making process is rare.

Biologists, fisheries managers, and fishermen all recognize that habitat quality is one of the keys to maintaining and improving fish stocks for harvest. Increasing demands for seafood and recreation requires that fisheries regulations provide for maximizing yield, minimizing bycatch, and rebuilding and maintaining adequate spawning stocks. Effective fishery management requires more than issuing regulations governing sizes, seasons and catch limits. Degraded habitat negatively affects aquatic communities necessary to support fish life, reduces levels of fish, and inhibits management to provide adequate fish for food or recreational experiences.

Fisheries managers recognize that provisions must be made for agriculture, housing, commerce, and transportation that support our present and growing population; however, components of an unaltered watershed including forested uplands, wetlands, and tidal and nontidal streams are integral for maintaining suitable fish habitat. By 2020 the terrestrial portions of Chesapeake Bay watershed comprised 17% actively used for agriculture, 11% had been developed, and 60% was forested (Chesapeake Conservation Partnership, 2020). These watershed wide percentages are not uniformly distributed among spawning tributaries. For example, the Potomac River is estimated at 26% agriculture and 26% developed, the Choptank River is estimated at 48% agricultural and 10% developed, and the James River is estimated to be 14% agricultural and 11% developed (Chesapeake Bay Program as cited in Chesapeake Bay Foundation, 2021). Population within the Chesapeake Bay watershed will increase from 18 million in 2020 to a projected 22.5 million by 2050 and with it an estimated additional 570,000 acres or 1.3% of land area converted to developed land (Chesapeake Conservation Partnership, 2020). Inherent in land development is increased impervious surface, its veritable permanence, and resultant exacerbation of chemical, biological, and physical threats to striped bass habitat. As ecosystems are altered, production of coastal fishery resources is typically reduced.

Habitat management, as a tool of fisheries management, was traditionally practiced by installation and manipulation of physical structures in the water for the benefit of aquatic life, remediation of point source pollution, removal of stream blockages, and planting of streamside trees. These traditional practices have demonstrated benefit and continue to be employed. However, fisheries management must consider the myriad of impacts that result from land use change and implement environmental protection and restoration activities outside the traditional scope of fish management.

At the federal level, the coastal Regional Fisheries Management Councils' fisheries management plans (FMPs) and federal EEZ FMPs all now are required to define Essential Fish Habitat (EFH) including Habitat Areas of Particular Concern (HAPC) and to be proactive in protecting it. A report to Congress by an Ecosystems Principles Advisory Panel, Ecosystem-Based Fishery Management (1999), recommended that Regional Management Councils develop Fisheries Ecosystem Plans that recognizes the interrelationships between species and the habitat needs of the managed species. The ASMFC FMP process has habitat protection as one of its objectives (ASMFC 2019). Each of the cooperating states of the ASMFC should incorporate habitat protection recommendations in its state waters as an element of their fisheries management framework. However, state fisheries management agencies often lack jurisdiction to mandate measures to protect and conserve fish habitat. Variously named state and county departments of natural resources, environment, coastal resources, and health have the primary responsibilities for programs that protect, promote, and enhance environmental quality for residents and living resources. Fisheries management agencies must integrate their fish production objectives with activities of these habitat management agencies. For example, North Carolina has mandated the preparation and implementation of a Coastal Habitat Protection Plan, which requires the collaboration of the state's Coastal Management, Environmental Management, and Marine Fisheries commissions.[2] Active involvement of fisheries management agencies in strategic planning, application of regulatory controls and permits that feature protection of environmental quality, and production of fish as objectives can provide for human needs while minimizing the impact on ecosystems.

1.5 IMPACTS OF THE FISHERY MANAGEMENT PROGRAM

1.5.1 Biological and Ecological Impacts

Addressing recreational release mortality through seasonal closures, gear restrictions, and/or education and outreach may reduce the number of striped bass released alive (through seasonal closures) or may increase the chance of survival of striped bass caught and released in the recreational fishery (through gear restrictions and education/outreach). Some seasonal closures could offer additional benefit to the stock by reducing effort during seasons associated with higher post-release mortality rates or by protecting spawning or pre-spawn fish, which could contribute to stock rebuilding. Changes to the management triggers may affect how quickly and how often the F rate, which is the rate at which striped bass are dying because of fishing, is adjusted.

1.5.2 Social and Economic Impacts

Changes in gear restrictions, in spatial or seasonal closures, bag and size limits, and other effort controls affect important attributes of a recreational fishing trip, such as the number of fish of each species that anglers catch and are allowed to keep. In turn, these changes in trip attributes will modify the utility (i.e., level of satisfaction) an angler expects to obtain from the fishing trip (McConnell et al. 1995, Haab and McConnell 2003). As a result, the angler may shift target species, modify trip duration or location, or decide not to take the trip and do something else instead. These behavioral responses lead to changes in directed fishing effort, with accompanying changes in harvest, fishing mortality, and angler welfare. This is, however, only a short-term response and stock dynamics will dictate any longer-term effects on the resource, which may subsequently feedback and affect future management decisions and angling behavior.

Assessing the fishery impacts and potential success of proposed policy measures requires a predictive model that links angler participation and decision-making to changes in management measures, stock levels, and fishing conditions. When data describing angler trip-taking, species targeting, and/or harvest decisions are available, fisheries economists can utilize bioeconomic models to assess the impact of changes in regulation on recreational fishing. Bioeconomic models seek to assess the total effect of changes in policy, immediate and future.

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[2] See https://deq.nc.gov/about/divisions/marine-fisheries/public-information-and-education/habitat-information/chpp for more information.

Bioeconomic models combine an economic sub-model with a biological sub-model, which are linked via the impact of angler behavior and fishing mortality on stock dynamics. The integrated model is characterized by two-way feedback loops between fish stocks and angler decision-making in terms of participation, species targeting, and harvest. The number of trips, angler preferences for harvest and release, stock sizes, and regulations jointly determine fishing mortality which, in turn, impacts both future stock levels and future recreational fishing outcomes (Jarvis 2011, Lee at al. 2017). The economic sub-model uses anglers' preferences for different trip attributes to derive anglers' demand for recreational trips under alternative policy scenarios. The biological sub-model, typically an age-structured or size-structured population dynamics model in discrete time, specifies the effect of recreational fishing on the future structure and abundance of the population. Before conducting simulations under alternative policy scenarios, the integrated bioeconomic model can be calibrated such that the number of predicted trips under existing regulations corresponds to MRIP effort estimates (Lee at al. 2017, Holzer and McConnell 2017). The use of bioeconomic simulations allows for a wide range of analyses regarding policy options, often including novel regulatory alternatives, and provides both expected outcomes, in terms of stock abundances and angler welfare, as well as confidence levels around these outcomes.

Recent research into striped bass anglers' preferences and behavior illustrates the connection between regulatory policies and fishing effort while also providing information that could be used to operationalize a bioeconomic model for striped bass management in the future.

Murphy et al. (2019) surveyed striped bass anglers from Massachusetts, Connecticut, Virginia, and North Carolina, collecting data on angler motivations, attitudes, behavior and responses to alternative policy measures. The authors found that changes in size and bag limits led to changes in trip-taking, species targeting, and harvest decisions; these changes in behavior were correlated with angler characteristics such as consumptive orientation (i.e., different attitudes toward catching fish, keeping fish, catching large numbers of fish, and catching trophy fish) and that attitudes; and motivations of striped bass anglers were considerably diverse.

Carr-Harris and Steinback (2020) developed an angler behavioral model using stated preference choice experiment data collected from striped bass anglers from Maine through Virginia. The model was used to simulate trip-taking, harvest decisions, fishing mortality, and angler welfare across a range of alternative policy measures for anglers in Massachusetts, Rhode Island, and Connecticut, incorporating the impacts of fish size on angler behavior, utility, and resulting size- and sex-specific fishing mortality. The authors found that the range of economically efficient policies (i.e., policies that maximize angler welfare for a given level of recreational fishing mortality) was broad if managers were concerned with controlling recreational fishing mortality only, though considerably narrower if protecting female spawning stock was instead the primary management objective. Carr-Harris and Steinback (2020) note their behavioral model could be extended geographically and combined with a population dynamics sub-model to form an integrated bioeconomic model that would be capable of assessing feedbacks and long-run impacts of management decisions on anglers and the striped bass resource. Such an integrated model would allow the ASMFC to estimate the impact of alternative policy options, as currently done by the New England Fishery Management Council for the cod and haddock recreational fishery (Lee et al. 2017) (see *Section 6.3 Socio-Economic Research Needs*).

1.5.2.1 Striped Bass Fisheries and the Economy

A 2019 report from Southwick Associates[3] indicates 97% of the economic impacts associated with striped bass fishing came from the recreational sector in 2016. According to the report, total revenues in the commercial sector (from Maine to North Carolina) were $19.8 million that year, while total expenditures in the recreational sector amounted to $6.3 billion. The contribution of the commercial sector to the region's gross domestic product (GDP), when attempting to account for all industries involved in harvesting, processing, distributing, and retailing striped bass to consumers, was $103.2 million and supported 2,664 regional jobs. In comparison, the contribution of the recreational sector to the region's GDP was $7.7 billion and supported 104,867 jobs. Importantly, the report acknowledges that it is not intended to be used to set fishery regulations, but rather to demonstrate the economic significance of striped bass to local economies. It should also be noted that these numbers are for the entire region and actual economic impacts are expected to vary by state.

The dollar values above refer to economic impacts, not to the economic value (or net economic benefit for society) associated with the recreational and commercial fisheries. While data required to quantify these measures are not currently available, the effects of changes to the striped bass management program for recreational sector can be qualified as follows: further limitations on the size and number of fish that can be kept can lead to increased effort to retain a legal-sized fish and an increase in dead releases. Conversely, increased fishing restrictions could result in a reduction in number of recreational trips which could translate into a reduction in angler welfare. However, as in the case of the economic impacts (and assuming increased restrictions do not permanently deter stakeholders from the striped bass fishery), these effects are expected to be outweighed by the positive effects on anglers', harvesters', and consumers' welfare associated with stock recovery in successive years.

2.0 GOALS AND OBJECTIVES

2.1 HISTORY OF MANAGEMENT

Atlantic striped bass (*Morone saxatilis*) have supported valuable commercial and recreational fisheries on the U.S. Atlantic coast for centuries. The Commission coordinates interstate management of the species in state waters (0-3 miles from shore), while management authority in the exclusive economic zone (3-200 miles) lies with NMFS. The first Interstate FMP for the species was approved in 1981 in response to poor juvenile recruitment and declining landings. The FMP recommended increased restrictions on commercial and recreational

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[3] While this is a useful source of updated information, it is not peer-reviewed and, therefore, the methods behind the report's figures should be considered accordingly.

fisheries, such as minimum size limits and harvest closures on spawning grounds. Two amendments were passed in 1984 recommending additional management measures to reduce F. To strengthen the management response and improve compliance and enforcement, the Atlantic Striped Bass Conservation Act (P.L. 98-613) was passed in late 1984. The Striped Bass Act mandated the implementation of striped bass regulations passed by the Commission and gave the Commission authority to recommend to the Secretaries of Commerce and Interior that states be found out of compliance when they failed to implement management measures consistent with the FMP.

The first enforceable plan under the Striped Bass Act, Amendment 3, was approved in 1985, and required size regulations to protect the 1982 year class—the first modest size cohort since the previous decade. The objective was to increase size limits to allow at least 95% of the females in the 1982 year class to spawn at least once. Smaller size limits were permitted in producer areas than along the coast. Several states opted for a more conservative approach and imposed a total moratorium on striped bass landings for several years. The amendment contained a trigger mechanism to relax regulations when the 3-year moving average of the Maryland juvenile abundance index (JAI) exceeded an arithmetic mean of 8.0. This was attained with the recruitment of the 1989 year class and led to the development of Amendment 4. Also, in 1985, the Commission determined the Albemarle Sound-Roanoke River (Albemarle-Roanoke) stock in North Carolina contributed minimally to the coastal migratory population, and was therefore allowed to operate under an alternative management program.

Amendment 4, implemented in 1989, aimed to rebuild the resource rather than maximize yield. The amendment allowed state fisheries to reopen under an interim target fishing morality (F) of 0.25, which was half the estimated F needed to achieve maximum sustainable yield (MSY). The amendment would allow an increase in the target F (0.5) once female SSB was restored to levels estimated during the late 1960s and early 1970s. The dual size limit concept was maintained (28” coastal versus 18” producer areas), and a recreational trip limit and commercial season was implemented to reduce the harvest to 20% of that during 1972-1979. A series of four addenda were implemented from 1990-1994 to maintain protection of the 1982 year class through sequentially higher minimum size limits which reached 34” along the coast by 1994.

In 1990, to provide additional protection to striped bass and ensure the effectiveness of state regulations, NMFS adopted a prohibition on possession, fishing (catch and release fishing), harvest, and retention of Atlantic striped bass in the Exclusive Economic Zone (EEZ), with the exception of a defined transit zone within Block Island Sound (55 Federal Register 40181-02). Atlantic striped bass may be transported through this defined area provided that the vessel is not used to fish while in the EEZ and the vessel remains in continuous transit, and that the fish were legally caught in adjoining state waters. The EEZ has remained closed since 1990. In addition, an Executive Order issued in 2017 prohibits the sale of striped bass caught from the EEZ.

In 1995, the Atlantic striped bass migratory stock was declared recovered by the Commission (the Albemarle-Roanoke stock was declared recovered in 1997 and the Delaware River stock was declared recovered in 1998) and Amendment 5 was adopted to increase the target F to 0.33, midway between the existing F target (0.25) and F_{MSY}. Target F was allowed to increase again to 0.40 after two years of implementation. Regulations were developed to achieve the target F, which included measures to restore commercial harvest to 70% of the average landings during the 1972-1979 historical period, and recreational season, possession (two fish), and size limits (a return to 28" on the coast and 20" for producer areas). States were allowed to submit proposals to implement alternative regulations that were deemed conservationally equivalent to the Amendment 5 measures, provided no size limits were below 18". From 1997-2000[4], a series of five addenda were implemented to respond to the latest stock status information and adjust the regulatory program to achieve each change in target F.

In 2003, Amendment 6[5] was adopted to address five limitations within the existing management program: 1) potential inability to prevent the Amendment 5 exploitation target from being exceeded; 2) perceived decrease in availability or abundance of large striped bass in the coastal migratory population; 3) a lack of management direction with respect to target and threshold biomass levels; 4) inequitable effects of regulations on the recreational and commercial fisheries, and coastal and producer area sectors; and 5) excessively frequent changes to the management program.

Amendment 6 modified the F target and threshold, and introduced a new set of biological reference points (BRPs) based on female SSB, as well as a list of management triggers based on the BRPs. The F threshold value was set to achieve MSY and the F target was set to provide a higher long-term yield from the fishery and adequate protection to ensure that the striped bass population is not reduced to a level where the spawning potential is adversely affected. The F target provided a buffer to account for the uncertainty in the estimate of F_{MSY} threshold. The female SSB threshold value was set equal to the female SSB value in 1995, the year that the striped bass stock was declared rebuilt, while the SSB target was set to 125% of the SSB threshold. New management measures were selected based on the F target.

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[4] The 1997 reauthorization of the Striped Bass Act also required the Secretaries of Commerce and Interior provide a biennial report to Congress highlighting the progress and findings of studies of migratory and estuarine Striped Bass. The tenth such report was recently provided to Congress (Shepherd et al. 2020).

[5] While NMFS continues to implement a complete ban on the fishing and harvest of striped bass in the EEZ, Amendment 6 includes a recommendation to consider reopening the EEZ to striped bass fisheries. In September 2006, NMFS concluded that it would be imprudent to open the EEZ to striped bass fishing because it could not be certain that opening the EEZ would not lead to increased effort and an overfishing scenario. In 2018, the Consolidated Appropriations Act directed NMFS (in consultation with ASMFC) to review the federal moratorium once the 2018 Benchmark Stock Assessment was completed, and consider lifting the ban, however, there has not been any update from NMFS on this directive.

The coastal commercial quotas were restored to 100% of the states' average landings during the 1972-1979 historical period, except for Delaware's coastal commercial quota which remained at the level allocated in 2002[6]. For the recreational fisheries, a two-fish bag limit with a minimum size limit of 28 inches was established, except for the Chesapeake Bay fisheries and North Carolina fisheries that operate in the Albemarle-Roanoke. The Chesapeake Bay and Albemarle-Roanoke regulatory programs were predicated on a more conservative F target than the coastal migratory stock, which allowed these states/jurisdictions (hereafter states) to implement separate seasons, harvest caps, and size and bag limits as long as they remained under that F target. Additionally, states were permitted the flexibility to deviate from the coastwide regulations by submitting CE proposals. No minimum size limit could be less than 18 inches under Amendment 6. The same minimum size standards regulated the commercial fisheries as the recreational fisheries, except for a minimum 20 inch size limit in the Delaware Bay spring American shad gillnet fishery.

Five addenda to Amendment 6 have been implemented. Addendum I, approved in 2007, established a bycatch monitoring and research program to increase the accuracy of data on striped bass discards and recommended development of a web-based angler education program. Addendum II was approved in 2010 and established a new definition of recruitment failure such that each index would have a fixed threshold rather than a threshold that changes annually with the addition of each year's data. Addendum III was approved in 2012 and requires all states with a commercial fishery for striped bass to implement a uniform commercial harvest tagging program. The Addendum was initiated in response to significant poaching events in the Chesapeake Bay and aims to limit illegal harvest of striped bass.

Addendum IV was triggered in response to the 2013 Benchmark Stock Assessment, which indicated a steady decline in SSB since the mid-2000s to the point of approaching the SSB threshold in the terminal year. The Addendum established new F reference points, including the elimination of Chesapeake Bay stock-specific reference points due to modeling limitations, and changed commercial and recreational measures to reduce F to a level at or below the new target. While the 1995 female SSB level had proved to be a useful reference point for striped bass, fishing at (and even below) the F_{MSY} target reference point did not maintain female SSB at the 1995 level. To address this issue, the 2013 Benchmark Stock Assessment recommended new F reference points that would maintain SSB at or above its 1995 level which Addendum IV adopted. Chesapeake Bay fisheries were required to implement lower reductions than coastal states (20.5% compared to 25%) since their fisheries were reduced by 14% in 2013 based on their management program; however, this included replacing the Bay's variable commercial harvest cap (based on exploitable biomass) with a fixed level based on reducing 20.5% from the 2021 harvest. Along the coast, the measures included 25% coastal commercial quota reductions

[6] The decision to hold Delaware's commercial quota at the 2002 level was based on tagging information that indicated F on the Delaware River/Bay stock was too high, and uncertainty regarding the status of the spawning stock for the Delaware River/Bay.

and a 1-fish limit and 28” minimum size for recreational fisheries. The addendum maintained the flexibility to implement alternative regulations through the CE process, which resulted in some variety of regulations among states. All states promulgated regulations prior to the start of their 2015 seasons.

In February 2017, the Board initiated development of Draft Addendum V to consider liberalizing coastwide commercial and recreational regulations. The Board’s action responded to concerns raised by Chesapeake Bay jurisdictions regarding continued economic hardship endured by its stakeholders since the implementation of Addendum IV and information from the 2016 stock assessment update indicating that F was below target in 2015, and that total removals could increase by 10% to achieve the target F. However, the Board chose to not advance the draft addendum for public comment largely due to harvest estimates having increased in 2016 without changing regulations. Instead, the Board decided to wait until it reviewed the results of the 2018 Benchmark Stock Assessment (NEFSC 2019) before considering making changes to the management program.

Addendum VI was initiated in response to the 2018 Benchmark Stock Assessment which indicated the stock was overfished and experiencing overfishing in 2017. Approved in October 2019, the Addendum aimed to reduce total removals by 18% relative to 2017 levels in order to achieve the F target in 2020 and begin rebuilding the stock. Specifically, the Addendum reduced all state commercial quotas by 18%, and implemented a 1 fish bag limit and a 28”to less than 35” slot limit for ocean fisheries and a 1 fish bag limit and an 18” minimum size limit in Chesapeake Bay to reduce total recreational removals by 18% in both regions. The Addendum’s measures were designed to apply the needed reductions proportionally to both the commercial and recreational sectors, although states were permitted to submit alternative regulations through CE that achieve an 18% reduction in total removals statewide. The Board reviewed and approved management options, including CE programs (Table 7), for 2020 on a state-by-state basis in February, and all states promulgated regulations by April 1 (Tables 5-6).

Addendum VI also required the mandatory use of circle hooks when fishing with bait to reduce release mortality in recreational striped bass fisheries. States are encouraged to promote the use of circle hooks through various public outreach and education platforms to garner support and compliance with this important conservation measure. Circle hook regulations were required to be implemented no later than January 1, 2021. In March 2021, the Board approved a clarification on the definition of bait and methods of fishing that require circle hooks. The Board also approved guidance on how to address incidental catch of striped bass when targeting other species with non-circle hooks with bait attached.[7]

[7] This guidance on incidental catch could not be implemented as a compliance criterion since incidental catch was not originally part of Addendum VI.

2.2 PURPOSE AND NEED FOR ACTION

The purpose of Amendment 7 is to update the management program to align with current fishery needs and priorities given the status and understanding of the resource and fishery has changed considerably since implementation of Amendment 6 in 2003. The Board intends for this amendment to build upon the Addendum VI action to end overfishing and initiate rebuilding in response to the overfished status.

The Board-approved 2018 Benchmark Stock Assessment indicated the striped bass stock is overfished and experiencing overfishing relative to the updated reference points defined in the assessment. By accepting the assessment for management use in 2019, two management triggers were tripped requiring the Board to take action to address both the overfishing and overfished status. Addendum VI was implemented in 2020 to address the overfishing status by implementing measures to reduce F back to the F target in 2020. To address the overfished status, the Board must adjust the striped bass management program to rebuild the biomass to the target level by no later than 2029 (within 10 years). Addendum VI measures are expected to contribute to stock rebuilding.

Amendment 7 consolidates Amendment 6 and its associated addenda into a single document, and establishes new requirements for the following components of the FMP: management triggers, conservation equivalency, additional measures to address recreational release mortality, and the stock rebuilding plan.

Amendment 7 also maintains the same recreational and commercial measures specified in Addendum VI to Amendment 6, which were implemented in 2020. As such, all approved Addendum VI CE programs and state implementation plans are maintained until such measures are changed in the future. A stock assessment update is expected in October 2022, which will determine whether management measures need to be changed to achieve stock rebuilding by the 2029 deadline.

2.3 GOAL

The goal of Amendment 7 to the Interstate Fishery Management Plan for Atlantic Striped Bass is to perpetuate, through cooperative interstate fishery management, migratory stocks of striped bass; to allow commercial and recreational fisheries consistent with the long-term maintenance of a broad age structure, a self-sustaining spawning stock; and also to provide for the restoration and maintenance of their essential habitat.

2.4 OBJECTIVES

In support of this goal, the following objectives are specified:

1. Manage striped bass fisheries under a control rule designed to maintain stock size at or above the target female spawning stock biomass level and a level of fishing mortality at or below the target exploitation rate
2. Manage fishing mortality to maintain an age structure that provides adequate spawning potential to sustain long-term abundance of striped bass populations
3. Provide a management plan that strives, to the extent practical, to maintain coastwide consistency of implemented measures, while allowing the states defined flexibility to implement alternative strategies that accomplish the objectives of the FMP
4. Foster quality and economically-viable recreational, for-hire, and commercial fisheries
5. Maximize cost effectiveness of current information gathering and prioritize state obligations in order to minimize costs of monitoring and management
6. Adopt a long-term management regime that minimizes or eliminates the need to make annual changes or modifications to management measures
7. Establish a fishing mortality target that will result in a net increase in the abundance (pounds) of age 15 and older striped bass in the population, relative to the 2000 estimate

2.5 MANAGEMENT UNIT

The management unit includes all coastal migratory striped bass stocks on the East Coast of the United States, excluding the exclusive economic zone (3-200 nautical miles offshore), which is managed separately by NMFS. The coastal migratory striped bass stocks occur in the coastal and estuarine areas of all states and jurisdictions from Maine through North Carolina. Inclusion of these states in the management unit is also congressionally mandated in the Atlantic Striped Bass Conservation Act (PL 98-613).

2.5.1 Chesapeake Bay Management Area

The Chesapeake Bay management area is defined by the striped bass residing between the baseline from which the territorial sea is measured as it extends from Cape Henry to Cape Charles to the upstream boundary of the fall line. Unlike the Albemarle Sound-Roanoke River stock, the striped bass in the Chesapeake Bay are unquestionably part of the coastal migratory stock and are assessed as part of the coastal migratory striped bass management unit. However, Amendment 7 implements a separate management program for the Chesapeake Bay due to the size availability of striped bass in this area.

2.5.2 Albemarle Sound-Roanoke River Management Area

The Albemarle Sound-Roanoke River (Albemarle-Roanoke) stock is currently assessed and managed separately by the State of North Carolina under the auspices of ASMFC.[8] The Albemarle-Roanoke management area is defined by the striped bass inhabiting the Albemarle, Currituck, Croatan, and Roanoke Sounds and their tributaries, including the Roanoke River. The Virginia/North Carolina line bound these areas to the north and a line from Roanoke Marshes Point to the Eagle Nest Bay bounds the area to the south. The Bonner Bridge at Oregon Inlet defines the ocean boundary of the Albemarle-Roanoke management area.

The Albemarle-Roanoke stock is not included in the coastwide assessment and management program because it contributes minimally to the coastal migratory stock. The Albemarle-Roanoke stock is smaller in total abundance relative to the other producer areas and does not participate in the coastal migration until older ages. The female maturation schedule for the Albemarle-Roanoke stock is also different than the Chesapeake Bay stock (ASMFC 2013; NCDMF 2014). The Technical Committee (TC) will continue to monitor the contribution of the Albemarle-Roanoke stock to the coastal migratory population and make recommendations to the Board regarding future management.

2.6 REFERENCE POINTS

The current status of the Atlantic striped bass stock will be determined with respect to its biological reference points through the stock assessment. Amendment 7 maintains the previously existing reference point definitions from Amendment 6, as modified by Addendum IV, for female spawning stock biomass (SSB) and fishing mortality rate (F).

2.6.1 Definition of Overfishing and Overfished

A common approach in fisheries management for evaluating the need for management action as determined by stock status is through the use of a control rule. For striped bass, the control rule is based on the level of: 1) F and 2) SSB. Overfishing is defined relative to the rate of removals from the population, as determined by the F on the stock, whereas overfished status is defined relative to female SSB. For striped bass, the threshold levels of F and SSB are used to determine overfishing and overfished status, respectively. If F exceeds the F threshold, overfishing is occurring, and if SSB falls below the SSB threshold, the stock is overfished.

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[8] Estuarine striped bass in North Carolina are currently managed under Amendment 1 to the North Carolina Estuarine Striped Bass Fishery Management Plan (FMP) and its subsequent revision and recent supplement (NCDMF 2013, 2014, 2019). It is a joint plan between the North Carolina Marine Fisheries Commission (NCMFC) and the North Carolina Wildlife Resources Commission (NCWRC).

The management program is designed to achieve the target F and SSB levels. The use of F and female SSB targets and thresholds will provide managers with a series of factors to use when evaluating the status of the stock. *Section 4.1* outlines a series of management triggers associated with the targets and thresholds.

The following sections identify SSB and F reference points for the coastwide population, which includes the Chesapeake Bay, Hudson River and Delaware River/Bay as a metapopulation. These reference points are consistent with those accepted in the 2018 Striped Bass Benchmark Assessment and Peer Review Report (NEFSC 2019).

Additional work is being conducted by the TC and Stock Assessment Subcommittee (SAS) to develop management area-based reference points (e.g., for the Chesapeake Bay) for future Board consideration.

2.6.1.1 Female Spawning Stock Biomass Target and Threshold

The biomass target and threshold are based on the weight of sexually mature females in the striped bass population. The 1995 estimate of female SSB is used as the SSB threshold because many stock characteristics, such as an expanded age structure, were reached by this year, and this is also the year the stock was declared recovered. The female SSB target is equal to 125% of the female SSB threshold. Based on the results from the 2018 Benchmark Stock Assessment, the SSB threshold is 91,436 metric tons (202 million pounds) and the SSB target is 114,295 metric tons (252 million pounds) (Table 1). Female SSB target and threshold values will be updated with future stock assessments because these reference point values are estimated based on the best available data.

The striped bass population will be considered overfished when the female SSB falls below the SSB threshold level. *Section 4.1* outlines management triggers based on female SSB reference points.

The use of the word “target” is not intended to imply that the management program will try to limit the population from expanding beyond the target level. In other words, when the population is above the target it is not the intent to reduce the population back to target levels.

2.6.1.2 Fishing Mortality Target and Threshold

F-based reference points are designed to manage the rate at which individual striped bass die because of fishing. The F target and threshold are the values of F estimated to achieve the respective SSB target and threshold over the long-term. If the current F exceeds the F threshold, then overfishing is occurring. This means the rate at which striped bass are dying because of fishing (i.e., harvest and dead discards) exceeds the stock’s ability to maintain itself at the SSB threshold. The value of the F target is set at a cautionary level intended to safeguard the fishery from reaching the overfishing threshold.[9] The F target and threshold values will be updated with future stock assessments because these reference point values are estimated based on the best available data.

Section 4.1 outlines management triggers based on the F reference points.

Table 1. Coastwide Population Reference Points

Reference Point	**Definition**	**Value (as estimated in 2018 Benchmark Stock Assessment)***
$SSB_{THRESHOLD}$	SSB in 1995	202 million pounds
SSB_{TARGET}	125% of SSB in 1995	252 million pounds
$F_{THRESHOLD}$	F associated with achieving the SSB threshold	0.24
F_{TARGET}	F associated with achieving the SSB target	0.20

*The target and threshold values may change through future stock assessments because they are estimated based on the best available data.

2.6.1.3 Reference Points for the Albemarle Sound-Roanoke River

The State of North Carolina will manage the Albemarle Sound-Roanoke River stock using reference points from the latest North Carolina Albemarle Sound-Roanoke River stock assessment accepted by the TC and approved for management use by the Board. The recreational and commercial fisheries in the Albemarle Sound and Roanoke River will operate under North Carolina's Fishery Management Plan while the recreational and commercial fisheries in the Atlantic Ocean will continue to operate under the Commission's management measures as the rest of the coastal fisheries.

2.7 STOCK REBUILDING PROGRAM

2.7.1 Stock Rebuilding Targets

Should the Atlantic striped bass population be overfished at any time, it is the intent under Amendment 7 to rebuild the female SSB to the target level (defined in *Section 2.6.1.1*) within the timeframe established in *Section 2.7.2*.

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[9] F reference points are calculated by the stock assessment model, which includes incorporating recruitment from the values observed from 1990 to the terminal year of the assessment. If the recruitment trigger trips, as described in *Section 4.1,* an interim F target and threshold will be calculated based on recruitment values from a low recruitment time period only, as specified in *Section 4.1*.

2.7.2 Stock Rebuilding Schedules

If at any time the Atlantic striped bass population is declared overfished and rebuilding needs to occur (as specified in *Section 4.1 Management Triggers*), the Board will determine the rebuilding schedule at that time. The only limitation imposed under Amendment 7 is that the rebuilding schedule is not to exceed 10 years.

2.7.3 Maintenance of Stock Structure

Using the outputs from the stock assessment model, the TC will monitor the status of the age structure in the striped bass population. If the TC identifies a persistent change in the age structure that could jeopardize recruitment then the Board could modify the exploitation pattern to increase survival of target age classes. In addition, if an individual stock exceeds threshold limits for biomass or exploitation the Board should consider management changes for that stock.

3.0 MONITORING PROGRAM SPECIFICATION

In order to achieve the goals and objectives of Amendment 7, the collection and maintenance of quality data are necessary. All state fishery management agencies are encouraged to pursue full implementation of the standards of the Atlantic Coastal Cooperative Statistics Program (ACCSP).

3.1 COMMERCIAL CATCH AND LANDINGS INFORMATION

States and jurisdictions with commercial striped bass fisheries are required to collect commercial fishery data elements consistent with ACCSP standards and adhere to the ACCSP standard of mandatory trip-level reporting for catch and effort data collection. These data are used to support commercial quota monitoring efforts to prevent annual quota overages. Commercial quotas are allocated on a calendar year basis with quota monitoring being conducted annually during the Fishery Management Plan Review process based on landings information submitted in state compliance reports. States also conduct quota monitoring during the fishing season. Any overages incurred by a state or jurisdiction is deducted from that state or jurisdictions allowable quota in the following year.

3.1.1 Commercial Tagging Program

States and jurisdictions are required to implement a tagging program for all commercially harvested striped bass within state or jurisdictional waters. Further descriptions of the program requirements are provided in the following sections.

Tag Information and Type

All states and jurisdictions with a commercial striped bass fishery are required to submit a Commercial Tagging Report to ASMFC no later than 60 days prior to the start of the first commercial fishery in that state or jurisdiction. The Commercial Tagging Report will include a picture of the tag(s), as well as a description of the tag color, style, and inscription for all gears and/or seasons issued. Additionally, it should include the number of tags issued or printed and a description of the biological metric used to determine the number of tags printed and distributed to participants. All tags used in a state or jurisdictions tagging program must be tamper-evident. Tags are required to be valid for only one year or fishing season. Tags are required to be inscribed with, at a minimum, the year of issue, the state of issue, and a unique number that can be linked back to the permit holder. Where possible, tags should also be inscribed with size limit. States should consider the use of bar codes or QR codes imprinted on tags, for use in tracking fish from harvester to dealer to buyer, as the technology becomes more available. Changes to the tags, with the exception of year, are required to be reported to ASMFC as specified in *Section 5.3*.

Tag Timing

States or jurisdictions with a commercial striped bass fishery may choose to implement their commercial tagging program at either the point of harvest or the point of sale.

Tag Allowance

States and jurisdictions with a commercial striped bass fishery are required to allocate commercial tags to permit holders based on a biological metric. This option is intended to help prevent state or jurisdictional commercial quota overages, which will contribute to the health and sustainability of the striped bass population. The biological metric used to allocate tags to participants is required to be included in the annual Commercial Tag Report.

Tag Accounting

States and jurisdictions with a commercial striped bass fishery must require permit holders to turn in unused tags or provide an accounting report for any unused tags prior to the start of the next fishing season. Tags or the accounting report shall be turned into the agency issuing the tags. The accounting report must include the disposition of all tags issued to the permittee (e.g., used, unused, broken, lost). Permit holders who do not comply with this section may be subject to penalties as set forth below.

Reporting for Tagging Program

States and jurisdictions with a commercial striped bass fishery shall, at a minimum, approve the ACCSP standards for catch and effort data collection. The ACCSP standard for commercial catch and effort data is mandatory, trip-level reporting of all species commercially harvested with reporting of specific minimum data elements; including species, quantity, state and port of landing, market grade and category, areas fished and hours fished. Dealers and/or harvesters landing catches must report to the state of landing monthly or more frequently, if possible. Each gear and area combination should be detailed; such as separate listings each time the fisherman changes gear or fishing area within a trip. Price data are preferred at the trip-level, but partners may opt to collect prices through dealer surveys.

Striped Bass Processing

For all commercial striped bass tagging programs, tags must remain affixed to the fish until processed for consumption by the consumer. Retail markets may prepare portions of legally tagged striped bass for the consumer but must retain the tagged carcass until all portions are sold. The tag must then be removed from the rack and destroyed (e.g. by cutting the tag in two). Possession of untagged striped bass or striped bass fillets or steaks without the properly tagged carcass in establishments where fish are sold or offered for sale (including wholesale establishments, retail establishments and restaurants) is presumptive evidence of intent to sell, trade, or barter such striped bass.

Striped Bass Exportation

It is unlawful to sell or purchase commercially caught striped bass without a commercial tag. This is to prevent the sale or purchase of untagged striped bass into a state or jurisdiction where there is currently no commercial fishery program.

Penalties

It is recommended that states and jurisdictions strengthen their penalties for striped bass violations, including counterfeit tag operations, so that the penalties are sufficient to deter illegal harvest of striped bass. License revocation or suspension is supported as a primary penalty for state or federal violations. Civil and/or criminal penalties can be effective deterrents.

It is recommended that if the permit holder issued tags cannot account for unused commercial striped bass tags, then that individual will not be issued a commercial striped bass permit for the subsequent fishing year.

3.2 RECREATIONAL CATCH AND LANDINGS INFORMATION

The Marine Recreational Information Program (MRIP) contains estimated Atlantic striped bass catches starting in 1981 for shore, private/rental boats, and for-hire modes. Recreational harvest of striped bass was previously collected through the Marine Recreational Fisheries Statistics Survey (MRFSS), which was a recreational data collection program used from 1981-2003. The MRFSS program was replaced by MRIP in 2004 and was designed to provide more accurate and timely reporting as well as greater spatial coverage. The MRFSS and MRIP programs were simultaneously conducted in 2004-2006 and this information was used to calibrate past MRFSS recreational harvest estimates against MRIP recreational harvest estimates.

In 2018, MRIP implemented the Fishing Effort Survey (FES) which used an improved methodology to address several concerns with the prior Coastal Household Telephone Survey. These concerns included under-coverage of the angling public, declining number of households with landline telephones, reduced response rates, and memory recall issues. Past estimates have been recalibrated to the FES. This calibration resulted in much higher recreational catch estimates compared to previous estimates. The 2018 striped bass Benchmark Stock Assessment incorporated these newly calibrated MRIP estimates.

Recreational catches of striped bass were downloaded from https://www.fisheries.noaa.gov/data-tools/recreational-fisheries-statistics-queries using the query option.

A description of MRIP survey methods can be found online: https://www.fisheries.noaa.gov/recreational-fishing-data/types-recreational-fishing-surveys#access-point-angler-intercept-survey.

3.3 SOCIAL AND ECONOMIC COLLECTION PROGRAMS

Data on a number of variables relevant to social and economic dimensions of striped bass fisheries are collected through existing ACCSP data collection programs and MRIP; however, no explicit mandates to collect socioeconomic data for this species currently exist. In addition to landed quantities, commercial harvesters and dealers may report ex-vessel prices or value, fishing and landing locations, landing disposition, and a variety of measures capturing fishing effort. MRIP regularly collects information on recreational fishing effort and landings, and occasionally gathers socioeconomic data on angler motivations and expenditures.

3.4 BIOLOGICAL DATA COLLECTION PROGRAM

3.4.1 Fishery-Dependent Data Collection

Required fishery-dependent data collection programs are as follows:

1. Catch composition information will be gathered by those states/jurisdictions with commercial fisheries (currently Massachusetts, Rhode Island, New York, Delaware, Maryland, Virginia, Potomac River Fisheries Commission, and North Carolina) and by those states with significant recreational fisheries (Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and the Potomac River Fisheries Commission). Samples shall be representative of location and seasonal distribution of catch, and appropriate biological data shall be collected.

2. Representative catch and effort data will be gathered by those states with significant commercial fisheries (currently Massachusetts, New York, Delaware, Maryland, Virginia, and the Potomac River Fisheries Commission) and by those agencies monitoring recreational fisheries (National Marine Fisheries Service, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and the Potomac River Fisheries Commission).

3. Striped bass tagging programs currently executed by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Southeastern Monitoring and Assessment Program, Massachusetts Division of Marine Fisheries, New York Department of Environmental Conservation, New Jersey Department of Environmental Protection, Maryland Department of Natural Resources, Virginia Marine Resources Commission, and North Carolina Division of Marine Fisheries will be continued to generate estimates of migration and mortality rates.

Appendix 1 summarizes required fishery-dependent data collection.

3.4.2 Fishery-Independent Data Collection

3.4.2.1 Young-of-Year (YOY) Surveys

Annual juvenile recruitment (appearance of juveniles in the ecosystem) of striped bass which comprise the Atlantic coast migratory population is measured in order to provide an indication of future stock abundance. When low numbers of juvenile fish (age 0) are produced in a given year, recreational and commercial catches from that year class may be lower four years later when surviving fish become available to the fisheries. Recruitment is measured by sampling current year juvenile fish abundance in nursery areas. Currently, these juvenile abundance indices are determined annually for stocks in the Kennebec River, Hudson River, Delaware River, Chesapeake Bay and its tributaries, and Albemarle Sound-Roanoke River. Since there is a time delay of several years between the measurement of recruitment and initial harvest of those fish, managers have ample time to protect year classes that have not yet been exploited.

The juvenile abundance index values for the Hudson River, Delaware River, Chesapeake Bay and its tributaries serve as input to the assessment model. Juvenile abundance indices can also serve as another indicator of the status, and future status, of the striped bass population. Recruitment failure is defined as an index value that is below 75% of all values in a fixed time series appropriate to each juvenile abundance index. The fixed time series for determining recruitment failure are as follows:

State JAI	Water Body	Reference Period
ME	Kennebec River	1987-2009
NY	Hudson River	1985-2009
NJ	Delaware River	1986-2009
MD	Chesapeake Bay	1957-2009
VA	Chesapeake Bay	1980-2009
NC	Albemarle-Roanoke	1955-2009

The following states are currently required to conduct juvenile abundance index surveys on an annual basis: Maine for the Kennebec River; New York for the Hudson River; New Jersey for the Delaware River; Maryland for the Chesapeake Bay tributaries; Virginia for Chesapeake Bay tributaries; and North Carolina for the Albemarle Sound-Roanoke River.

The requirements for measurement of juvenile indices are as follows:

1. The sampling protocol (stations, sampling intensity and gear type) shall be consistent throughout the period for which the index is to be used. For new indices, the following information will be required: details of the sampling design of the study yielding the data used to develop the index; a description of the analyses performed; and a presentation of the results of those analyses. The Technical Committee shall review any such submittal and either accept or reject it. If rejected, the Committee will provide a written explanation to the sponsor explaining the reasons for rejection.

2. In order to be validated, the index should exhibit a significant ($p<0.05$) positive correlation to either the magnitude of future landings (lagged 2-7 years) from the stock, or to the relative abundance of the same year class later in life (i.e., relative abundance of juveniles versus the relative abundance of yearling fish of the same year class).

3. The Board may require juvenile abundance surveys in additional river systems to evaluate the level of striped bass productivity.

4. The Technical Committee shall annually examine trends in all required juvenile abundance index surveys and evaluate index values against the recruitment trigger, as defined in *Section 4.1*.

Appendix 1 summarizes required juvenile abundance index surveys.

3.4.2.2 Spawning Stock Biomass Surveys
Spawning stock surveys are required to be monitored in each of the following areas: Hudson River, Delaware River, Chesapeake Bay, and Albemarle Sound-Roanoke River.

The requirements for monitoring spawning stock biomass are as follows:

1. The Technical Committee shall examine output from the stock assessment model when stock assessment benchmarks or updates are conducted and use those estimates to evaluate the status of the striped bass stock relative to the female spawning stock biomass targets and thresholds in this Amendment.

2. Jurisdictions bordering the Hudson River, Delaware River, Chesapeake Bay, and Albemarle Sound/Roanoke River (currently New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina) shall be responsible for conducting spawning stock assessment surveys in those river systems. Accepted studies for fulfilling this requirement currently include: **New York**: Hudson River haul seine survey and shad by-catch analysis; **Maryland**: Gill net surveys; **Virginia**: spring pound net survey; **North Carolina**: spring gill net and electroshocking surveys of spawning stock; **Pennsylvania-New Jersey-Delaware**: Delaware River electroshocking/gill net survey. Any changes to the survey methodology must be reviewed by the Technical Committee and approved by the Board prior to implementation.

Appendix 1 summarizes required spawning stock biomass surveys.

3.4.2.3 Observer Programs
As a condition of state and/or federal permitting, many vessels are required to carry at-sea observers when requested. A minimum set of standard data elements are to be collected through the ACCSP at-sea observer program (refer to the ACCSP Program Design document for details). Specific fisheries priorities will be determined by the Discard/Release Prioritization Committee of ACCSP.

3.4.2.4 Tagging Studies/Program

Tagging of fish with individually-numbered tags is a proven technique for determining movement and migration routes and rates, growth rates and patterns, estimation of mortality/survival, estimation of population size (if assumptions are met), stock identification and determination of movement/migration corridors and habitat use. The use of more sophisticated electronic tags can provide additional habitat information such as temperature (of both water and fish body), depth and specific location. The species' Advisory Panel, Stock Assessment Subcommittee, Technical Committee and/or Management Board (for ASMFC), Advisory Panel or Committee (for Fishery Management Councils) and working groups for International Fisheries Commissions may decide to recommend that tagging studies be performed. Alternatively, such studies may be initiated independently by one or more of the partners in the fishery management process.

Fish tagging is a technical activity which is usually conducted by scientific personnel; however a number of other entities have become involved in or conducted their own tagging studies. If a new tagging study is proposed for striped bass, a number of considerations should be addressed. Any proposed study must have stated objectives, which directly relate to scientific or management purposes. A second important consideration is whether a species can be tagged with minimal mortality, as the utility of study data will be highly questionable if handling/tagging mortality is high. The ideal tag should be one which has a unique alpha-numeric identifier and organization contact information, is easily implanted, has a high rate of retention, is readily visible to potential recoverers without increasing an animal's susceptibility to predation, and remains permanently legible, or in the case of internally-embedded coded wire (CWT) or passive integrated transponder (PIT) tags, is easily and consistently detectable. The implantation location and type of CWT or PIT tags should be fully coordinated with other investigators tagging the same species. Tag number sequences and colors of externally visible tags should be coordinated with other investigators conducting similar studies, via the Interstate Tagging Committee, to ensure that duplication does not occur, and contact information for recoveries and returns should be clearly imprinted on the tag. Tagging should be conducted in a consistent manner by personnel who have been properly trained. Consideration should be given to requiring certification of both professional staff and volunteer angler taggers by the sponsoring organization, in order to increase both the efficiency of tagging and the survival of tagged fish through minimization of handling/tagging mortality. The ASMFC Interstate Tagging Committee has developed a certification for tagging programs, for which sponsoring organizations may wish to apply.

Tagging studies should be highly publicized among the fishing public to maximize the rate of return from both commercial and recreational sectors. In most cases, efforts should be undertaken to accurately measure the rate of tag encounter and reporting. Ideally each study conducted should assess short-term tagging (handling) mortality; short and long-term tag loss; and reporting rates for each fishery sector. Advertised/promised rewards should be provided promptly upon receipt of data. Study managers should insist on complete and accurate return information. Numbers of animals tagged should be sufficiently high to ensure that the desired information will be produced by the study. Careful and appropriate study design (i.e., purpose, location, sample size, duration, recapture procedures, analysis) is vital to ensure success. Prior to study implementation, a repository for any resultant data should be specified, and long-term commitments made by the sponsoring program, and resources made available to analyze and publish the results. Funds should be provided/reserved to process recaptured tagged fish reported after the program has ended. In angler programs, participants with tagging kits should be notified when the program has ended. All incoming tagging data should be added to the existing database until no additional data are received. Failure to respond to reports of recaptured fish will be detrimental to surrounding tagging programs. Tag reporting apathy develops in anglers when they do not receive replies from the tagging entity.

Investigators may wish to consider collaboration with existing tag database managers (e.g. NMFS Northeast Fishery Science Center, Woods Hole, MA; or U.S. Fish and Wildlife Service, Fishery Resources Office, Annapolis, MD; Atlantic States Marine Fisheries Commission, 1050 N Highland Ave, Suite 200 A-N, Arlington, VA 22201, 703-842-0740, info@asmfc.org) for data entry and analysis. Studies should not be undertaken without adequate consideration of all of these issues. The Interstate Tagging Committee strongly encourages programs which are implemented with: 1) connection to an agency or scientific entity for study design and data analyses; 2) an established constituent base to promote the program; 3) training for individuals on proper fish handling and tagging techniques; and 4) identified research needs and objectives.

Any public or private entity proposing new tagging studies should seek guidelines from and provide a proposal to the Interstate Tagging Committee for review and coordination prior to initiation of any study. The proposal should use the ASMFC's Protocols for Tagging Programs as guidance in developing the proposed study. If the proposed study is an integral component of the FMP, study design should ideally be reviewed and approved by the Stock Assessment Subcommittee and/or Technical Committee as well, during the FMP review process. Tagging studies outside the ASMFC jurisdiction may choose not to participate in the ASMFC review process.

The ASMFC's Interstate Tagging Committee was developed to serve as a technical resource for jurisdictions other than the ASMFC, as well as for private, non-profit tagging groups, who may plan to tag. Protocols have been developed by the Committee as a source of information, advice and coordination for all Atlantic coast tagging programs. A copy of the protocol is available on the ASMFC web site. Copies of proposals for review and coordination should be provided to the Interstate Tagging Coordinator at the ASMFC.

3.5 ASSESSMENT OF STOCK CONDITION

An Atlantic striped bass stock assessment update or benchmark assessment will be performed by the Stock Assessment Subcommittee (SAS) on a regular schedule recommended by the Assessment Science Committee and as approved by the Interstate Fisheries Management Program Policy Board (ISFMP Policy Board). The Board can request a stock assessment at any time. The SAS and TC will meet to review the stock assessment and all other relevant data sources. The stock assessment report shall follow the general outline as approved by the ISFMP Policy Board for all Commission-managed species. In addition to the general content of the report as specified in the outline, the stock assessment report may also address the specific topics detailed in the following sections. Specific topics in the stock assessment may change as the SAS continues to provide the best model and metrics possible to assess the Atlantic striped bass stock.

3.5.1 Assessment of Population Age/Size Structure

Estimates of Atlantic striped bass age and size structure are monitored based on results of the stock assessment. As of the 2018 Benchmark Stock Assessment, the accepted model for use in striped bass stock assessments is a forward projecting statistical catch-at-age (SCA) model, which uses catch-at-age data and fishery-dependent and -independent survey indices to estimate annual population size and F. Indices of abundance track relative changes in the population over time while catch data provide information on the scale of the population size. Age structure data (numbers of fish by age) provide additional information on recruitment (number of age-1 fish entering the population) and trends in mortality.

3.5.2 Assessment of Annual Recruitment

Recruitment (age-1) of Atlantic striped bass is estimated by the SCA stock assessment model. The SCA model uses several fishery-independent indices of relative abundance for young-of-year (YOY) and age-1 fish (New York and Maryland YOY and Yearling Surveys, and New Jersey and Virginia YOY Surveys).

3.5.3 Assessment of Spawning Stock Biomass

Female SSB is estimated by the SCA stock assessment model and those estimates are compared to target and threshold levels (i.e., biological reference points) in order to assess the status of the stock. The 1995 estimate of female SSB is used as the SSB threshold because many stock characteristics, such as an expanded age structure, were reached by this year, and this is also the year the stock was declared recovered. The female SSB target is equal to 125% of the female SSB threshold.

3.5.4 Assessment of Fishing Mortality

The F rate is estimated by the SCA stock assessment model and that estimate is compared to target and threshold levels (i.e., biological reference points) in order to assess the status of the stock. The F threshold and target are calculated to achieve the respective SSB reference points in the long term.

3.6 STOCKING PROGRAM

Amendment 7 does not include a stocking program for Atlantic striped bass.

3.7 BYCATCH DATA COLLECTION PROGRAM

In general, states shall undertake every effort to reduce or eliminate the loss of striped bass from the general population due to bycatch discard mortality. The Technical Committee shall examine trends in estimated bycatch during benchmark stock assessments and stock assessment updates.

The overarching goal of the bycatch data collection program (established through Addendum I to Amendment 6) is to develop more accurate estimates of striped bass discards and discard mortality. Additional sector-specific goals are listed below.

<u>Commercial Fisheries</u>

- Implement at-sea observer coverage on commercial vessels that are targeting striped bass, as well as vessels that may encounter striped bass, to collect information on the number of fish being discarded from various commercial gears. Ideally, the sampling effort will be optimally allocated, both seasonally and spatially, among directed and non-directed fishing that has a strong likelihood of generating striped bass bycatch.
- Determine the discard mortality associated with all of the commercial gear types currently encountering striped bass.
- Document the level of bycatch in identified problem fisheries in annual state compliance reports.

<u>Recreational Fisheries</u>

- Determine proportional use of different gear types and fishing practices (e.g. fly fishing, live bait fishing, circle hooks, treble hooks, etc.).
- Determine the discard mortality associated with each gear type and fishing practice.
- Document the level of bycatch in identified problem fisheries in annual state compliance reports.

<u>For-Hire Fisheries</u>

- Determine proportional use of different gear types and fishing practices (e.g. fly fishing, live bait fishing, circle hooks, treble hooks, etc.).
- Determine the discard mortality associated with each gear type and fishing practice.
- Document the level of bycatch in identified problem fisheries in annual state compliance reports.

3.7.1 Requirements and Recommendations for Bycatch Data and Research

MANDATORY DATA COLLECTION

- Collect commercial fishery data elements consistent with ACCSP standards.
- Coordinate with NMFS to ensure coverage in federal waters.
- Continue collection of quantitative data on the bycatch of finfish species as reported by interviewed fishermen through existing recreational and for-hire intercept surveys (ACCSP standard).

RECOMMENDED DATA COLLECTION

- Implement commercial at-sea observer coverage on 2-5% of the total trips in state waters. Applicable to all states with commercial fisheries (directed and non-directed) that encounter striped bass.
- Develop "add-on" questions for interview surveys to collect information on gear/terminal tackle used (circle hooks, J-Hooks, treble hooks, fly fishing, live bait, etc.) in recreational and for-hire fisheries.
- Develop a survey to estimate size composition of discarded fish. The Board will need to work with the TC to determine an effective way to collect these data. Approaches for consideration include, but are not limited to, volunteer angler surveys, additional questions for intercept survey, and expansion of data collected in for-hire fisheries.

MANDATORY DISCARD MORTALITY STUDIES

- Review existing commercial discard studies to determine what information has already been collected.
- Review existing recreational studies for various species and gears to develop estimates of striped bass discard mortality.

RECOMMENDED DISCARD MORTALITY STUDIES

- Conduct studies to estimate the discard mortality associated with the following commercial gear types: trawl (highest priority), gill net, fixed nets (pound net/fyke net/floating fish trap), hook and line, haul seine. These studies do not need to be conducted in all states, but should be conducted to reflect the fishing activities (gear type, temperature, salinity, etc.) that encounter striped bass.
- Conduct additional studies on recreational post-release mortality associated with a range of temperature, salinity, and gear types.

MANDATORY TECHNICAL COMMITTEE ANALYSES

- Analyze any newly collected commercial at-sea observer data to determine if any discarding "hot spots" can be reliably identified.
- Develop estimates for the proportion of discards based on water temperature and salinity, if possible. Apply existing post-release mortality rates to the proportions to determine the effect on estimated discard mortality. For example, if 20% of the catch occurs in warm brackish water, that portion of the catch is likely to have a higher mortality rate than discards in cold ocean water.

RECOMMENDED TECHNICAL COMMITTEE ANALYSES

- Analyze the number and type of all fishing trips from each state, by season and area if possible, and determine ideal allocation of recommended observer coverage.

MANDATORY DATA REPORTING

- Once any mandatory or recommended elements of this program are implemented, states are required to report any bycatch and/or data monitoring as part of the annual compliance report to the Commission.

4.0 MANAGEMENT PROGRAM

The striped bass ocean fishery (also referred to as "ocean region") is defined as all fisheries operating in coastal and estuarine areas of the U.S. Atlantic coast from Maine through North Carolina, excluding the Chesapeake Bay and Albemarle Sound-Roanoke River management areas. The Chesapeake Bay fishery is defined as all fisheries operating within Chesapeake Bay, except for the Chesapeake Bay spring trophy fishery. The Chesapeake Bay spring trophy fishery is part of the ocean fishery for management purposes because it targets coastal migratory striped bass.[10]

The Albemarle Sound-Roanoke River stock is managed separately by the State of North Carolina (see *Section 2.5.2*).

Amendment 7 continues to use bag and size limits, as well as gear restrictions, to manage recreational striped bass fisheries, and quotas and size limits to regulate the striped bass commercial fisheries.

4.1 MANAGEMENT TRIGGERS

The management triggers are intended to keep the Board accountable. Upon reaching any (or all) of the specified management triggers, the Board is required to alter the management program, except when certain conditions are met (described below under *Deferred Management Action*), to ensure the objectives of Amendment 7 are achieved. It is important to note that the Board is not limited to taking action only when a management trigger is tripped.

The intent is to evaluate the triggers against the most recent year(s) of data from the most recent stock assessment update or benchmark stock assessment accepted by the Board for management use, and from the juvenile abundance indices (JAIs) for the recruitment trigger. During years when stock assessments are conducted, the recruitment trigger should be evaluated concurrently, when possible, with the F and female SSB triggers when assessment results are presented to the Board.

Fishing Mortality (F) Triggers

F Threshold Trigger: If F exceeds the threshold, the striped bass management program must be adjusted to reduce F to a level that is at or below the target within one year.

F Target Trigger: If F exceeds the target for two consecutive years and the female SSB falls below the target in either of those years, the striped bass management program must be adjusted to reduce F to a level that is at or below the target within one year.

[10] While the Chesapeake Bay spring trophy fishery is subject to the same requirements as the ocean recreational fishery, Chesapeake Bay trophy fishery removals are counted as part of total removals from the Chesapeake Bay and are included as part of the Chesapeake Bay fleet in the stock assessment model.

Spawning Stock Biomass (SSB) Triggers

SSB Threshold Trigger: If female SSB falls below the threshold, the striped bass management program must be adjusted to rebuild the biomass to a level that is at or above the target within an established timeframe [not to exceed 10-years].

SSB Target Trigger: If female SSB falls below the target for two consecutive years and the F rate exceeds the target in either of those years, the striped bass management program must be adjusted to rebuild the biomass to a level that is at or above the target within an established timeframe [not to exceed 10-years].

Deadline to Implement a Rebuilding Plan

The Board must implement a rebuilding plan within two years from when an SSB-based management trigger is tripped. A management trigger is not considered tripped until the Board formally reviews and accepts, if necessary, the results of the relevant stock assessment.

Recruitment Trigger

If any of the four JAIs used in the stock assessment model to estimate recruitment (NY, NJ, MD, VA)[11] shows an index value that is below 75% of all values (i.e., below the 25th percentile) in the respective JAI from 1992-2006* (which represents a period of high recruitment; see note below) for three consecutive years, then an interim F target and interim F threshold calculated using the low recruitment assumption will be implemented, and the F-based management triggers defined in *Section 4.1* will be reevaluated using those interim reference points. If an F-based trigger is tripped upon reevaluation, the striped bass management program must be adjusted to reduce F to the interim F target within one year.

The lower interim F reference points will remain in place at least until the next stock assessment update or benchmark assessment is approved for management use. Upon reviewing the results of that next assessment, the Board will determine which F rate (target or interim target) to manage towards moving forward by considering factors such as current stock status, recent JAI data, and TC input.

**Note: The high and low recruitment reference periods used for the recruitment trigger may be adjusted as recommended by the TC during benchmark stock assessments. These reference periods were identified by the TC based on a change point analysis of the Maryland JAI with data through 2020. 1992-2006 represents the current high recruitment period (i.e., high recruitment regime) and 2007-2020 represents the current low recruitment*

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[11] The North Carolina JAI for the Albemarle Sound-Roanoke River is not used in the stock assessment because the Albemarle Sound-Roanoke River stock is managed and assessed separately by the state of North Carolina; the Maine JAI for the Kennebec River is not used in the stock assessment because that stock is assumed to only contribute a small amount to the coastwide stock.

period (i.e., low recruitment regime) for the recruitment trigger and interim F calculations. This translates to years 1993-2007 and 2008-2017 for age-1 model estimates of recruit abundance used to calculate the interim F reference points if the recruitment trigger is tripped; the age-1 model estimate of recruit abundance will be updated to include estimates through 2021 during the 2022 assessment. The TC will update the change point analysis during benchmark assessments to evaluate whether the definition of the high/low recruitment reference periods for the trigger has changed with new years of data.

Deferred Management Action

If a management trigger is tripped at any time, the Board must take the corresponding action. However, if a management trigger trips after the Board has already initiated action (e.g., developing addendum) in response to a different management trigger, the Board may defer management action in response to the subsequent trigger until the next assessment.

4.2 RECREATIONAL FISHERY MANAGEMENT MEASURES

4.2.1 Size Limits, Bag Limit, and Seasons

Ocean recreational fisheries are constrained by a one fish bag limit and a slot limit of 28 inches to less than 35 inches. Chesapeake Bay recreational fisheries are constrained by a one fish bag limit and a minimum size of 18 inches. All bag limits are per person per day. All minimum and maximum size limits are in total length. States are required to maintain the same seasons that were in place in 2017.[12]

4.2.2 Measures to Address Recreational Release Mortality

Since release mortality accounts for a significant proportion of total F, Amendment 7 seeks to lower the rate at which fish die after being released, as specified below in *Section 4.2.2.1* and *Section 4.2.2.2*.

Recreational releases are fish caught and released alive during recreational fishing trips. The vast majority of recreational striped bass catch is released alive either due to angler preference or regulation; roughly 90% annually since 1990. A proportion of releases die as a result of that fishing interaction, which is referred to as release mortality (or dead releases). The number of striped bass that die after being caught and released is estimated by multiplying the total number of live releases by an estimated rate of release mortality. The stock assessment currently applies a 9% hooking mortality rate to all recreationally released striped bass (Diodati

[12] Some states have implemented alternative recreational size limits, bag limits, and seasons through CE, which are maintained through current (approved in 2020) CE programs and state implementation plans from Addendum VI to Amendment 6. Refer to Table 6 in *Section 9.0* for each state's 2020 recreational measures. Maryland's updated summer no-targeting closure dates (changed from August 16-31 closure in 2020 to July 16-31 closure in 2021) was discussed at the August 2021 Board meeting.

and Richards 1996). This does not mean every time a fish is released alive it has a 9% chance of dying. Under some conditions, the released fish has a higher or lower probability of dying, but overall, coastwide, it is assumed that 9% of all striped bass released alive die. Each year since 2017, more fish were estimated to have died from catch and release fishing than were harvested by the recreational fishery.

The use of circle hooks by anglers targeting striped bass with bait, live or chunk, has been identified as a method to reduce the release mortality of striped bass in recreational fisheries. When a circle hook begins to exit the mouth of a fish, the shape causes the shaft to rotate towards the point of resistance and the barb is more likely to embed in the jaw or corner of the fish's mouth. Circle hooks can reduce rates of "gut-hooking" and lower the likelihood of puncturing internal organs if the hook is swallowed.

While circle hooks have been demonstrated to reduce hooking mortality rates, factors other than hook type can also affect survivability including water and air temperatures, salinity, hook size, fish length, hooking location, and angler experience/behavior (e.g., how fish are handled), among others (Nelson 1998; Wilde et al. 2000; Millard et al. 2005; Lukacovic and Uphoff 2007). Additionally, it is unknown how many anglers currently use circle hooks, resulting in uncertainty on how many additional fish could be saved when mandatory circle hook measures are put in place. Enforceability and compliance are also concerns depending on how regulations are implemented, specifically depending on which anglers these regulations would apply to (e.g., to only those targeting striped bass, or all bait fishing in a state). For these reasons, angler education on the benefits of using circle hooks and on the effective safe handling of fish caught and released remains a critical component to improve post-release survival.

4.2.2.1 Gear Restrictions
The use of circle hooks, as defined herein, is required when recreationally fishing for striped bass with bait, which is defined as any marine or aquatic organism live or dead, whole or parts thereof. This shall not apply to any artificial lure with bait attached. A circle hook is "a non-offset hook where the point is pointed perpendicularly back towards the shank" (Figure 1). The term "non-offset" means the point and barb are in the same plane as the shank (e.g. when the hook is laying on a flat surface, the entire hook and barb also lay flat). States have the flexibility to further specify details of the regulation to address specific needs of the state fishery.

It shall be unlawful for any person to gaff or attempt to gaff any striped bass at any time when fishing recreationally.

Striped bass caught on any unapproved method of take must be returned to the water immediately without unnecessary injury.

4.2.2.2 Outreach and Education
In order to promote the use of circle hooks, states are encouraged to develop public education and outreach campaigns on the benefits of circle hooks when fishing with bait. It is also recommended states continue to promote best striped bass handling and release practices

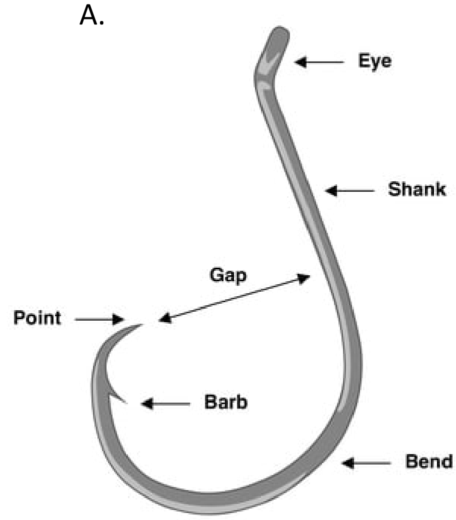
through public education and outreach campaigns. States should provide updates on public education and outreach efforts in annual state compliance reports. Best practices could include:

- Be attentive and set the hook immediately to prevent the fish from swallowing the hook (setting the hook is not necessary with circle hooks).
- If the hook is swallowed, do not forcefully remove it. Cut the line off as close to the mouth as possible and then release the fish.
- Leave the fish in the water when possible, including while removing the hook, to minimize stress and injury to the fish. If you need to remove the fish from the water, wet your hands or use a wet rag in order to preserve the protective mucous layer on the outside of the fish.
- Don’t use the gills or eyes as a handhold. On larger fish, support under the belly.
- Reduce the fight time.
- Once an angler has retained their bag limit, consider targeting a different species.

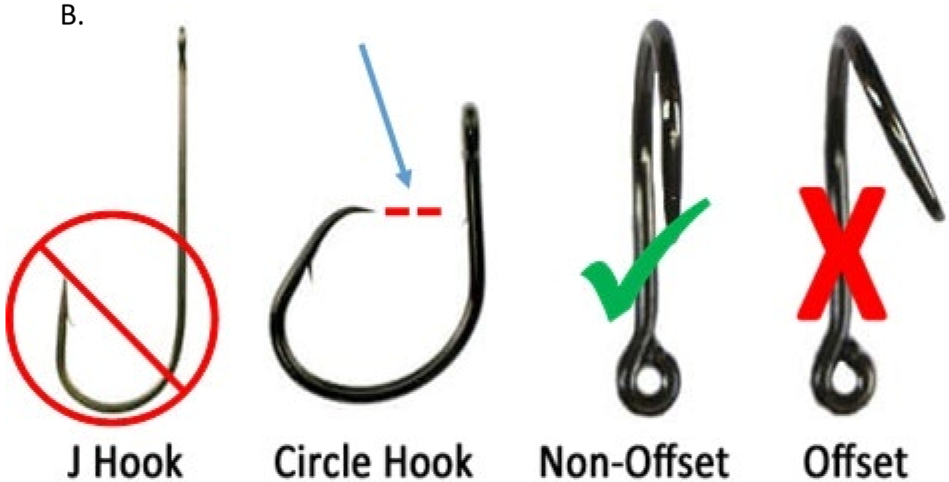
See Figure 1 on the following page.

Figure 1. Anatomy of a circle hook (A) and hook-type comparison (B). Amendment 7 mandates the use of non-offset circle hooks when fishing with bait in the recreational sector. The ASMFC defines circle hook as “a non-offset hook where the point is pointed perpendicularly back towards the shank.” The term “non-offset” means the point and barb are in the same plane as the shank (e.g. when the hook is laying on a flat surface, the entire hook and barb also lay flat).
Source: www.freshwaterfishingadvice.com (A) and Virginia Marine Resources Commission (B).

A.



B.



4.3 COMMERCIAL FISHERY MANAGEMENT MEASURES

4.3.1 Size Limits

All commercial fisheries are required to maintain their 2017 size limits.[13]

4.3.2 Quota Allocation

Amendment 7 maintains the commercial quotas from Addendum VI to Amendment 6.[14] Table 2 provides the commercial quota in pounds for the ocean region and for Chesapeake Bay. The Chesapeake Bay commercial quota is allocated to Maryland, Virginia, and the Potomac River Fisheries Commission per the jurisdictions' mutual agreement. Table 3 provides each state's commercial quota for the ocean region.

Table 2. Ocean Region and Chesapeake Bay commercial quota. Note: Not adjusted for CE.

Region	Quota (Pounds of Fish)
Chesapeake Bay Total	2,588,603
Ocean Total	2,333,408

Table 3. Ocean region commercial quota. Note: Not adjusted for CE.

State	Quota (Pounds of Fish)
Maine	154
New Hampshire	3,537
Massachusetts	713,247
Rhode Island	148,889
Connecticut	14,607
New York	652,552
New Jersey	197,877
Delaware	118,970
Maryland	74,396
Virginia	113,685
North Carolina	295,495
Ocean Total	2,333,408

Note: Refer to Table 4 in Section 9.0 for CE-adjusted quotas, where applicable, for fishing year 2020.

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[13] Some states have implemented alternative commercial size limits through CE, which are maintained through current (approved in 2020) CE programs and state implementation plans from Addendum VI to Amendment 6. Refer to Table 5 in *Section 9.0* for each state's 2020 commercial regulations.

[14] Some states have implemented adjusted commercial quotas and/or reallocated commercial quota to the recreational sector through CE, which are maintained through current (approved in 2020) CE programs and state implementation plans from Addendum VI to Amendment 6. Refer to Table 4 in *Section 9.0* for each state's commercial quota for 2020, including CE-adjusted quotas where applicable.

Quotas are allocated on a calendar year basis.[15] In the event a state exceeds its allocation, the amount in excess of its annual quota is deducted from the state's allowable quota in the following year.

4.3.2.1 Commercial Quota Transfers

Commercial quota transfers are not permitted.

4.4 REBUILDING PLAN

The 2018 Benchmark Stock Assessment indicated the striped bass stock is overfished and experiencing overfishing relative to the updated reference points defined in the assessment. By accepting the assessment for management use in 2019, two management triggers were tripped requiring the Board to take action to address both the overfishing and overfished status determinations. Addendum VI was implemented in 2020 to address the overfishing status by implementing measures to reduce F back to F target in 2020. To address the overfished status, the Board must adjust the striped bass management program to rebuild SSB to the target level in a timeframe not to exceed 10 years, no later than 2029. Addendum VI measures are expected to contribute to stock rebuilding.

The stock rebuilding process is iterative in nature given the 10 year rebuilding horizon. The next stock assessment update (expected in 2022) will provide an updated evaluation of stock status that will incorporate two years of management and data under Addendum VI (2020-2021). The most recent estimates of SSB and F currently available for management use are from the 2018 Benchmark Stock Assessment with a terminal year of 2017. The 2022 stock assessment update will provide estimates of SSB and F through 2021, and will update the SSB and F reference point values. Additionally, the 2022 stock assessment will calculate the F rate required to rebuild SSB to the SSB target by no later than 2029 (i.e., F rebuild). F rebuild is distinct from F target such that F target is the F rate required to achieve the SSB target in the long term, with no fixed rebuilding time frame. F rebuild may or may not be lower than F target.

4.4.1 Recruitment Assumption for Rebuilding Calculation in the 2022 Stock Assessment

For the 2022 stock assessment update, F rebuild will be calculated to achieve the SSB target by no later than 2029 using the low recruitment regime assumption as identified by the TC's change point analysis.

The TC conducted a change point analysis of the Maryland JAI to identify periods of high and low recruitment as part of the analysis for recruitment trigger *(Section 4.1)*. This analysis (based on data through 2020) identified 1992-2006 as a high recruitment period (i.e., high recruitment

[15] North Carolina's fishing year is December 1-November 30; PRFC's fishing year for gill nets is November-March. Refer to Table 5 in *Section 9.0* for each state's commercial regulations.

regime) and 2007-2020 as a low recruitment period (i.e., low recruitment regime). This translates to years 1993-2007 and 2008-2017 for age-1 model estimates of recruit abundance; the age-1 model estimate of recruit abundance will be updated to include estimates through 2021 during the 2022 assessment.

4.4.2 Rebuilding Plan Framework

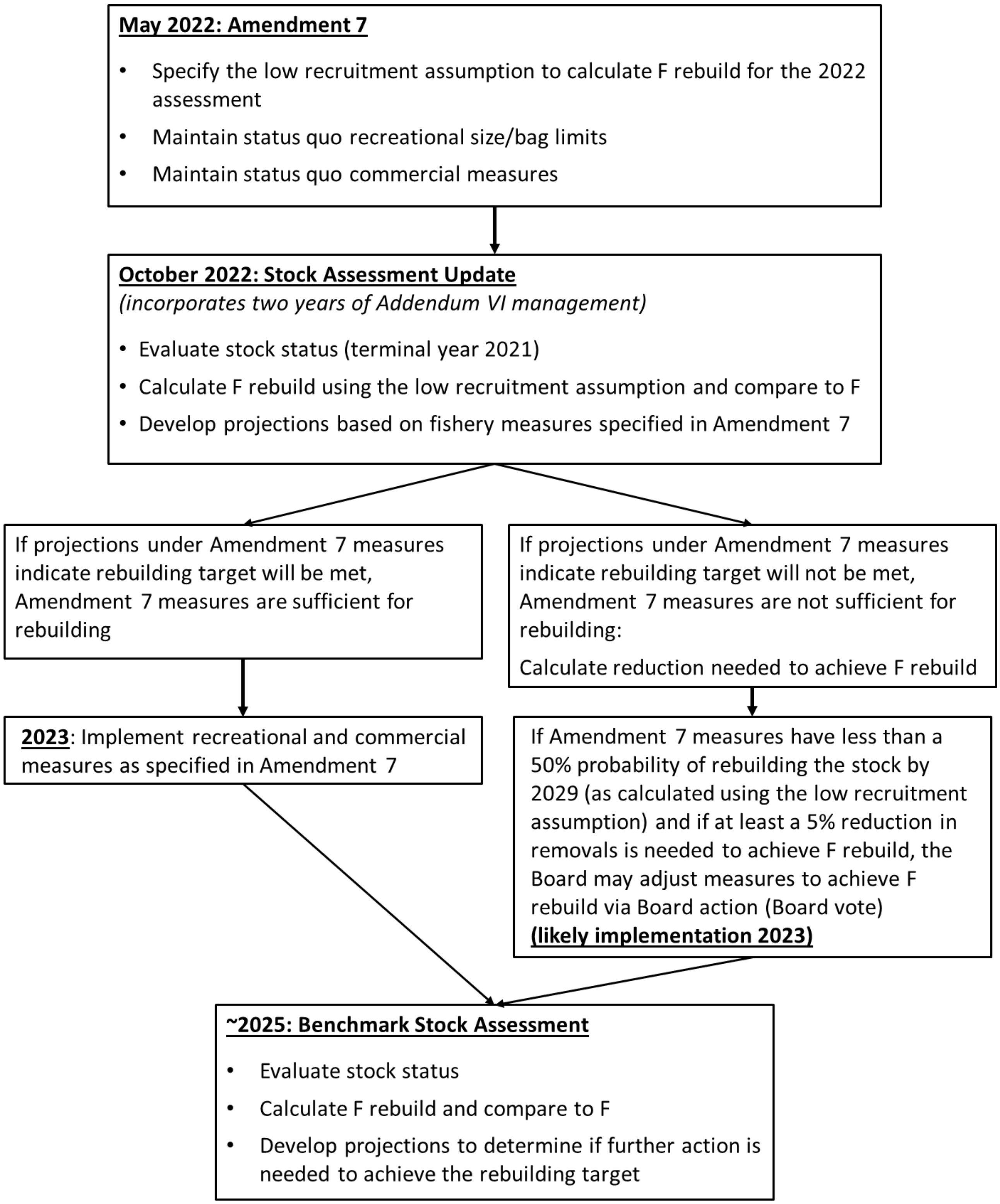
If the 2022 assessment indicates Amendment 7 management measures (i.e., status quo recreational size/bag limits and status quo commercial measures) are not projected to achieve stock rebuilding by 2029, the Board will need to consider adjusting measures to achieve the rebuilding target (Figure 2). The TC would calculate the percent reduction in removals required to achieve F rebuild, and the Board would then consider new management measures designed to achieve that reduction and achieve F rebuild.

If the 2022 stock assessment results indicate the Amendment 7 measures have less than a 50% probability of rebuilding the stock by 2029 (as calculated using the low recruitment assumption) and if the stock assessment indicates at least a 5% reduction in removals is needed to achieve F rebuild, the Board may adjust measures to achieve F rebuild via Board action (change management measures by voting to pass a motion at a Board meeting).

If a Board motion specifying new management measures was passed in 2022, new management measures could likely be implemented for at least part of the 2023 fishing season. Public comment could be provided during Board meetings per the Commission's guidelines for public comment at Board meetings, and/or public comment could be provided in writing to the Board per the Commission's timeline for submission of written public comments prior to Board meetings.

See Figure 2 on the following page.

Figure 2. Framework to rebuild to SSB target level by no later than 2029.



4.5 HABITAT CONSERVATION AND RESTORATION RECOMMENDATIONS

Each state should engage their county, township, and other local jurisdictions to implement protection for striped bass habitat to ensure the sustainability of that portion of the migratory or resident stock. Such a program should inventory historical habitats, identify habitats presently used, specify those targeted for recovery, and impose or encourage measures to retain or increase the quantity and quality of striped bass essential habitats.

Habitats essential for maintaining striped bass populations include spawning, nursery, wintering areas, and migration corridors. Each state jurisdiction should monitor those habitats located within state waters to ensure adequate water and substrate quality; the quantity, timing, and duration of freshwater flows into spawning and nursery areas; water, substrate quality, and integrity of wintering areas; and open and free access to migration corridors, especially ocean inlets. Federal agencies should work with state partners in addressing these needs in state waters and in the EEZ. State and Federal agencies should partner to develop detailed maps of striped bass habitat use, by life stage, to provide a basis for regulatory review of proposed federal or state actions which could adversely affect striped bass populations. Parameters of particular concern to which jurisdictions should be attentive include nutrient loading, long-term adverse changes in water quality, hypoxia events, substrate extraction in areas used by striped bass (e.g., proposed Corps of Engineers sand mining off NJ and NC, as well as navigational dredging), and projects which could potentially jeopardize striped bass habitat quality or access.

4.5.1 Preservation of Existing Habitat

1) States in which striped bass spawning occurs should notify in writing the appropriate federal and state regulatory agencies of the locations of habitats used by striped bass. Regulatory agencies should be advised of the types of threats to striped bass populations and recommended measures which should be employed to avoid, minimize, or eliminate any threat to current habitat quantity or quality.

2) Where available, States should seek to designate striped bass essential habitats for special protection. Tools available include High Quality Waters, Outstanding Resource Waters, and Fish Habitats of Concern (as defined by ASMFC, in preparation) designations. Designations should, where possible, be accompanied by requirements of nondegradation of habitat quality, including minimization of nonpoint source runoff, prevention of significant increases in contaminant loadings, and prevention of the introduction of any new categories of contaminants into the area (via restrictions on National Pollutant Discharge Elimination System (NPDES) discharge permits for facilities in those areas).

3) State fishery regulatory agencies should develop protocols and schedules for providing input on water quality regulations to the responsible agency, to ensure that water quality needs for striped bass are met.

4) State fishery regulatory agencies should develop protocols and schedules for providing input on Federal permits and licenses required by the Clean Water Act, Federal Power Act, and other appropriate vehicles, to ensure that striped bass habitats are protected.

5) Water quality criteria for striped bass spawning and nursery areas should be established or existing criteria should be upgraded to levels which are sufficient to ensure successful reproduction. Any action taken should be consistent with Federal Clean Water Act guidelines and specifications.

6) All State and Federal agencies responsible for reviewing impact statements and permit applications for projects or facilities proposed for striped bass spawning and nursery areas should ensure that those projects will have no or only minimal impact on local stocks. Natal rivers of stocks considered depressed or undergoing restoration are of special concern. Any project which would result in the elimination of essential habitat should be avoided.

7) State agencies should engage with local jurisdictions during comprehensive development planning to ensure impacts to striped bass spawning and nursery areas are avoided or minimized.

4.5.2 Habitat Restoration and Improvement

1) Each State should survey existing literature and data to determine the historical extent of striped bass occurrence and use within its jurisdiction. An assessment should be conducted of those areas not presently used for which restoration is feasible.

2) Every effort should be made to eliminate existing contaminants from striped bass habitats where a documented adverse impact occurs (e.g., PCBs from the Hudson River).

3) States should work in concert with the USFWS and NMFS, Office of Habitat Conservation, to identify federally-regulated hydropower dams which pose significant impediment to striped bass migration and target them for appropriate recommendations during FERC relicensing.

4.5.3 Avoidance of Incompatible Activities

1) Federal and State fishery management agencies should take steps to limit the introduction of compounds which are known to be accumulated in striped bass tissues and which pose a threat to striped bass health or human health.

2) Each State should establish windows of compatibility for activities known or suspected to adversely affect striped bass such as navigational dredging, bridge construction, and dredged material disposal and notify the appropriate construction or regulatory agencies in writing.

3) Projects involving water withdrawal (e.g., power plants, irrigation, water supply projects) should be scrutinized to ensure that adverse impacts resulting from impingement, entrainment,

and/or modification of flow and salinity regimes due to water removal will not adversely impact on striped bass stocks.

4) Each state which encompasses spawning rivers within its jurisdiction should develop water use and flow regime guidelines which are protective of striped bass spawning and nursery areas, and which will ensure the long-term health and sustainability of the stock.

4.5.4 Fishery Practices

The use of any fishing gear deemed by management agencies to have an unacceptable impact on striped bass habitat should be prohibited within appropriate essential habitats (e.g., trawling in spawning areas or primary nursery areas should be prohibited).

4.6 ALTERNATIVE STATE MANAGEMENT REGIMES

Once approved by the Atlantic Striped Bass Management Board, a state may not amend its regulatory program without the approval of the Board, except when implementing more restrictive measures. All other proposed changes to state regulations must be submitted in writing to the Commission. When implementing more restrictive measures, states should notify the Commission of the new measures in its annual compliance report.

Under no circumstances will states be allowed to institute minimum sizes below 18 inches in alternative management regimes.

4.6.1 General Procedures

A state may submit a proposal for a change to its regulatory program or any mandatory compliance measure under this amendment to the Commission. Such changes shall be submitted to the Chair of the Plan Review Team (PRT), who shall distribute the proposal to appropriate groups, including the Board, the PRT, the TC, and the Advisory Panel (AP).

The PRT is responsible for gathering the comments of the TC and the AP. The PRT is also responsible for presenting these comments to the Board for decision.

The Board will decide whether to approve the state proposal for an alternative management program if it determines that it is consistent with the management program detailed in this Amendment.

4.6.2 Management Program Equivalency

Management program equivalency (also known as "conservation equivalency" or CE) refers to actions taken by a state which differ from the specific requirements of the FMP, but which achieve the same quantified level of conservation for the resource under management. It is the responsibility of the state to demonstrate the proposed management program is equivalent to the FMP standards and consistent with the restrictions and requirements for CE determined by the Board.

The Commission's Conservation Equivalency Policy and Technical Guidance Document (CE Guidance Document) provides specific guidance on development, submission, review and approval of CE proposals.

Beyond the mandatory default restrictions and requirements for the use of CE outlined in the following section, the Board will determine CE and has final discretion regarding the use of CE and approval of CE programs. The Board may restrict the use of CE on an ad hoc basis for any FMP requirement. Restrictions may include, but are not limited to:

- measures that are not applicable for CE;
- restrictions on rationale for pursuing CE;
- limitations on the range of measures that may be proposed (e.g., maximum or minimum size limits);
- minimum levels of precision for catch and effort data used in CE proposals (beyond the mandatory default requirement below);
- whether proposals must include an uncertainty buffer on the reduction/liberalization target (beyond the mandatory default requirement below);
- if states may implement, without further Board review, alternative measures than those specifically approved by the Board if developed using the same methodology; and
- if additional sampling or fishery monitoring is required.

When setting restrictions, the Board should consider such factors as stock status, stock structure, data availability, range of species, socio-economic information, and management goals and objectives.

4.6.2.1 Default Restrictions and Requirements for the Use of Conservation Equivalency

<u>Stock Status Restriction for Most Non-Quota Managed Fisheries</u>

CE programs will not be approved for non-quota managed recreational fisheries, with the exception of the Hudson River, Delaware River, and Delaware Bay recreational fisheries, when the stock is at or below the biomass threshold (i.e., overfished), as determined by the results of the most recent stock assessment update or benchmark stock assessment approved for management use. CE programs will not be considered until a subsequent stock assessment indicates stock biomass is above the threshold level.

Precision Standards for MRIP Estimates Used in Conservation Equivalency Proposals

CE proposals cannot use Marine Recreational Information Program (MRIP) estimates associated with a percent standard error (PSE) exceeding 40.

All MRIP datasets used in CE proposals are subject to this precision standard. For example, if a CE proposal uses wave- and/or mode-specific data, the PSEs associated with those specific data cannot exceed 40.

Should states find themselves unable to propose certain CE programs because of the MRIP precision standard, they are encouraged to increase MRIP Access Point Angler Intercept Survey (APAIS) sampling to improve the PSE associated with their state's MRIP estimates. Increased APAIS sampling is recommended for all states, as resources allow, regardless of CE programming.

Conservation Equivalency Uncertainty Buffer for Non-Quota Managed Fisheries

Proposed CE programs for non-quota managed fisheries are required to include an uncertainty buffer of 10%. An uncertainty buffer of 25% is required when the CE proposal uses MRIP estimates with a PSE exceeding 30.

The uncertainty buffer is intended to increase the alternative measures' probability of success in achieving equivalency with the FMP standard (i.e., not exceeding a harvest or removals target).

When CE is pursued to implement new FMP requirements, the uncertainty buffer applies to the percent reduction required or liberalization allowed for the non-quota managed fishery (after any potential transfer of reduction/liberalization between fisheries). For example, if a 20% reduction is required with a 10% uncertainty buffer, CE proposals are required to demonstrate a 22% reduction. Similarly, if a 20% liberalization is allowed with a 10% uncertainty buffer, proposed CE proposals are required to demonstrate up to an 18% liberalization. The uncertainty buffer still applies when CE is requested separate from an implementation plan (e.g., a CE proposal submitted after a required 20% reduction was implemented would need to demonstrate a 2% reduction rather than no change).

The Board may need to further determine how the buffer is applied for some future management actions, particularly when CE proposals may include measures for both quota-managed and non-quota managed fisheries (e.g., if a reduction can be split between sectors). The Board may request guidance from the TC and/or PRT.

Definition of Equivalency for Conservation Equivalency Proposals with Non-Quota Managed Fisheries

Proposed CE programs for non-quota managed fisheries are required to demonstrate equivalency to the percent reduction/liberalization projected for the FMP standard at the state-specific level.

This establishes a default definition of what "equivalency" means for CE proposals associated with the implementation of coastwide actions (in non-quota managed fisheries). In other words, the percent reduction or liberalization that must be met in a CE proposal when the FMP standard is projected to have different effects at the coastwide and state-specific levels, is that of the state-specific level. The intent is to add transparency and consistency to the use of CE across management actions.

4.6.3 *De Minimis* Fishery Guidelines

The ASMFC Interstate Fisheries Management Program Charter (ISFMP Charter) defines *de minimis* as "a situation in which, under the existing condition of the stock and scope of the fishery, the conservation and enforcement actions taken by an individual state would be expected to contribute insignificantly to a coastwide conservation program required by a Fishery Management Plan or amendment," (ASMFC 2016).

4.6.3.1 Qualifications for De Minimis

States may apply for *de minimis* status if, for the last two years, their combined average commercial and recreational landings (by weight) constitute less than one percent (1%) of the average coastwide commercial and recreational landings for the same two-year period. When petitioning for *de minimis* status, the state should also propose the type of exemption associated with *de minimis* status. In addition to determining if the state meets the criteria for *de minimis* status, the Board will evaluate the proposed exemption to be certain it does not compromise the goals and objectives of Amendment 7. The States may petition the Atlantic Striped Bass Management Board at any time for *de minimis* status, if their fishery falls below the threshold level. Once *de minimis* status is granted, designated states must submit annual reports to the Board justifying the continuance of *de minimis* status. States must include *de minimis* requests as part of their annual compliance reports.

4.6.3.2 Procedure to Apply for De Minimis Status

States must specifically request *de minimis* status each year. Requests for *de minimis* status will be reviewed by the PRT as part of the annual FMP review process (*Section 5.3: Compliance Reports*). Requests for *de minimis* must be submitted to the ASMFC Atlantic Striped Bass FMP Coordinator as a part of the state's yearly compliance report. The request must contain the following information: all available commercial landings data for the current and 2 previous full years of data, commercial and recreational regulations for the current year, and the proposed management measures the state plans to implement for the year *de minimis* status is requested. The FMP Coordinator will then forward the information to the PRT.

In determining whether or not a state meets the *de minimis* criteria, the PRT will consider the information provided with the request, the most recent available coastwide landings data, any information provided by the TC and SAS, and any additional information deemed necessary by the PRT. The PRT will make a recommendation to the Board to either accept or deny the *de* *minimis* request. The Board will then review the PRT recommendation and either grant or deny the *de minimis* classification.

The Board must make a specific motion to grant a state *de minimis* status, including the measures the state would be excused from implementing. The state should request which measures they would like to be excused from as part of the *de minimis* request.

If landings in a *de minimis* state exceed the *de minimis* threshold, the state will lose its *de minimis* classification, will be ineligible for *de minimis* in the following year, and will be required to implement all provisions of the FMP. If the Board denies a state's *de minimis* request, the state will be required to implement all the provisions of the FMP. When a state rescinds or loses its *de minimis* status, the Board will set a compliance date by which the state must implement the required regulations.

If the coastwide fishery is closed for any reason through Emergency Procedures (*Section 4.7*), *de minimis* states must close their fisheries as well.

Any additional components of the FMP, which the Board determines necessary for a *de minimis* state to implement, can be defined at the time *de minimis* status is granted.

4.7 ADAPTIVE MANAGEMENT

The Board may vary the requirements specified in this Amendment as a part of adaptive management in order to conserve the Atlantic striped bass resource. The elements that can be modified by adaptive management are listed in *Section 4.7.2*. The process under which adaptive management can occur is provided below.

4.7.1 General Procedures

The PRT will monitor the status of the fishery and the resource and report on that status to the Board annually or when directed to do so by the Board. The PRT will consult with TC, the SAS, and the AP in making such review and report.

The Board will review the report of the PRT, and may consult further with the TC, SAS, or AP. The Board may, based on the PRT report or on its own discretion, direct the PDT to prepare an addendum to make any changes it deems necessary. The addendum shall contain a schedule for the states to implement the new provisions.

The PDT will prepare a draft addendum as directed by the Board, and shall distribute it to all states for review and comment. A public hearing will be held in any state that requests one. The PDT will also request comment from federal agencies and the public at large. After a 30-day review period, staff, in consultation with the PDT, will summarize the comments received and prepare a final version of the addendum for the Board.

The Board shall review the final version of the addendum prepared by the PDT, and shall also consider the public comments received and the recommendations of the TC, LEC, and AP. The Board shall then decide whether to adopt, or revise and then adopt, the addendum.

Upon adoption of an addendum by the Board, states shall prepare plans to carry out the addendum, and submit them to the Board for approval according to the schedule contained in the addendum.

4.7.2 Measures Subject to Change

The following measures are subject to change under adaptive management upon approval by the Board:

(1) Goal
(2) Objectives
(3) Management areas and unit
(4) Reference points, including:
  (a) overfishing and overfished definition
  (b) region-specific reference points
(5) Rebuilding targets and schedules
(6) Management triggers and planning horizon
(7) Recreational Fishery Management Measures
(8) Commercial Fishery Management Measures, including:
  (a) commercial quota allocation
(9) Management Program Equivalency
(10) Recommendations to the Secretaries for complementary actions in federal jurisdictions
(11) Any other management measures currently included in Amendment 7

4.8 EMERGENCY PROCEDURES

Emergency procedures may be used by the Board to require any emergency action that is not covered by, is an exception to, or a change to any provision in Amendment 7. Procedures for implementation are addressed in the ASMFC Interstate Fisheries Management Program Charter, Section Six (c)(10) (ASMFC 2016).

4.9 MANAGEMENT INSTITUTIONS

The management institutions for Atlantic striped bass shall be subject to the provisions of the ISFMP Charter (ASMFC 2016). The following is not intended to replace any or all of the provisions of the ISFMP Charter. All committee roles and responsibilities are included in detail in the ISFMP Charter and are only summarized here.

4.9.1 Atlantic States Marine Fisheries Commission and ISFMP Policy Board

The ASMFC (Commission) and the ISFMP Policy Board are generally responsible for the oversight and management of the Commission's fisheries management activities. The Commission must approve all fishery management plans and amendments, including Amendment 7. The ISFMP Policy Board reviews any non-compliance recommendations of the various Boards and, if it concurs, forwards them to the Commission for action.

4.9.2 Atlantic Striped Bass Management Board

The Board was established under the provisions of the Commission's ISFMP Charter (Section Four; ASMFC 2016) and is generally responsible for carrying out all activities under this Amendment.

The Board establishes and oversees the activities of the PDT, PRT, TC, SAS, Tagging Subcommittee, and the AP. In addition, the Board makes changes to the management program under adaptive management, reviews state programs implementing the amendment, and approves alternative state programs through CE. The Board reviews the status of state compliance with the management program annually, and if it determines that a state is out of compliance, reports that determination to the ISFMP Policy Board under the terms of the ISFMP Charter.

4.9.3. Atlantic Striped Bass Plan Development Team

The Plan Development Team (PDT) is composed of personnel from state and federal agencies who have scientific knowledge of Atlantic striped bass and management abilities. The PDT is responsible for preparing and developing management documents, including addenda and amendments, using the best scientific information available and the most current stock assessment information. The ASMFC FMP Coordinator chairs the PDT. The PDT will either disband or assume inactive status upon completion of Amendment 7.

4.9.4 Atlantic Striped Bass Plan Review Team

The Plan Review Team (PRT) is composed of personnel from state and federal agencies who have scientific and management ability and knowledge of Atlantic striped bass. The PRT is responsible for providing annual advice concerning the implementation, review, monitoring, and enforcement of Amendment 7 once it has been adopted by the Commission. After final action on Amendment 7, the Board may elect to retain members of the PDT as members of the PRT, or appoint new members.

4.9.5 Atlantic Striped Bass Technical Committee

The Atlantic Striped Bass Technical Committee (TC) consists of representatives from state or federal agencies, Regional Fishery Management Councils, the Commission, a university, or other specialized personnel with scientific and technical expertise, and knowledge of the

Atlantic striped bass fishery. The Board appoints the members of the TC and may authorize additional seats as it sees fit. The role of the TC is to assess the species' population, provide scientific advice concerning the implications of proposed or potential management alternatives, and respond to other scientific questions from the Board, PDT, or PRT. The SAS reports to the TC.

4.9.6 Atlantic Striped Bass Stock Assessment Subcommittee

The Atlantic Striped Bass Stock Assessment Subcommittee (SAS) is appointed and approved by the Board, with consultation from the Atlantic Striped Bass TC, and consists of scientists with expertise in the assessment of the Atlantic striped bass population. Its role is to assess the Atlantic striped bass population and provide scientific advice concerning the implications of proposed or potential management alternatives, and to respond to other scientific questions from the Board, TC, PDT or PRT. The SAS reports to the TC.

4.9.7 Atlantic Striped Bass Tagging Subcommittee

The Tagging Subcommittee will consist of those scientists with the expertise in analysis of tag and recapture data for striped Bass. Its role is to assess the available data for inclusion in the assessment of the striped bass populations, which will be provided to the Stock Assessment Subcommittee for inclusion in the annual status of the stock report. The Tagging Subcommittee is also responsible for responding to Board questions using the available tagging data, when possible. The Tagging Subcommittee will report to the TC.

4.9.8 Atlantic Striped Bass Advisory Panel

The Atlantic Striped Bass Advisory Panel (AP) is established according to the Commission's Advisory Committee Charter. Members of the AP are citizens who represent a cross-section of commercial and recreational fishing interests and others who are concerned about Atlantic striped bass conservation and management. The AP provides the Board with advice directly concerning the Commission's Atlantic striped bass management program.

4.9.9 Federal Agencies

4.9.9.1 Management in the Exclusive Economic Zone

Management of Atlantic striped bass in the EEZ is within the jurisdiction of the three Regional Fishery Management Councils under the Magnuson-Stevens Act (16 U.S.C. 1801 et seq.). In the absence of a Council Fishery Management Plan, management is the responsibility of the National Marine Fisheries Service as mandated by the Atlantic Coastal Fishery Cooperative Management Act.

4.9.9.2 Consultation with Fishery Management Councils

At the time of adoption of Amendment 7, none of the Regional Fishery Management Councils had implemented a management plan for Atlantic striped bass, nor had they indicated an intent to develop a plan.

4.10 RECOMMENDATION TO THE SECRETARY OF COMMERCE FOR COMPLEMENTARY MEASURES IN FEDERAL WATERS

There is no recommendation to the Secretary of Commerce since federal waters (between 3 and 200 miles offshore) remain closed to all commercial and recreational fishing for Atlantic striped bass.

4.11 COOPERATION WITH OTHER MANAGEMENT INSTITUTIONS

The Board will cooperate, when necessary, with other management institutions during the implementation of this amendment, including NMFS and the New England, Mid-Atlantic, and South Atlantic Fishery Management Councils.

5.0 COMPLIANCE

The full implementation of the provisions included in this amendment is necessary for the management program to be equitable, efficient, and effective. States are expected to implement these measures faithfully under state laws. ASMFC will continually monitor the effectiveness of state implementation and determine whether states are in compliance with the provisions of this fishery management plan.

The Board sets forth specific elements that the Commission will consider in determining state compliance with this fishery management plan, and the procedures that will govern the evaluation of compliance. Additional details of the procedures are found in the ASMFC Interstate Fishery Management Program Charter (ASMFC 2016).

5.1 MANDATORY COMPLIANCE ELEMENTS FOR STATES

A state will be determined to be out of compliance with the provision of this fishery management plan according to the terms of Section Seven of the ISFMP Charter if:

- Its regulatory and management programs to implement Amendment 7, or any addendum prepared under adaptive management (*Section 4.7*), have not been approved by the Board; or
- It fails to meet any schedule required by *Section 5.2* or within any addendum prepared under adaptive management (*Section 4.7*); or
- It has failed to implement a change to its program when determined necessary by the Board; or

- It makes a change to its regulations required under *Section 4* or any addendum prepared under adaptive management (*Section 4.7*), without prior approval of the Board.

5.1.1 Regulatory Requirements

To be considered in compliance with this fishery management plan, all state programs must include a regime of restrictions on Atlantic striped bass fisheries consistent with the requirements of *Section 3.1: Commercial Catch and Landings Programs; Section 3.4: Biological Data Collection Programs; Section 4.2 Recreational Fishery Management Measures;* and *Section 4.3: Commercial Fishery Management Measures*. A state may propose an alternative management program under *Section 4.6: Alternative State Management Regimes*, which, if approved by the Board, may be implemented as an alternative regulatory requirement for compliance.

States may begin to implement Amendment 7 after final approval by the Commission. Each state must submit its required Atlantic striped bass regulatory program to the Commission through ASMFC staff for approval by the Board. During the period between submission and Board approval of the state's program, a state may not adopt a less protective management program than contained in this Amendment or contained in current state law or regulation. The following lists the specific compliance criteria that a state/jurisdiction must implement in order to be in compliance with Amendment 7:

- Recreational fishery management measures as specified in *Section 4.2;*
- Commercial fishery management measures as specified in *Section 4.3*;
- Monitoring requirements as specified in *Section 3.0*, including the Commercial Tagging Program (*Section 3.1.1*), Fishery-Dependent Data Collection (*Section 3.4.1*), and Fishery-Independent Data Collection (*Section 3.4.2*);
- All state programs must include law enforcement capabilities adequate for successful implementation of the compliance measures contained in this Amendment;
- There are no mandatory research requirements at this time; however, research requirements may be added in the future under Adaptive Management, *Section 4.7*;
- There are no mandatory habitat requirements in Amendment 7. See *Section 4.4* for habitat recommendations.

For monitoring programs, states must submit proposals for all intended changes to required monitoring programs, which may affect the quality of the data or the ability of the program to fulfill the needs of the fishery management plan. State proposals for making changes to required monitoring programs will be submitted to the Technical Committee. Proposals must be on a calendar year basis. The Technical Committee will make recommendations to the Board concerning whether the proposals are consistent with Amendment 7.

In the event that a state realizes it will not be able to fulfill its fishery independent monitoring requirements, it should immediately notify the Commission in writing. The Commission will work with the state to develop a plan to secure funding or plan an alternative program to satisfy the needs outlined in Amendment 7. If the plan is not implemented 90 days after it has been adopted, the state will be found out of compliance with Amendment 7.

5.2 COMPLIANCE SCHEDULE

All provisions of Amendment 7 are effective May 5, 2022 except for gear restrictions in *Section 4.2.2.1* Gear Restrictions. States must implement new gear restrictions by January 1, 2023.

5.3 COMPLIANCE REPORTS

Each state must submit to the Commission an annual report concerning its Atlantic striped bass fisheries and management program for the previous year, no later than June 15th. A standard compliance report format has been prepared and adopted by the ISFMP Policy Board. States should follow this format in completing the annual compliance report.

The report shall cover:

- The previous calendar year's fishery and management program including mandatory reporting programs (including frequency of reporting and data elements collected), fishery dependent data collection, fishery independent data collection, regulations in effect, harvest and catch information, and *de minimis* requests.
- The planned management program for the current calendar year summarizing regulations that will be in effect and monitoring programs that will be performed, highlighting any changes from the previous year.

5.3.1 Commercial Tagging Program Reports

States and jurisdictions with a commercial striped bass fishery must annually report any changes to the tag program such as tag type, which includes color, text (with the exception of year), and style; the biological metric used; or any other requirements as specified under Section 3.1.1 no later than 60 days prior to the start of the first fishing season in that state or jurisdiction. This information will be compiled and distributed to law enforcement officials to aid in commercial tag enforcement in the striped bass fishery.

5.4 PROCEDURES FOR DETERMINING COMPLIANCE

Detailed procedures regarding compliance determinations are contained in the ISFMP Charter, Section Seven (ASMFC 2016). In brief, all states are responsible for the full and effective implementation and enforcement of fishery management plans in areas subject to their jurisdiction. Written compliance reports as specified in the Amendment must be submitted annually by each state with a declared interest. Compliance with Amendment 7 will be reviewed at least annually; however, the Board, ISFMP Policy Board, or the Commission may request the PRT to conduct a review of state’s implementation and compliance with Amendment 7 at any time.

The Board will review the written findings of the PRT within 60 days of receipt of a State's compliance report. Should the Board recommend to the Policy Board that a state be determined out of compliance, a rationale for the recommended noncompliance finding will be addressed in a report. The report will include the required measures of Amendment 7 that the state has not implemented or enforced, a statement of how failure to implement or enforce required measures jeopardizes Atlantic striped bass conservation, and the actions a state must take in order to comply with Amendment 7 requirements.

The ISFMP Policy Board will review any recommendation of noncompliance from the Board within 30 days. If it concurs with the recommendation, it shall recommend to the Commission that a state be found out of compliance.

The Commission shall consider any noncompliance recommendation from the ISFMP Policy Board within 30 days. Any state that is the subject of a recommendation for a noncompliance finding is given an opportunity to present written and/or oral testimony concerning whether it should be found out of compliance. If the Commission agrees with the recommendation of the ISFMP Policy Board, it may determine that a state is not in compliance with Amendment 7, and specify the actions the state must take to come into compliance.

Any state that has been determined to be out of compliance may request that the Commission rescind its noncompliance findings, provided the state has revised its Atlantic striped bass conservation measures.

5.5. ANALYSIS OF THE ENFORCEABILITY OF PROPOSED MEASURES

All state programs must include law enforcement capabilities adequate for successfully implementing that state’s Atlantic striped bass regulations. The LEC will monitor the adequacy of a state’s enforcement activity.

5.6 RECOMMENDED (NON-MANDATORY) MANAGEMENT MEASURES

The following management measures are recommended for states to fully or partially implement. These measures are not part of the compliance criteria for Amendment 7.

5.6.1 Spawning Area Closures

Consideration should be given to the prohibition of fishing on the spawning grounds during the spawning season. States are encouraged to maintain existing spawning closures and evaluate the need for additional spawning closures.

5.6.2 Survey of Inland Recreational Fishermen

The states/jurisdictions are encouraged to conduct a survey of inland fishermen to evaluate the landings, catch rate, discards, participation, and number of trips.

5.6.3. Angler Education and Outreach

States are recommended to develop and implement an angler education program. The main tool of the education program could be a website accessible from each state fisheries agency website. When funding is available, states should develop posters and/or brochures for posting and distributing at boat launches, shore-based fishing areas, and for placement on charter and rental boats. State agencies should also coordinate outreach to anglers through influential fishing organizations.

In order to promote the use of circle hooks, states are encouraged to develop public education and outreach campaigns on the benefits of circle hooks when fishing with bait. Angler education on the benefits of using circle hooks and on the effective safe handling of fish caught and released remains a critical component to improve post-release survival.

5.6.4 Sampling of Recreational Fisheries

States are encouraged to increase Access Point Angler Intercept Survey (APAIS) sampling above the Marine Recreational Information Program (MRIP) baseline to provide more extensive coverage of their state recreational fisheries.

6.0 RESEARCH NEEDS

The following list of research needs have been identified in order to enhance the state of knowledge of the Atlantic striped bass resource. Research recommendations are broken down into several categories: data collection, assessment methodology, life history, habitat, and socioeconomic. Some research needs are further categorized into high and moderate priority levels.

6.1 STOCK ASSESSMENT, DATA COLLECTION, AND LIFE HISTORY RESEARCH NEEDS

The following categorized and prioritized research recommendations were developed by the 2018 Benchmark Stock Assessment Subcommittee and the 66th SARC (NEFSC 2019).

6.1.1 Fishery-Dependent Data

High

- Continue collection of paired scale and otolith samples, particularly from larger striped bass, to facilitate development of otolith-based age-length keys and scale-otolith conversion matrices.
- Develop studies to provide information on gear specific (including recreational fishery) discard morality rates and to determine the magnitude of bycatch mortality.
- Conduct study to directly estimate commercial discards in the Chesapeake Bay.
- Collect sex ratio information on the catch and improve methods for determining population sex ratio for use in estimates of female SSB and biological reference points.

Moderate

- Improve estimates of striped bass harvest removals in coastal areas during wave 1 and in inland waters of all jurisdictions year round.

6.1.2 Fishery-Independent Data

High

- Develop an index of relative abundance from the Hudson River Spawning Stock Biomass survey to better characterize the Delaware Bay/Hudson River stock.
- Improve the design of existing spawning stock surveys for Chesapeake Bay and Delaware Bay.

Moderate

- Develop a refined and cost-efficient, fisheries-independent coastal population index for striped bass stocks.
- Collect sex ratio information from fishery-independent sources to better characterize the population sex ratio.

6.1.3 Stock Assessment Modeling/Quantitative

High

- Develop better estimates of tag reporting rates; for example, through a coastwide tagging study.
- Investigate changes in tag quality and potential impacts on reporting rate.
- Explore methods for combining tag results from programs releasing fish from different areas on different dates.
- Develop field or modeling studies to aid in estimation of natural mortality and other factors affecting the tag return rate.
- Compare M and F estimates from acoustic tagging programs to conventional tagging programs.

Moderate

- Examine methods to estimate temporal variation in natural mortality.

Low

- Evaluate truncated matrices to reduce bias in years with no tag returns and covariate based tagging models to account for potential differences from size or sex or other covariates.

6.1.4 Life History and Biology

High

- Continue in-depth analysis of migrations, stock compositions, sex ratio, etc. using mark-recapture data.
- Continue evaluation of striped bass dietary needs and relation to health condition.

- Continue analysis to determine linkages between the mycobacteriosis outbreak in Chesapeake Bay and sex ratio of Chesapeake spawning stock, Chesapeake juvenile production, and recruitment success into coastal fisheries.

Moderate

- Examine causes of different tag based survival estimates among programs estimating similar segments of the population.
- Continue to conduct research to determine limiting factors affecting recruitment and possible density implications.
- Conduct study to calculate the emigration rates from producer areas now that population levels are high and conduct multi-year study to determine inter-annual variation in emigration rates.

6.2 HABITAT RESEARCH NEEDS

- See *Section 4.4* for habitat conservation and restoration recommendations, which include reviewing striped bass habitat use and data (e.g., water quality criteria) to inform habitat conservation and restoration.

6.3 SOCIO-ECONOMIC RESEARCH NEEDS

- Conduct research on a coastwide scale to analyze striped bass anglers' preferences and behavior in response to regulatory changes and changes in fishery conditions (e.g., changes in fish availability). This research could inform an economic sub-model component of a bioeconomic model for striped bass (see *Section 1.5.2*).
    - The economic sub-model would use anglers' preferences for different trip attributes to calculate anglers' demand for recreational trips under alternative policy scenarios. In modern applications, this is often achieved by parameterizing recreational demand using survey data from choice experiments in which anglers make trip decisions based on expectations about catch, harvest, and regulatory releases or discards. Choice experiment surveys and revealed preference studies could be used to estimate the effects of changes in regulations in the absence of market data and behavioral observations.
- When the above research is available, work with stock assessment scientists to develop a bioeconomic model for striped bass, which would combine an economic sub-model and biological sub-model to assess feedbacks and long-run impacts of management decisions on anglers and the striped bass resource (see *Section 1.5.*2).
- Conduct research on angler preferences and behavior regarding targeting of substitute species (e.g., which species are targeted with striped bass and what species would anglers target if they were unable to keep striped bass) and how that behavior is influenced by regulations and how preferences differ across regions. This would inform understanding and predictions of changes in effort in response to future regulations and changes in fish availability (e.g., due to climate change).
- Improve understanding of non-consumptive value by region, including value of the catch and release fishery.

7.0 PROTECTED SPECIES

In the fall of 1995, Commission member states, NMFS, and USFWS began discussing ways to improve implementation of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) in state waters. Historically, these policies had been only minimally implemented and enforced in state waters (0-3 miles). In November 1995, the Commission, through its ISFMP Policy Board, approved an amendment to its ISFMP Charter (Section Six (b)(2)) requiring protected species/fishery interactions to be discussed in the Commission's fisheries management planning process. As a result, the Commission's fishery management plans describe impacts of state fisheries on MMPA protected and ESA-listed (endangered or threatened) species, collectively termed "protected species". The following section outlines: (1) the federal legislation which guides protection of marine mammals and sea turtles, (2) the protected species with potential fishery interactions; (3) the specific types of fishery interaction; (4) information about the affected protected species; and (5) potential impacts to Atlantic coast state and interstate fisheries.

7.1 MARINE MAMMAL PROTECTION ACT REQUIREMENTS

Since its passage in 1972, and subsequent Amendment in 1994, one of the underlying goals of the MMPA has been to reduce the incidental serious injury and mortality of marine mammals in the course of commercial fishing operations to insignificant levels approaching a zero mortality and zero serious injury rate. Pursuant to the MMPA, NMFS publishes a List of Fisheries (LOF) annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injuries and/or mortalities of marine mammals in each fishery (i.e., Category I=frequent; Category II=occasional; Category III=remote likelihood or no known interactions). The Act also requires NMFS to develop and implement a take reduction plan to assist in the recovery of, or prevent the depletion of, each strategic stock that interacts with a Category I or II fishery. A strategic stock is defined as a stock: (1) for which the level of direct human-caused mortality exceeds the potential biological removal (PBR)[16] level; (2) which is declining and is likely to be listed under the Endangered Species Act (ESA) in the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or as a depleted species under the MMPA.

Under 1994 mandates, the MMPA also requires fishermen in Category I and II fisheries to register under the Marine Mammal Authorization Program (MMAP). The purpose of this is to provide an exception for commercial fishermen from the general taking prohibitions of the MMPA. All fishermen, regardless of the category of fishery in which they participate, must report all incidental injuries and mortalities to a marine mammal caused by commercial fishing operations within 48 hours.

[16] PBR is the number of human-caused deaths per year each stock can withstand and still reach an optimum population level. This is calculated by multiplying the minimum population estimate by the stock's net productivity rate and a recovery factor ranging from 0.1 for endangered species to 1.0 for healthy stocks.

Section 101(a)(5)(E) of the MMPA allows for authorization of the incidental take of ESA-listed marine mammals in the course of commercial fishing operations if it is determined that: (1) incidental mortality and serious injury will have a negligible impact on the affected species or stock; (2) a recovery plan has been developed or is being developed for such species or stock under the ESA; and (3) where required under MMPA Section 118, a monitoring program has been established, vessels engaged in such fisheries are registered, and a take reduction plan has been developed or is being developed for such species or stock. MMPA Section 101(a)(5)(E) permits are not required for Category III fisheries, but any serious injury or mortality of a marine mammal must be reported.

7.2 ENDANGERED SPECIES ACT REQUIREMENTS

The taking of endangered or threatened species including sea turtles, marine mammals, and fish, is prohibited and considered unlawful under Section 9(a)(1) of the ESA. In addition, NMFS or the USFWS may determine Section 4(d) protective regulations to be necessary and advisable to provide for the conservation of threatened species. There are several mechanisms established in the ESA which allow for exceptions to the prohibited take of protected species listed under the ESA. Section 10(a)(1)(A) of the ESA authorizes NMFS to allow the taking of listed species through the issuance of research permits, which allow ESA species to be taken for scientific purposes or to enhance the propagation and survival of the species. Section 10(a)(1)(B) authorizes NMFS to permit, under prescribed terms and conditions, any taking otherwise prohibited by Section 9(a)(1)(B) of the ESA if the taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity. In recent years, some Atlantic state fisheries have obtained section 10(a)(1)(B) permits for state fisheries.

Section 7(a)(2) requires federal agencies to consult with NMFS to ensure that any action that is authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species. If, following completion of the consultation, an action is found to jeopardize the continued existence of any listed species or cause adverse modification to critical habitat of such species, reasonable and prudent alternatives need to be identified so that jeopardy or adverse modification to the species does not occur. Section (7)(o) provides the actual exemption from the take prohibitions established in Section 9(a)(1), which includes Incidental Take Statements that are provided at the end of consultation via the ESA Section 7 Biological Opinions.

7.3 PROTECTED SPECIES WITH POTENTIAL FISHERY INTERACTIONS

Commercial striped bass fisheries operate in the state waters (0-3 miles) of Massachusetts, Rhode Island, New York, Delaware, Maryland, the Potomac River Fisheries Commission, Maryland, Virginia, and North Carolina.[17] The Chesapeake Bay typically accounts for roughly 60 percent of striped bass commercial landings by weight each year. The primary gear types for the striped bass commercial fishery are gill nets (roughly 50 percent of commercial landings by weight each year), hook and line (typically 20-30 percent of commercial landings by weight each year), and pound nets/other fixed gears (typically 10-20 percent of commercial landings by weight each year). Haul seines and trawls are also used in the commercial fishery to a lesser extent (combined less than 5 percent of commercial landings by weight each year). The recreational sector operates in state waters across the entire management unit (0-3 miles from Maine through North Carolina) and uses hook and line almost exclusively.

A number of protected species occur within the striped bass management unit for Atlantic striped bass. Ten are classified as endangered or threatened under the ESA; the remainder are protected under provisions of the MMPA. The species found in coastal Northwest Atlantic waters are listed below.

<u>Endangered</u>	
North Atlantic Right whale	(*Eubalaena glacialis*)
Fin whale	(*Balaenoptera physalus*)
Leatherback sea turtle	(*Dermochelys coriacea*)
Kemp's Ridley sea turtle	(*Lepidochelys kempii*)
Shortnose sturgeon	(*Acipenser brevirostrum*)
Atlantic sturgeon (New York Bight, Chesapeake Bay, Carolina, and South Atlantic Distinct Population Segments (DPS))	(*Acipenser oxyrinchus oxyrinchus*)
<u>Threatened</u>	
Loggerhead sea turtle (NW Atlantic Ocean DPS)	*(Caretta caretta)*
Green sea turtle (North Atlantic DPS)	*(Chelonia mydas)*
Giant Manta Ray	*(Manta birostris)*
Atlantic Sturgeon (Gulf of Maine DPS)	*(Acipenser oxyrinchus oxyrinchus)*
<u>MMPA</u>	
Includes all marine mammals above in addition to:	
Minke whale	*(Balaenoptera acutorostrata)*
Humpback whale	*(Megaptera novaeangliae)*
Bottlenose dolphin[18]	*(Tursiops truncatus)*
Atlantic-white sided dolphin	*(Lagenorhynchus acutus)*
Short Beaked Common dolphin	*(Delphinus delphis)*

[17] North Carolina has reported zero offshore commercial harvest since 2013.

[18] The following bottlenose dolphin stocks occur within the striped bass management unit: Western North Atlantic Northern Migratory Coastal; Western North Atlantic Southern Migratory Coastal; Northern North Carolina Estuarine System; Southern North Carolina Estuarine System.

Harbor seal	*(Phoca vitulina)*
Gray seal	*(Halichoerus grypus)*
Harp seal	(*Phoca groenlandica*)
Harbor porpoise	(*Phocoena phocoena*)

In the Northwest Atlantic waters, protected species utilize marine habitats for feeding, reproduction, nursery areas, and migratory corridors. Some species occupy the area year round while others use the region only seasonally or move intermittently nearshore, inshore, and offshore. Interactions may occur whenever fishing gear and protected species overlap spatially and temporally.

As the primary concern for both MMPA protected and ESA listed species is the potential for the fishery to interact (e.g., bycatch, entanglement) with these species it is necessary to consider species occurrence in the affected environment of the fishery and how the fishery will overlap in time and space with this occurrence; and observed records of protected species interaction with particular fishing gear types, to understand the potential risk of an interaction.

7.3.1 Marine Mammals

Large whales, small cetaceans (e.g., bottlenose dolphins), and pinniped (e.g., harbor seals) species co-occur with the Atlantic striped bass fishery.

Large whales

Large whales, including Humpback, North Atlantic right, fin, and minke whales, occur in the Northwest Atlantic. Generally speaking, large whales follow an annual pattern of migration between low latitude (south of 35°N) wintering/calving grounds and high latitude spring/summer/fall foraging grounds (primarily north of 41°N). This is a simplification of whale movements, particularly as it relates to winter movements. It is unknown if all individuals of a population migrate to low latitudes in the winter, although increasing evidence suggests that for some species, some portion of the population remains in higher latitudes throughout the winter (Clapham et al. 1993; Davis et at. 2017; Davis et al. 2020; Hayes et al. 2020; Swingle et al. 1993; Vu et al. 2012). For additional information on the biology, status, and range wide distribution of humpback, North Atlantic right, fin, sei, and minke whales, refer to the marine mammal SARs provided at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.

Small Cetaceans and Pinnipeds

Small cetaceans can be found throughout the year in the Northwest Atlantic Ocean (Maine to Florida), including in harbors, bays, gulfs, and estuaries; however, within this range, there are seasonal shifts in species distribution and abundance. Pinnipeds are primarily found throughout the year or seasonally from New Jersey to Maine; however, increasing evidence indicates that some species (e.g., harbor seals) may be extending their range seasonally into waters as far south as Cape Hatteras, North Carolina (35°N).

For additional information on the biology and range wide distribution of each species of small cetacean and pinniped, as well as information on other marine mammals that occur on the Atlantic coast, refer to the marine mammal SARs provided at:
https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region

7.3.1.1 Gear Interactions with Marine Mammals

Marine mammal interactions have been documented in the primary fisheries that target striped bass, including the pound net and gillnet fisheries as well as trawl, haul seine, and hook and line. The following sections are not a comprehensive review of all fishing gear types known to interact with a given species and the bycatch reports included below do not represent a complete list. It should be noted that without an observer program for many of these fisheries, actual numbers of interactions associated with the striped bass fishery are difficult to obtain.

Gillnets

The mid-Atlantic gillnet fishery is listed as a Category I fishery in the 2021 LOF (86 FR 3028, January 14, 2021). The fishery was originally listed as a Category II fishery but in 2003, it was elevated to a Category I fishery after stranding and observer data documented the incidental mortality and serious injury of bottlenose dolphins (68 FR 41725, July 15, 2003). Other species with documented interactions include the common dolphin, harbor seal, gray seal, and hooded seal; however, since gillnet fisheries target many species, not all incidents may have occurred while harvesting striped bass. Between 1995 and 2018, observer coverage has ranged from 1% to 9%.

The Chesapeake Bay inshore gillnet and the North Carolina inshore gillnet are all listed as Category II fisheries in the 2021 LOF (86 FR 3028, January 14, 2021). The primary species reported interacting with these gears is the bottlenose dolphin. Both the Chesapeake Bay inshore gillnet and the North Carolina inshore gillnet fisheries were elevated from a Category III fishery to a Category II fishery in the 2006 and 2001 LOFs, respectively (66 FR 42780, August 15, 2001; 71 FR 48802, August 22, 2006).

The Delaware River inshore gillnet, the Long Island Sound inshore gillnet, and the Rhode Island/Southern Massachusetts/New York Bight inshore gillnet fisheries are listed as Category III fisheries in the 2021 LOF (86 FR 3028, January 14, 2021). There have been no documented interactions with marine mammals in the past five years of data.

Hook and Line

Large whales have been documented entangled with hook and line gear or monofilament line (Greater Atlantic Region Marine Animal Incident Database, unpublished data; Marine Mammal SARs: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). In the most recent (2008-2017) mortality and serious injury determinations for baleen whales, the majority of cases identified with confirmed hook and line or monofilament entanglement did not result in the serious injury or mortality to the whale (84.8 % observed/reported whales had a serious injury value of 0; 15.2 % had a serious injury value of 0.75; none of the cases resulted in mortality; Cole and Henry 2013; Henry et al. 2017; Henry et al. 2020). In fact, 75.8 % of the whales observed or reported with a hook/line or monofilament entanglement were resighted gear free and healthy; confirmation of the health of the other remaining whales remain unknown as no resightings had been made over the timeframe of the assessment (Cole and Henry 2013; Henry et al. 2017; Henry et al. 2020). Based on this information, while large whale interactions with hook and line gear are possible, there is a low probability that an interaction will result in serious injury or mortality to any large whale species. Therefore, relative to other gear types, such as fixed gear, hook and line gear represents a low source serious injury or mortality to any large whale (Henry et al. 2020).

Based on the most recent 10 years of data provided in the marine mammal SARs (i.e., 2008-2017) for small cetaceans and pinnipeds that occur within the striped bass management unit, only bottlenose dolphin stocks have been identified (primarily through stranding records/data) as entangled in hook and line gear (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). In some cases, these entanglements have resulted in the serious injury or mortality to the animal. Specifically, reviewing stranding data provided in marine mammal SARs from 2008-2017, estimated mean annual mortality for each bottlenose stock due to interactions with hook and line gear was approximately one animal (Palmer 2017; https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region). Based on this, although interactions with hook and line gear are possible, relative to other gear types, such as trawl gear, hook and line gear represents a low source serious injury or mortality to any bottlenose dolphin stock. For other species of small cetaceans or pinnipeds, hook and line gear is not expected to be a source of serious injury or mortality.

Pound Nets

The Virginia pound net fishery is listed as a Category II fishery in the 2021 LOF due to documented interactions with bottlenose dolphins (86 FR 3028, January 14, 2021). During 2014–2018, there were no documented mortalities or serious injuries to bottlenose dolphins involving pound net gear in Virginia. There is no formal observer coverage for the Virginia pound net fishery but there has been sporadic monitoring by the Northeast Fishery Observer Program. All other Atlantic coast pound net fisheries are listed as a Category III fishery.

NOAA Fisheries issued a final rule in 2015 amending the Bottlenose Dolphin Take Reduction Plan and its implementing regulations under the Marine Mammal Protection Act (MMPA) requiring gear restrictions for VA pound nets in estuarine and coastal state waters of Virginia to reduce bycatch (80 FR 6925, February 9, 2015). NOAA Fisheries also amended regulations and definitions for Virginia pound nets under the Endangered Species Act (ESA) for sea turtle conservation to be consistent with this final rule. More information on this rule is available here: https://www.fisheries.noaa.gov/action/amendment-virginia-pound-net-regulations.

Fyke Net and Floating Fish Traps

The Rhode Island Floating fish trap and the Northeast/Mid-Atlantic fyke net fisheries are listed as a Category III fishery in the 2021 LOF (86 FR 3028, January 14, 2021). There are no documented interactions between marine mammals in the Northeast/Mid-Atlantic fyke net fishery nor the floating fish trap fishery.

Bottom Trawls

The Mid-Atlantic bottom trawl fishery is listed as a Category II fishery in the 2021 LOF (86 FR 3028, January 14, 2021). In 2005, Mid-Atlantic bottom trawl fishery was elevated to Category II based on mortality and injury of common dolphins and pilot whales (later removed from the list of species killed or injured by this fishery). This fishery continues to be listed as a Category II fishery due to interactions with bottlenose dolphins, common dolphins, and gray seals. Interactions with other species include the harbor seal, Risso's dolphin, and white-sided dolphin.[19]

With the exception of minke whales, there have been no observed interactions with large whales and bottom trawl gear.[20] In 2008, several minke whales were observed dead in bottom trawl gear attributed to the northeast bottom trawl fishery; estimated annual mortality attributed to this fishery in 2008 was 7.8 minke whales (Waring et al. 2015). Since 2008, serious injury and mortality records for minke whales in U.S. waters have shown zero interactions with bottom trawl (northeast or Mid-Atlantic) gear.[21] Based on this information, large whale interactions with bottom trawl gear are expected to be rare to nonexistent.

Haul/Beach Seine

The Mid-Atlantic haul/beach seine fishery is listed as a Category II fishery in the 2021 LOF due to interactions with coastal bottlenose dolphin (86 FR 3028, January 14, 2021). NMFS has recorded one observed take of a bottlenose dolphin in this fishery in 1998 (Waring and Quintal 2000). During 2014–2018, one serious injury of a common bottlenose dolphin occurred associated with the mid-Atlantic haul/beach seine fishery. During 2014, a common

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[19] For additional information on small cetacean and pinniped interactions, see: Chavez-Rosales et al. 2017; Hatch and Orphanides 2014, 2015, 2016, 2019; Josephson et al. 2017; Josephson et al. 2019; Lyssikatos 2015; Lyssikatos et al. 2020; Orphanides 2020; Read *et al*. 2006; Waring et al. 2015b; Marine Mammal SARS: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; MMPA LOF at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries.

[20] Refer to Greater Atlantic Region Marine Animal Incident Database (unpublished data); Marine Mammal SARs: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region; NEFSC observer/sea sampling database, unpublished data ; MMPA LOF: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries; NMFS NEFSC reference documents (marine mammal serious injury and mortality reports): https://apps-nefsc.fisheries.noaa.gov/rcb/publications/center-reference-documents.html

[21] Refer to: Greater Atlantic Region Marine Animal Incident Database (unpublished data); Waring et al. 2016; Hayes et al. 2017; Hayes et al. 2018; Hayes et al. 2019; Hayes et al. 2020; Cole and Henry 2013; and, Henry et al. 2014, 2015, 2016, 2017, 2019, 2020; MMPA LOF: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-list-fisheries.

bottlenose dolphin was found within a haul seine net in Virginia and released alive seriously injured (Maze-Foley and Garrison 2020). Harbor porpoise was removed from the list of species killed or injured in the Mid-Atlantic haul/beach seine fishery due to no other interactions between 1999 and 2003. The fishery was observed from 1998-2001 but there has been limited observer coverage since 2001.

7.3.2 Sea Turtles

All sea turtles that occur in U.S. waters are listed as either endangered or threatened under the ESA. Four sea turtle species likely to overlap with the striped bass fishery are loggerhead (*Caretta caretta*), Kemp's Ridley (*Lepidochelys kempi*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) sea turtles.

The Atlantic seaboard provides important developmental habitat for post-pelagic juveniles, as well as foraging and nesting habitat for adult sea turtles. The distribution and abundance of sea turtles along the Atlantic coast is related to geographic location and seasonal variations in water temperatures. In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, MA, although their presence varies with the seasons due to changes in water temperature. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States and also move up the Atlantic coast (Braun-McNeill & Epperly 2004; Epperly et al. 1995a,b,c; Griffin et al. 2013; Morreale & Standora 2005), occurring in Virginia foraging areas as early as late April and on the most northern foraging grounds in the GOM in June (Shoop & Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by September, but some remain in Mid-Atlantic and Northeast areas until late fall (i.e., November). By December, sea turtles have migrated south to waters offshore of North Carolina, particularly south of Cape Hatteras, and further south, although it should be noted that hard-shelled sea turtles can occur year-round in waters off Cape Hatteras and south (Epperly et al. 1995b; Griffin et al. 2013; Hawkes et al. 2011; Shoop & Kenney 1992).

Juvenile Kemp's ridleys sea turtles use northeastern and mid-Atlantic waters of the U.S. Atlantic coastline as primary developmental habitat, with shallow coastal embayments serving as important foraging grounds during the summer months. Juvenile ridleys migrate south as water temperatures cool, and are predominantly found in shallow coastal embayments along the Gulf Coast during the fall and winter months. Kemp's ridleys can be found from New England to Florida, and are the second most abundant sea turtle in Virginia and Maryland waters (Keinath et al. 1987; Musick and Limpus, 1997). In the Chesapeake Bay, ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation (Lutcavage and Musick, 1985; Bellmund et al., 1987; Keinath et al,. 1987; Musick and Limpus, 1997). These turtles primarily feed on crabs, but also consume mollusks, shrimp, and fish (Bjorndal, 1997).

The leatherback is the largest living turtle and its range is farther than any other sea turtle species (NMFS, 2013). Leatherback turtles are often found in association with jellyfish, with the species primarily feeding on Cnidarians (*medusae, siphonophores*) and tunicates (*salps,* *pyrosomas*). While these turtles are predominantly found in the open ocean, they do occur in coastal water bodies such as Cape Cod Bay and Narragansett Bay, particularly the fall. The most significant nesting in the U.S. occurs in southeast Florida (NMFS, 2013). Leatherbacks are known to use coastal waters of the U.S. continental shelf and to have a greater tolerance for colder water than hard-shelled sea turtles (James *et al.* 2005; Eckert *et al.* 2006; Murphy *et al.* 2006; NMFS and USFWS 2013b; Dodge *et al.* 2014). Leatherback sea turtles engage in routine migrations between northern temperate and tropical waters; they are found in more northern waters (i.e., Gulf of Maine) later in the year (i.e., similar time frame as hard-shelled sea turtles), with most leaving the Northwest Atlantic shelves by mid-November (NMFS and USFWS 1992; James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014).

More information about sea turtles can be found here: https://www.fisheries.noaa.gov/sea-turtles.

7.3.2.1 Potential Impacts of Striped Bass Fishery on Sea Turtles

The following sections are not a comprehensive review of all fishing gear types known to interact with a given species and the bycatch reports included below do not represent a complete list.

Gillnet

An observer program for protected species has not been established for the striped bass fishery. However, under the ESA Annual Determination to Implement Sea Turtle Observer Requirement (80 FR 14319, April 18, 2015), one fishery that targets striped bass is included, the Chesapeake Bay Inshore Gillnet Fishery.

Hook and Line

Interactions between ESA listed species of sea turtles and hook and line gear have been documented, particularly in nearshore waters of the Mid-Atlantic (e.g., Greater Atlantic Region Sea Turtle and Disentanglement Network, unpublished data; NMFS Sea Turtle Stranding and Salvage Network, unpublished data; Palmer 2017). Interactions with hook and line gear have resulted in sea turtle injury and mortality and therefore, poses an interaction risk to these species. However, the extent to which these interactions are impacting sea turtle populations is still under investigation, and therefore, no conclusions can currently be made on the impact of hook and line gear on the continued survival of sea turtle populations.

Pound Nets

Populations of loggerhead, Kemp's ridley, and leatherback sea turtles are at risk in areas where pound net fishing is abundant, such as the Chesapeake Bay and surrounding waters. NOAA Fisheries issued a final rule in 2015 amending the Bottlenose Dolphin Take Reduction Plan and its implementing regulations under the MMPA requiring gear restrictions for VA pound nets in estuarine and coastal state waters of Virginia to reduce bycatch (80 FR 6925, February 9, 2015). NOAA Fisheries also amended regulations and definitions for Virginia pound nets under the ESA for sea turtle conservation to be consistent with this final rule. Pound net regulations were enacted to protect both sea turtles and bottlenose dolphins. More information on this rule is available here: https://www.fisheries.noaa.gov/action/amendment-virginia-pound-net-regulations.

Bottom Trawl

Bottom trawl gear poses an injury and mortality risk to sea turtles (Sasso and Epperly 2006; NMFS Observer Program, unpublished data). Since 1989, the date of our earliest observer records for federally managed fisheries, sea turtle interactions with trawl gear have been observed in the Gulf of Maine, Georges Bank, and/or the Mid-Atlantic; however, most of the observed interactions have been observed south of the Gulf of Maine (Murray 2008; Murray 2015b; Murray 2020; NMFS Observer Program, unpublished data; Warden 2011 a, b). Murray (2020) provided information on sea turtle interaction rates from 2014-2018 and estimated 571 loggerhead, 46 Kemp's ridley, 20 leatherback, and 16 green sea turtle interactions were estimated to have occurred in bottom trawl gear in the Mid-Atlantic region over the five-year period. On Georges Bank, 12 loggerheads, and 6 leatherback interactions. An estimated 272 loggerhead, 23 Kemp's ridley, 13 leatherback, and 8 green sea turtle interactions resulted in mortality over this period (Murray 2020).

7.3.3 Atlantic Sturgeon

Since 1998, there has been a moratorium on the harvest of Atlantic Sturgeon in both state and federal waters; however, the population has continued to decline and, in 2012, Atlantic sturgeon became listed under the ESA. The listing identifies five distinct population segments (DPS), which include the Gulf of Maine, the New York Bight, the Chesapeake Bay, Carolina, and the South Atlantic (77 FR 5914 and 77 FR 5880, February 6, 2012). All DPSs are listed as endangered except for the Gulf of Maine population, which is listed as threatened. Primary threats to the species include historic overfishing, the bycatch of sturgeon in other fisheries, habitat destruction from dredging, dams, and development, and vessel strikes (77 FR 5914; 77 FR 5880). In April 2017, NOAA Fisheries published a final rule (82 FR 39160) to designate Atlantic sturgeon critical habitat (i.e., specific areas that are considered essential to the conservation of the species) in each of the DPSs.

The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. Based on fishery-independent and dependent data, as well as data collected from tracking and tagging studies, in the marine environment, Atlantic sturgeon appear to primarily occur inshore of the 50 meter depth contour (Stein et al. 2004 a,b; Erickson et al. 2011; Dunton et al. 2010); however, Atlantic sturgeon are not restricted to these depths, as excursions into deeper continental shelf waters have been documented (Timoshkin 1968; Collins and Smith 1997; Stein et al. 2004a,b; Dunton et al. 2010; Erickson et al. 2011). Data from fishery-independent surveys and tagging and tracking studies also indicate that Atlantic sturgeon may undertake seasonal movements along the coast (Dunton et al. 2010; Erickson et al. 2011; Wipplehauser 2012); however, there is no evidence to date that all Atlantic sturgeon make these seasonal movements and therefore, may be present throughout the marine environment throughout the year.

For additional information on the biology, status, and range wide distribution of each distinct population segment (DPS) of Atlantic sturgeon please refer to 77 FR 5880 and 77 FR 5914, as well as the Atlantic Sturgeon Status Review Team's (ASSRT) 2007 status review of Atlantic sturgeon (ASSRT 2007) and the Atlantic States Marine Fisheries Commission 2017 Atlantic Sturgeon Benchmark Stock Assessment and Peer Review Report (ASMFC 2017).

7.3.3.1 Potential Impacts of Striped Bass Fishery on Atlantic Sturgeon

The following sections are not a comprehensive review of all fishing gear types known to interact with a given species and the bycatch reports included below do not represent a complete list.

Bottom Trawl and Gillnet

Since 1989, Atlantic sturgeon interactions (i.e., bycatch) with sink gillnet and bottom trawl gear have frequently been observed in the Greater Atlantic Region, with most sturgeon observed captured falling within the 100 to 200cm total length range; however, both larger and small individuals have been observed (ASMFC 2007; ASMFC 2017; Miller and Shepard 2011; NEFSC observer/sea sampling database, unpublished data; Stein et al. 2004). For sink gillnets, higher levels of Atlantic sturgeon bycatch have been associated with depths of less than 40 meters, mesh sizes of greater than 10 inches, and the months of April and May (ASMFC 2007). Hager et al. (2021) found that subadult Atlantic sturgeon are particularly susceptible to interactions with striped bass sink gillnet gear in the James River, VA.

For otter trawl fisheries, the highest incidence of Atlantic sturgeon bycatch have been associated with depths less than 30 meters (ASMFC 2007). More recently, over all gears and observer programs that have encountered Atlantic sturgeon, the distribution of haul depths on observed hauls that caught Atlantic sturgeon was significantly different from those that did not encounter Atlantic surgeon, with Atlantic sturgeon encountered primarily at depths less than 20 meters (ASMFC 2017).

The ASMFC (2017) Atlantic sturgeon Benchmark Stock Assessment represents the most accurate predictor of annual Atlantic sturgeon interactions in fishing gear (e.g., otter trawl, gillnet). The stock assessment analyzes fishery observer and VTR data to estimate Atlantic sturgeon interactions in fishing gear in the Mid-Atlantic and New England regions from 2000-2015, the timeframe which included the most recent, complete data at the time of the report. The total bycatch of Atlantic sturgeon from bottom otter trawls ranged between 624-1,518 fish over the 2000-2015 time series, while the total bycatch of Atlantic sturgeon from gillnets ranged from 253-2,715 fish. Focusing on the most recent five-year period of data provided in the stock assessment report[22], the estimated average annual bycatch during 2011-2015 of

[22] The period of 2011-2015 was chosen as it is the period within the stock assessment that most accurately resembles the current trawl fisheries in the region.

Atlantic sturgeon in bottom otter trawl gear is 777.4 individuals and in gillnet gear is 627.6 individuals.

Hook and Line

Interactions between ESA-listed species of Atlantic sturgeon and hook and line gear have been documented, particularly in nearshore waters (ASMFC 2017). Interactions with hook and line gear have resulted in Atlantic sturgeon injury and mortality and therefore, poses an interaction risk to these species. However, the extent to which these interactions are impacting Atlantic sturgeon DPSs is still under investigation and therefore, no conclusions can currently be made on the impact of hook and line gear on the continued survival of Atlantic sturgeon DPSs (NMFS 2011b; ASMFC 2017).

7.3.4 Shortnose Sturgeon

Shortnose sturgeon occur in estuaries large coastal rivers on the Atlantic coast from Canada to Florida, including the Chesapeake Bay and its tributaries. Shortnose sturgeon spend most of their life in their natal river system and estuaries and tend to spend little time in ocean waters (NMFS 1998). Adults generally migrate upriver in spring to spawn and move back downstream after spawning to higher salinity habitats for foraging (SSSRT 2010). Shortnose sturgeon have been listed as endangered under the ESA since 1967 and the 1998 recovery plan identified 19 DPSs across 25 river systems.

7.3.4.1 Potential Impacts of Striped Bass Fisheries on Shortnose Sturgeon

Bycatch of shortnose sturgeon in fisheries targeting other species has been documented throughout its range (SSSRT 2010). Bycatch of shortnose sturgeon primarily occurs in gillnet fisheries, but has also occurred in other gear types including pound nets, fyke nets, and hook and lines. Adult shortnose sturgeon are thought to be especially vulnerable to fishing gears targeting anadromous species (such as shad, striped bass, alewives and herring) during times of extensive migration, particularly their spawning migration (SSSRT 2010; Litwiler 2001).

7.3.5 Giant Manta Ray

While there is considerable uncertainty regarding the species' current abundance throughout its range, the best available information indicates that the species has experienced population declines of potentially significant magnitude within areas of the Indo-Pacific and eastern Pacific portions of its range (Miller and Klimovich 2017). While it's assume that declining populations within the Indo-Pacific and eastern Pacific will likely translate to overall declines in the species throughout its entire range, there is very little information on the abundance, and thus, population trends in the Atlantic portion of its range (Miller and Klimovich 2017).

Based on the giant manta ray's distribution, the species may occur in coastal, nearshore, and pelagic waters off the U.S. east coast (Miller and Klimovich 2017). Along the U.S. East Coast, giant manta rays are usually found in water temperatures between 19 and 22 degrees Celsius (Miller and Klimovich 2017) and have been observed as far north as New Jersey. Given that the species is rarely identified in the fisheries data in the Atlantic, it may be assumed that populations within the Atlantic are small and sparsely distributed (Miller and Klimovich 2017).

7.3.5.1 Potential Impacts of Striped Bass Fishery on Giant Manta Rays

The following sections are not a comprehensive review of all fishing gear types known to interact with a given species and the bycatch reports included below do not represent a complete list.

Bottom Trawl and Gillnet Gear

Giant manta rays are potentially susceptible to capture by gillnet and bottom trawl gear based on records of their capture in fisheries using this gear types (NEFSC observer/sea sampling database, unpublished data). Review of the most recent 10 years of NEFOP data showed that between 2010-2019, two (unidentified) Giant Manta Rays were observed in bottom trawl gear and two were observed in gillnet gear (NMFS NEFSC observer/sea sampling database, unpublished data). Additionally, all of the giant manta ray interactions in gillnet or trawl gear recorded in the NEFOP database (13 between 2001 and 2019) indicate the animals were encountered alive and released alive. However, details about specific conditions such as injuries, damage, time out of water, how the animal was moved or released, or behavior on release is not always recorded. While there is currently no information on post-release survival, NMFS Southeast Gillnet Observer Program observed a range of 0 to 16 giant manta rays captured per year between 1998 and 2015 and estimated that approximately 89% survived the interaction and release (see NMFS reports available at: http://www.sefsc.noaa.gov/labs/panama/ob/gillnet.htm).

Hook and Line

The most recent 10 years of data on observed or documented interactions between giant manta rays and fishing gear, there have been no observed/documented interactions between giant manta rays and hook and line gear (NEFSC observer/sea sampling database, unpublished data). Based on this information, hook and line gear is not expected to pose an interaction risk to giant manta rays and therefore, is not expected to be source of injury or mortality to this species

7.3.6 Seabirds

Like marine mammals, seabirds are vulnerable to entanglement in commercial fishing gear. Under the Migratory Bird Treaty Act, it is unlawful “by any means or in any manner, to pursue, hunt, take, capture, [or] kill” any migratory birds except as permitted by regulation (16 U.S.C. 703). Given that an interaction has not been quantified in the Atlantic striped bass fishery, impacts to seabirds are not considered to be significant. Endangered and threatened bird species, such as the piping plover, are unlikely to be impacted by the gear types employed in the striped bass fishery. Other human activities such as coastal development, habitat degradation and destruction, and the presence of organochlorine contaminants are considered to be the major threats to some seabird populations.

7.4 POTENTIAL IMPACTS TO ATLANTIC COASTAL STATE AND INTERSTATE FISHERIES

There are several take reduction teams, whose management actions have potential impacts to coastal striped bass fisheries.

The Mid-Atlantic coastal gillnet fishery is one of two fisheries regulated by the Harbor Porpoise Take Reduction Plan (50 CFR 229.33 and 229.34). Amongst other measures, the plan uses time area closures in combination with pingers in Northeast waters, and time area closures along with gear modifications for both small and large mesh gillnets in mid-Atlantic waters. Although the plan predominately impacts the dogfish and monkfish fisheries due to higher porpoise bycatch rates, other gillnet fisheries are also affected.

The Atlantic Large Whale Take Reduction Plan (50 CFR 229.32) (ALWTRP) addresses the incidental bycatch of large baleen whales, primarily the North Atlantic right whale and the humpback whale, in several fisheries including Mid-Atlantic coastal gillnet fishery. Amongst other measures, the plan closes right whale critical habitat areas to specific types of fishing gear during specific seasons, and modifies fishing gear and practices. The Atlantic Large Whale Take Reduction Team continues to identify ways to reduce possible interactions between large whales and commercial gear. In 2014 and 2015, the ALWTRP was modified to reduce the number of vertical lines associated with trap/pot fisheries and required expanded gear markings for gillnets and traps in Jeffrey's Ledge and Jordan Basin (79 FR 35686, June 27, 2014; 80 FR 30367, May 28, 2015).

The Bottlenose Dolphin Take Reduction Team first convened in 2001 to discuss incidental catch of coastal bottlenose dolphins in Category I and II fisheries. In 2006, a Bottlenose Dolphin Take Reduction Plan was established, which created gear regulations for the mid-Atlantic coastal gillnet fishery, the Virginia pound net fishery, the mid-Atlantic beach seine fishery, and the North Carolina inshore gillnet fishery, among others. Specifically, the plan established mesh sizes for the gill net fisheries and prohibited night fishing for some regions and gear types (71 FR 24776, April 26, 2006).

Based on a consensus recommendation from the Bottlenose Dolphin Take Reduction Team, NOAA Fisheries issued a final rule in 2015 amending the Bottlenose Dolphin Take Reduction Plan and its implementing regulations under the Marine Mammal Protection Act (MMPA) to require the year-round use of modified pound net leaders for offshore Virginia pound nets in specified waters of the lower mainstem Chesapeake Bay and coastal state waters (80 FR 6925, February 9, 2015). The rule also finalized Virginia pound net-related definitions, gear prohibitions, and non-regulatory measures. NOAA Fisheries also amended regulations and definitions for Virginia pound nets under the Endangered Species Act (ESA) for sea turtle conservation to be consistent with this final rule. Pound net regulations were enacted to protect both sea turtles and bottlenose dolphins. More information on this rule is available here: https://www.fisheries.noaa.gov/action/amendment-virginia-pound-net-regulations.

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9.0 TABLES

Note: Tables 1-3 are in-text.

Table 4. Base commercial quota, 2020 commercial quota, and 2020 commercial harvest by state in pounds for the calendar year. Source: 2021 state compliance reports. 2020 quota was based on Addendum VI and approved conservation equivalency programs.

State	Base Quota	2020 Quota^	2020 Harvest
Ocean			
Maine*	154	154	-
New Hampshire*	3,537	3,537	-
Massachusetts	713,247	735,240	386,924
Rhode Island	148,889	148,889	115,891
Connecticut*	14,607	14,607	-
New York	652,552	640,718	473,461
New Jersey**	197,877	215,912	-
Delaware	118,970	142,474	137,986
Maryland	74,396	89,094	83,594
Virginia	113,685	125,034	77,239
North Carolina	295,495	295,495	0
Ocean Total	**2,333,409**	**2,411,154**	**1,275,095**
Chesapeake Bay			
Maryland	**2,588,603**	1,442,120	1,273,757
Virginia		983,393	611,745
PRFC		572,861	400,319
Bay Total		**2,998,374**	**2,285,821**

* Commercial harvest/sale prohibited, with no re-allocation of quota.
** Commercial harvest/sale prohibited, with re-allocation of quota to the recreational fishery.
^ 2020 quota changed through conservation equivalency by either changing size limit with equivalent 18% quota reduction (MA, NY), or by taking a greater than 18% reduction in recreational removals to offset a less than 18% commercial quota reduction (NJ, DE, MD, PRFC, VA).
Note: Maryland's Chesapeake Bay quota for 2020 was adjusted to account for the overage in 2019.

Table 5. Summary of Atlantic striped bass commercial regulations in 2020. Source: 2021 State Compliance Reports. Minimum sizes and slot size limits are in total length (TL). *Commercial quota reallocated to recreational bonus fish program.

STATE	COMMERCIAL SIZE LIMITS (TL) and TRIP LIMITS	COMMERCIAL SEASONAL QUOTA	COMMERCIAL OPEN SEASON
ME	Commercial fishing prohibited		
NH	Commercial fishing prohibited		
MA	≥35" minimum size; no gaffing undersized fish. 15 fish/day with commercial boat permit; 2 fish/day with rod and reel permit.	735,240 lbs. Hook & Line only.	6.24 until quota reached, Mondays and Wednesdays only. (In-season adjustment added Tuesdays effective Sept 1.) July 3rd, July 4th and Labor Day closed. Cape Cod Canal closed to commercial striped bass fishing.
RI	Floating fish trap: 26" minimum size unlimited possession limit until 70% of quota reached, then 500 lbs. per licensee per day	Total: 148,889 lbs., split 39:61 between the trap and general category. Gill netting prohibited.	4.1 – 12.31
	General category (mostly rod & reel): 34" min. 5 fish/vessel/day limit.		5.20-6.30, 7.1-12.31, or until quota reached. Closed Fridays, Saturdays, and Sundays during both seasons.
CT	Commercial fishing prohibited; bonus program in CT suspended indefinitely in 2020.		
NY	26"-38" size; (Hudson River closed to commercial harvest)	640,718 lbs. Pound Nets, Gill Nets (6-8"stretched mesh), Hook & Line.	5.15 – 12.15, or until quota reached. Limited entry permit only.
NJ*	Commercial fishing prohibited; bonus program: 1 fish at 24" to <28" slot size	215,912 lbs.	5.15 – 12.31 (permit required)
PA	Commercial fishing prohibited		

(Table 5 continued – Summary of commercial regulations in 2020).

STATE	COMMERCIAL SIZE LIMITS (TL) and TRIP LIMITS	COMMERCIAL SEASONAL QUOTA	COMMERCIAL OPEN SEASON
DE	Gill Net: 20" min in DE Bay/River during spring season. 28" in all other waters/seasons.	Gillnet: 135,350 lbs. No fixed nets in DE River.	Gillnet: 2.15-5.31 (2.15-3.30 for Nanticoke River) & 11.15-12.31; drift nets only 2.15-28 & 5.1-31; no trip limit.
	Hook and Line: 28" min	Hook and line: 7,124 lbs.	Hook and Line: 4.1–12.31, 200 lbs./day trip limit
MD	Chesapeake Bay and Rivers: 18–36" Common pool trip limits: Hook and Line - 250 lbs./license/week Gill Net - 300 lbs./license/week	1,445,394 lbs. (part of Bay-wide quota) – Initial quota 1,442,120 lbs. – Adjusted quota due to 2019 overage	Bay Pound Net: 6.1-12.31 Bay Haul Seine: 6.1-12.31 Bay Hook & Line: 6.4-12.31 Bay Drift Gill Net: 1.1-2.28, 12.1-12.31
	Ocean: 24" minimum	Ocean: 89,094 lbs.	1.1-5.31, 10.1-12.31
PRFC	18" min all year; 36" max 2.15–3.25	572,861 lbs. (part of Bay-wide quota)	Hook & Line: 1.1-3.25, 6.1-12.31 Pound Net & Other: 2.15-3.25, 6.1-12.15 Gill Net: 11.9.2019-3.25.2020 Misc. Gear: 2.15-3.25, 6.1-12.15
VA	Bay and Rivers: 18" min; 28" max size limit 3.15–6.15	983,393 lbs. (part of Bay-wide quota)	1.16-12.31
	Ocean: 28" min	125,034 lbs.	
NC	Ocean: 28" min	295,495 lbs. (split between gear types).	Seine fishery was not opened Gill net fishery was not opened Trawl fishery was not opened

Table 6. Summary of Atlantic striped bass recreational regulations in 2020. Source: 2021 State Compliance Reports. Minimum sizes and slot size limits are in total length (TL).

STATE	RECREATIONAL SIZE LIMITS (TL)/REGION	BAG LIMIT	RECREATIONAL GEAR/FISHING RESTRICTIONS	RECREATIONAL OPEN SEASON
ME	28" to <35"	1 fish/day	Hook & line only; circle hooks only when using live bait	All year, except spawning areas are closed 12.1-4.30 and C&R only 5.1-6.30
NH	28" to <35"	1 fish/day	Gaffing and culling prohibited; Use of corrodible non-offset circle hooks required if angling with bait	All year
MA	28" to <35"	1 fish/day	Hook & line only; no high-grading; gaffs and other injurious removal devices prohibited. Private angler circle hook requirement when fishing with natural bait (exception for artificial lures).	All year
RI	28" to <35"	1 fish/day	The use of circle hooks is required by any vessel or person while fishing recreationally with bait for striped bass	All year
CT	28" to <35"	1 fish/day	Inline circle hooks only when using whole, cut or live natural bait (Dec 1st, 2020). Spearing and gaffing prohibited	All year
NY	Ocean and DE River: Slot Size: 28 -35	1 fish/day	Angling only. Spearing permitted in ocean waters. C&R only during closed season.	Ocean: 4.15-12.15 Delaware River: All year
	HR: Slot Size: 18 -28	1 fish/day	Angling only.	Hudson River: 4.1-11.30
NJ	1 fish at 28" to < 38" (effective 4/1/2020)	1 fish/day	Non-offset circle hooks must be used when using bait with a #2 sized hook or larger in Delaware River & tributaries from 4.1-5.31.	Closed 1.1 – last day of Feb in all waters except in the Atlantic Ocean, and closed 4.1-5.31 in the lower DE River and tributaries
PA	Upstream from Calhoun St Bridge: 1 fish at 28" to <35"			
	Downstream from Calhoun St Bridge: 1 fish at 28" to <35", and 2 fish at 21-24" slot size limit from 4.1 – 5.31			

(Table 6 continued – Summary of recreational regulations in 2020).

STATE	RECREATIONAL SIZE LIMITS/REGION	BAG LIMIT	RECREATIONAL GEAR/FISHING RESTRICTIONS	RECREATIONAL OPEN SEASON
DE	28” to <35"	1 fish/day	Hook & line, spear (for divers) only. Circle hooks required in spawning season.	All year. C&R only 4.1-5.31 in spawning grounds. 20”-25”slot from 7.1-8.31 in DE River, Bay & tributaries
MD	Ocean: 28” to <35"	1 fish/day		All year
	Chesapeake Bay and tribs^+	C&R only	no eels; no stinger hooks; barbless hooks when trolling; circle or J-hooks when using live bait; max 6 lines when trolling	1.1-2.28, 3.1-3.31, 12.11-12.31
	Chesapeake Bay: 35" min	1 fish/day	Geographic restrictions apply+.	5.1-5.15
	Chesapeake Bay: 1 fish/day, 19" minimum size; 2/fish/day for charter with only 1 fish >28"		Geographic restrictions apply+; circle hooks if chumming or live-lining; no treble hooks when bait fishing.	5.16-5.31
	Chesapeake Bay and tribs: 1 fish/day, 19" minimum size; 2/fish/day for charter with only 1 fish >28"		All Bay and tribs open; circle hooks if chumming or live-lining; no treble hooks when bait fishing.	6.1-8.15 (no targeting 8.16-8/31)*, 9.1-12.10
PRFC	Spring Trophy: 1 fish/day, 35” minimum size		No more than two hooks or sets of hooks for each rod or line; no live eel; no high-grading	5.1-5.15
	Summer and Fall: 2 fish/day, 20” min		No more than two hooks or sets of hooks for each rod or line.	5.16-7.6 and 8.21-12.31; closed 7.7-8.20 (No Direct Targeting)

^ Susquehanna Flats: C&R only Jan 1 – March 31 (no treble hooks when bait fishing); 1 fish at 19”-26” slot May 16 – May 31.
+ Current Maryland maps available here: https://dnr.maryland.gov/fisheries/Pages/sb_reg_maps.aspx
*Open season in 2021 for Maryland Chesapeake Bay and tributaries changed to 6.1-7.15 (no targeting 7.16-7.31), 8.1-12.10.

(Table 6 continued – Summary of recreational regulations in 2020).

STATE	RECREATIONAL SIZE LIMITS/REGION	BAG LIMIT	RECREATIONAL GEAR/FISHING RESTRICTIONS	RECREATIONAL OPEN SEASON
DC	18" minimum size	1 fish/day	Hook and line only	5.16-12.31
VA	Ocean: 28"-36" slot limit	1 fish/day	Hook & line, rod & reel, hand line only. No gaffing. Circle hooks required if/when fishing with live bait (as of July 2020).	1.1-3.31, 5.16-12.31
	Ocean Spring Trophy: NO SPRING TROPHY SEASON			
	Chesapeake Bay Spring Trophy: NO SPRING TROPHY SEASON			
	Bay Spring: 20"-28" slot limit	1 fish/day	Hook & line, rod & reel, hand line only. No gaffing. Circle hooks required if/when fishing with live bait (as of July 2020).	5.16-6.15
	Bay Fall: 20 - 36" slot limit	1 fish/day	Hook & line, rod & reel, hand line only. No gaffing. Circle hooks required if/when fishing with live bait (as of July 2020).	10.4-12.31
NC	28" to <35"	1 fish/day	No gaffing allowed. Circle hooks required when fishing with natural bait.	All year

Table 7. CE programs implemented for Addendum VI to Amendment 6.

State	Recreational Fisheries	Commercial Fisheries
MA	N/A	Changed size limit (35” minimum) with equivalent quota change
NY	Hudson River: Alternative size limit (18” to 28”) to achieve 18% removals reduction in combination with standard Ocean slot	Changed size limit (26” to 38”) with equivalent quota reduction
NJ	Alternative size limit (28 to < 38”) to achieve 25% removals reduction	Decreased commercial quota reduction (to 0%) with surplus recreational fishery reduction and transferred commercial quota to recreational bonus program fishery (24 to < 28”, 1 fish/day)
PA	DE River and Estuary downstream Calhoun St Bridge: Alternative size and bag limit on limited seasonal basis (2 fish/day at 21 to <24” during 4.1–5.31) to achieve 18% removals reduction	N/A
DE	DE River/Bay/tributaries: Alternative slot on limited seasonal basis (20" to <25" during 7.1–8.31) to achieve 20.4% removals reduction in combination with standard Ocean slot	Decreased commercial quota reduction (to -1.8%) with surplus recreational fishery reduction
MD	Chesapeake Bay: Alternative Summer/Fall for-hire bag limit with restrictions (2 fish, only 1 >28”, no captain retention) through increased minimum size (19”), April and two-week Wave 4 targeting closures, and shorter spring trophy season (May 1–15) to achieve 20.6% removals reduction; Ocean: FMP standard slot	Decreased Ocean and Chesapeake Bay commercial quota reduction (to -1.8%) with surplus Chesapeake Bay recreational fishery reduction
PRFC	Alternative Summer/Fall minimum size and bag limit (20” min, 2 fish/day) with a no targeting closure (7.7–8.20) and shorter spring trophy season (May 1–15) to achieve a 20.5% removals reduction	Decreased Chesapeake Bay commercial quota (to -1.8%) with surplus recreational fishery reduction
VA	Chesapeake Bay: Alternative slot limits during 5.16–6.15 (20” to 28”) and 10.4–12.31 (20” to 36”) and no spring trophy season to achieve a 23.4% removals reduction (reduction was the result of lowering prior bag limit from 2 to 1-fish per angler); Ocean: Alternative slot limit (28” to 36”)	Decreased Ocean commercial quota (to -7.7%) and Chesapeake Bay commercial quota (to -9.8%) with surplus recreational fishery reduction

Table 8. Total removals (harvest plus discards/release mortality) of Atlantic striped bass by sector in numbers of fish, 1990-2020. Note: Harvest is from state compliance reports/MRIP (July 8, 2021), discards/release mortality is from ASMFC. Estimates exclude inshore harvest from North Carolina.

Year	Commercial		Recreational		Total Removals
	Harvest	Discards*	Harvest	Release Mortality	
1990	93,888	47,859	578,897	442,811	1,163,455
1991	158,491	92,480	798,260	715,478	1,764,709
1992	256,476	193,281	869,779	937,611	2,257,147
1993	314,526	115,859	789,037	812,404	2,031,826
1994	325,401	166,105	1,055,523	1,360,872	2,907,900
1995	537,412	188,507	2,287,578	2,010,689	5,024,186
1996	854,102	257,749	2,487,422	2,600,526	6,199,800
1997	1,076,591	325,998	2,774,981	2,969,781	7,147,351
1998	1,215,219	347,343	2,915,390	3,259,133	7,737,085
1999	1,223,572	337,036	3,123,496	3,140,905	7,825,008
2000	1,216,812	209,329	3,802,477	3,044,203	8,272,820
2001	931,412	182,606	4,052,474	2,449,599	7,616,091
2002	928,085	199,770	4,005,084	2,792,200	7,925,139
2003	854,326	131,319	4,781,402	2,848,445	8,615,492
2004	879,768	157,724	4,553,027	3,665,234	9,255,753
2005	970,403	146,126	4,480,802	3,441,928	9,039,259
2006	1,047,648	158,808	4,883,961	4,812,332	10,902,750
2007	1,015,114	160,728	3,944,679	2,944,253	8,064,774
2008	1,027,837	106,791	4,381,186	2,391,200	7,907,013
2009	1,049,838	130,200	4,700,222	1,942,061	7,822,321
2010	1,031,430	134,817	5,388,440	1,760,759	8,315,446
2011	944,777	85,503	5,006,358	1,482,029	7,518,667
2012	870,684	198,911	4,046,299	1,847,880	6,963,774
2013	784,379	114,009	5,157,760	2,393,425	8,449,573
2014	750,263	111,753	4,033,746	2,172,342	7,068,103
2015	621,952	84,463	3,085,725	2,307,133	6,099,273
2016	609,028	88,171	3,500,434	2,981,430	7,179,063
2017	592,670	98,343	2,937,911	3,421,110	7,050,035
2018	621,123	100,646	2,244,765	2,826,667	5,793,201
2019	653,807	84,013	2,150,936	2,589,045	5,477,801
2020	577,363	65,319	1,709,973	2,760,231	5,112,886

* Commercial dead discard estimates are derived via a generalized additive model (GAM), and are therefore re-estimated for the entire time series when a new year of data is added.

Table 9. Proportion of total removals (harvest plus discards/release mortality) of Atlantic striped bass by sector in numbers of fish, 1990-2020. Note: Harvest is from state compliance reports/MRIP (July 8, 2021), discards/release mortality is from ASMFC. Estimates exclude inshore harvest from North Carolina.

Year	Commercial		Recreational	
	Harvest	Discards*	Harvest	Release Mortality
1990	8%	4%	50%	38%
1991	9%	5%	45%	41%
1992	11%	9%	39%	42%
1993	15%	6%	39%	40%
1994	11%	6%	36%	47%
1995	11%	4%	46%	40%
1996	14%	4%	40%	42%
1997	15%	5%	39%	42%
1998	16%	4%	38%	42%
1999	16%	4%	40%	40%
2000	15%	3%	46%	37%
2001	12%	2%	53%	32%
2002	12%	3%	51%	35%
2003	10%	2%	55%	33%
2004	10%	2%	49%	40%
2005	11%	2%	50%	38%
2006	10%	1%	45%	44%
2007	13%	2%	49%	37%
2008	13%	1%	55%	30%
2009	13%	2%	60%	25%
2010	12%	2%	65%	21%
2011	13%	1%	67%	20%
2012	13%	3%	58%	27%
2013	9%	1%	61%	28%
2014	11%	2%	57%	31%
2015	10%	1%	51%	38%
2016	8%	1%	49%	42%
2017	8%	1%	42%	49%
2018	11%	2%	39%	49%
2019	12%	2%	39%	47%
2020	11%	1%	33%	54%

* Commercial dead discard estimates are derived via a generalized additive model (GAM), and are therefore re-estimated for the entire time series when a new year of data is added. Note: Percent may not sum to 100 due to rounding.

Table 10. Total harvest of Atlantic striped bass by sector, 1990-2020. Note: Harvest is from state compliance reports/MRIP (Query July 8, 2021). Estimates exclude inshore harvest from North Carolina.

Year	Numbers of Fish			Pounds		
	Commercial	Recreational	Total	Commercial	Recreational	Total
1990	93,888	578,897	672,785	715,902	8,207,515	8,923,417
1991	158,491	798,260	956,751	966,096	10,640,601	11,606,697
1992	256,476	869,779	1,126,255	1,508,064	11,921,967	13,430,031
1993	314,526	789,037	1,103,563	1,800,176	10,163,767	11,963,943
1994	325,401	1,055,523	1,380,924	1,877,197	14,737,911	16,615,108
1995	537,412	2,287,578	2,824,990	3,775,586	27,072,321	30,847,907
1996	854,102	2,487,422	3,341,524	4,822,874	28,625,685	33,448,559
1997	1,076,591	2,774,981	3,851,572	6,078,566	30,616,093	36,694,659
1998	1,215,219	2,915,390	4,130,609	6,552,111	29,603,199	36,155,310
1999	1,223,572	3,123,496	4,347,068	6,474,290	33,564,988	40,039,278
2000	1,216,812	3,802,477	5,019,289	6,719,521	34,050,817	40,770,338
2001	931,412	4,052,474	4,983,886	6,266,769	39,263,154	45,529,923
2002	928,085	4,005,084	4,933,169	6,138,180	41,840,025	47,978,205
2003	854,326	4,781,402	5,635,728	6,750,491	54,091,836	60,842,327
2004	879,768	4,553,027	5,432,795	7,317,897	53,031,074	60,348,971
2005	970,403	4,480,802	5,451,205	7,121,492	57,421,174	64,542,666
2006	1,047,648	4,883,961	5,931,609	6,568,970	50,674,431	57,243,401
2007	1,015,114	3,944,679	4,959,793	7,047,179	42,823,614	49,870,793
2008	1,027,837	4,381,186	5,409,023	7,190,701	56,665,318	63,856,019
2009	1,049,838	4,700,222	5,750,060	7,217,380	54,411,389	61,628,769
2010	1,031,430	5,388,440	6,419,870	6,996,713	61,431,360	68,428,073
2011	944,777	5,006,358	5,951,135	6,789,792	59,592,092	66,381,884
2012	870,684	4,046,299	4,916,983	6,516,761	53,256,619	59,773,380
2013	784,379	5,157,760	5,942,139	5,819,678	65,057,289	70,876,967
2014	750,263	4,033,746	4,784,009	5,937,949	47,948,610	53,886,559
2015	621,952	3,085,725	3,707,677	4,829,997	39,898,799	44,728,796
2016	609,028	3,500,434	4,109,462	4,848,772	43,671,532	48,520,304
2017	592,670	2,937,911	3,530,581	4,816,395	37,952,581	42,768,976
2018	621,123	2,244,765	2,865,888	4,741,342	23,069,028	27,810,370
2019	653,807	2,150,936	2,804,743	4,284,831	23,556,287	27,841,118
2020	577,363	1,709,973	2,287,336	3,560,917	14,858,984	18,419,901

10.0 FIGURES

Note: Figures 1-2 are in-text.

Figure 3. Atlantic striped bass female spawning stock biomass and recruitment, 1982-2017. Source: 2018 Benchmark Stock Assessment.

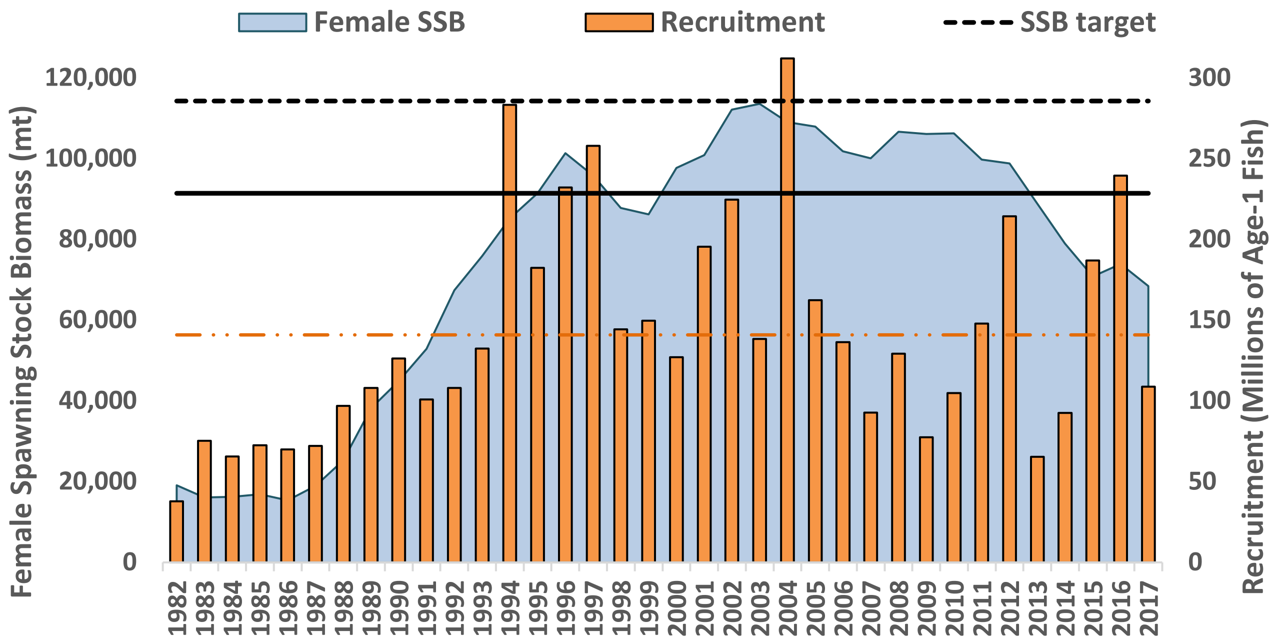


Figure 4. Atlantic striped bass fishing mortality, 1982-2017. Source: 2018 Benchmark Stock Assessment.

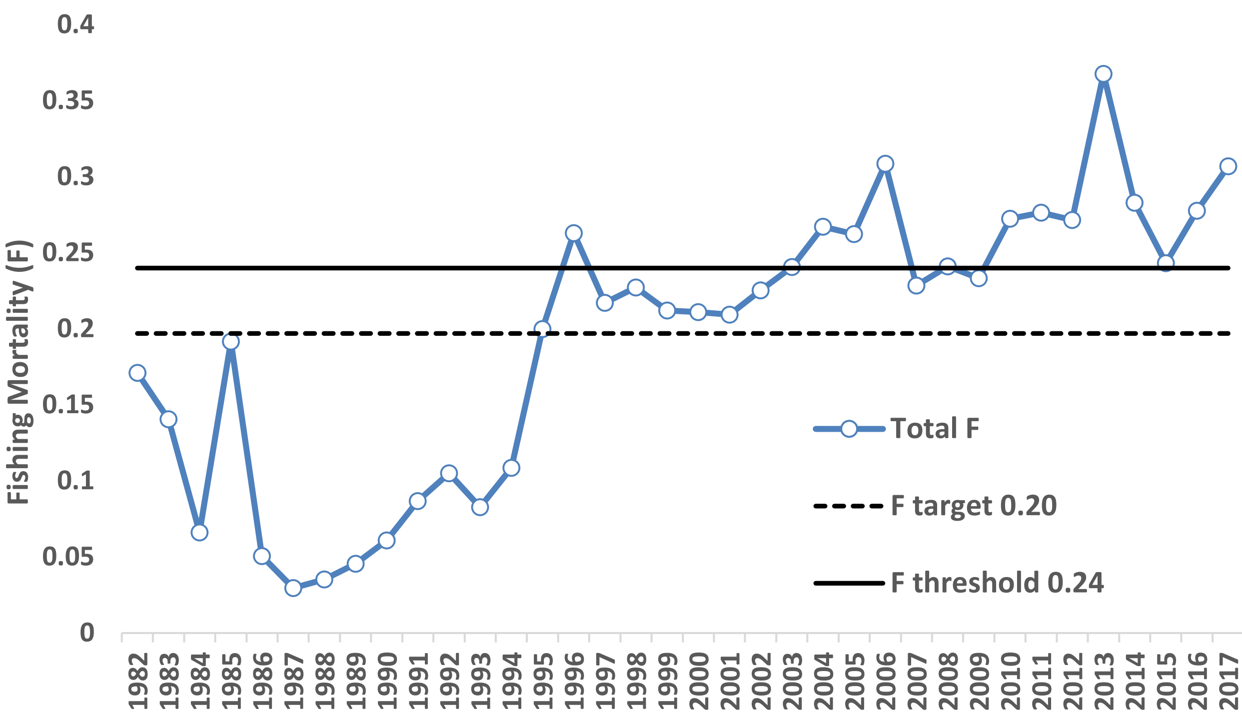


Figure 5. Albemarle Sound-Roanoke River striped bass female spawning stock biomass and recruitment (abundance of age-1), and biological reference points, 1991-2017. Source: 2020 Albemarle Sound-Roanoke River Stock Assessment (Lee et al. 2020).

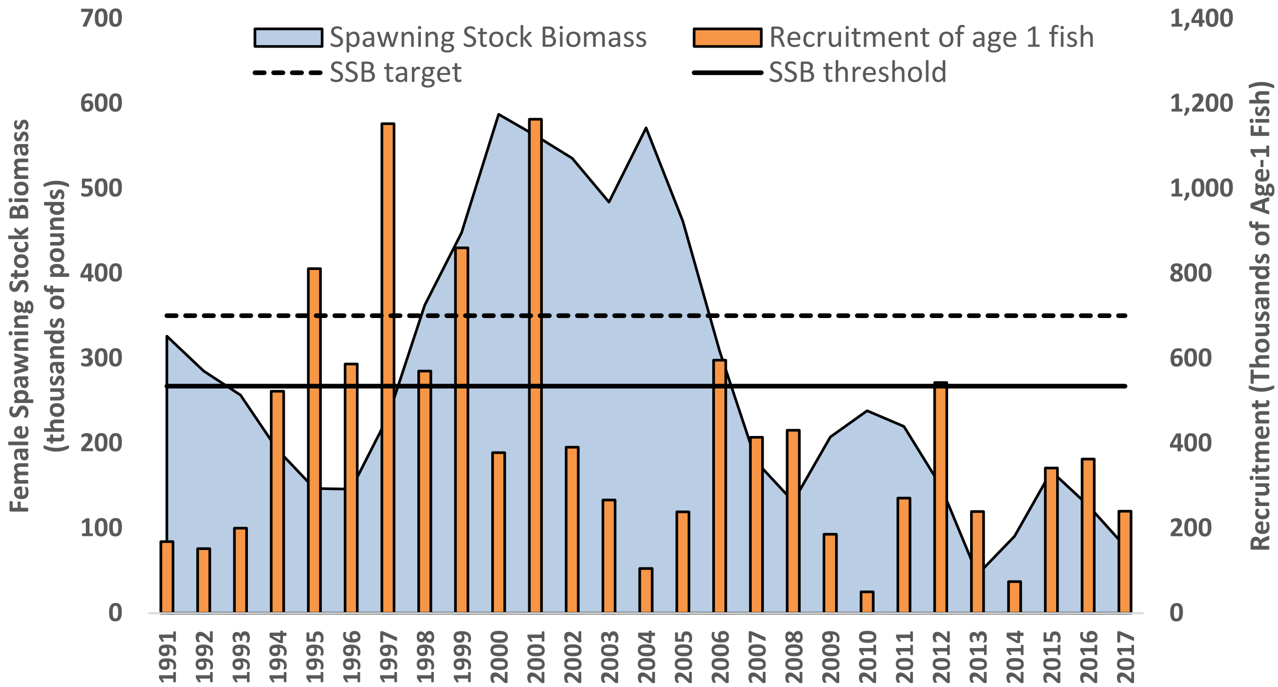


Figure 6. Albemarle Sounds-Roanoke River striped bass fishing mortality estimates, and biological reference points, 1991-2017. Source: 2020 Albemarle Sound-Roanoke River Stock Assessment (Lee et al. 2020).

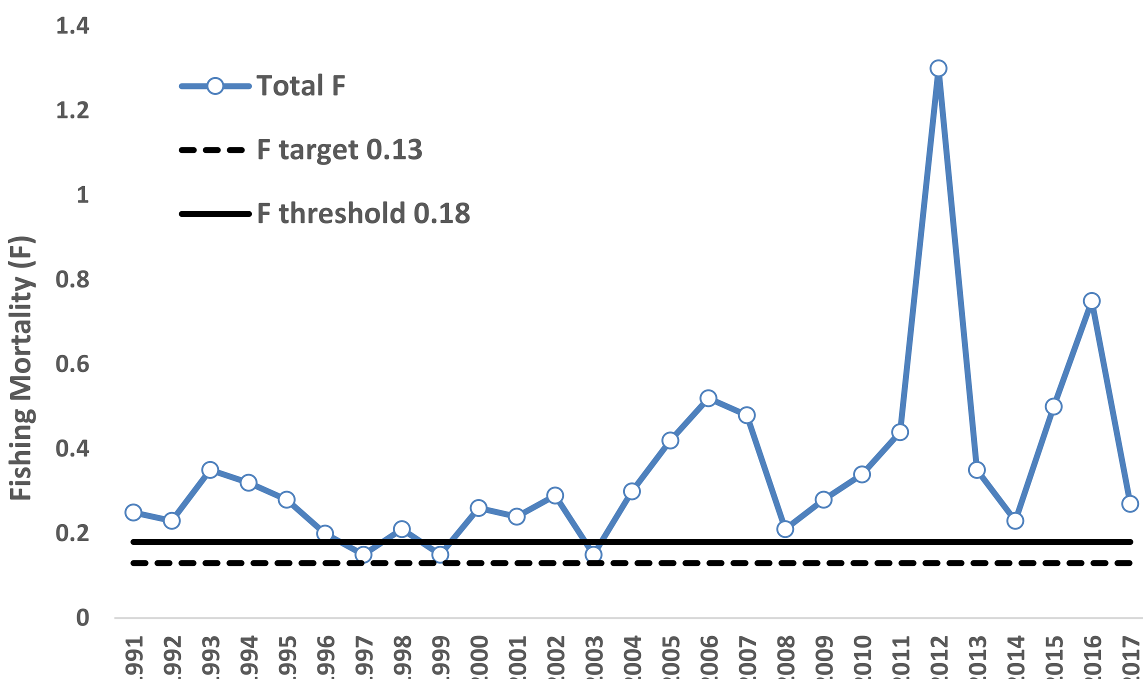


Figure 7. Total Atlantic striped bass removals by sector in numbers of fish, 1982-2020. Note: Harvest is from state compliance reports/MRIP, discards/release mortality is from ASMFC. Estimates exclude inshore harvest from Albemarle Sound-Roanoke River.

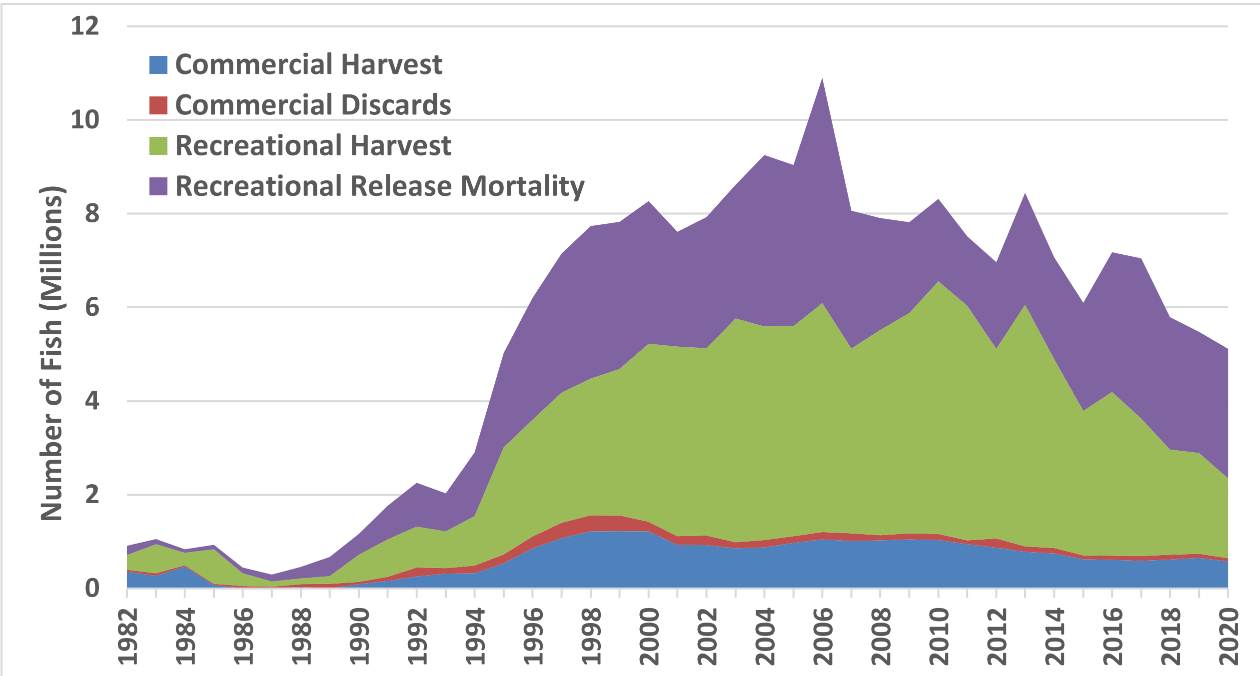


Figure 8. Commercial Atlantic striped bass landings by state in pounds, 1990-2020. Source: State compliance reports. Commercial harvest and sale prohibited in ME, NH, CT, and NJ. NC is ocean only.

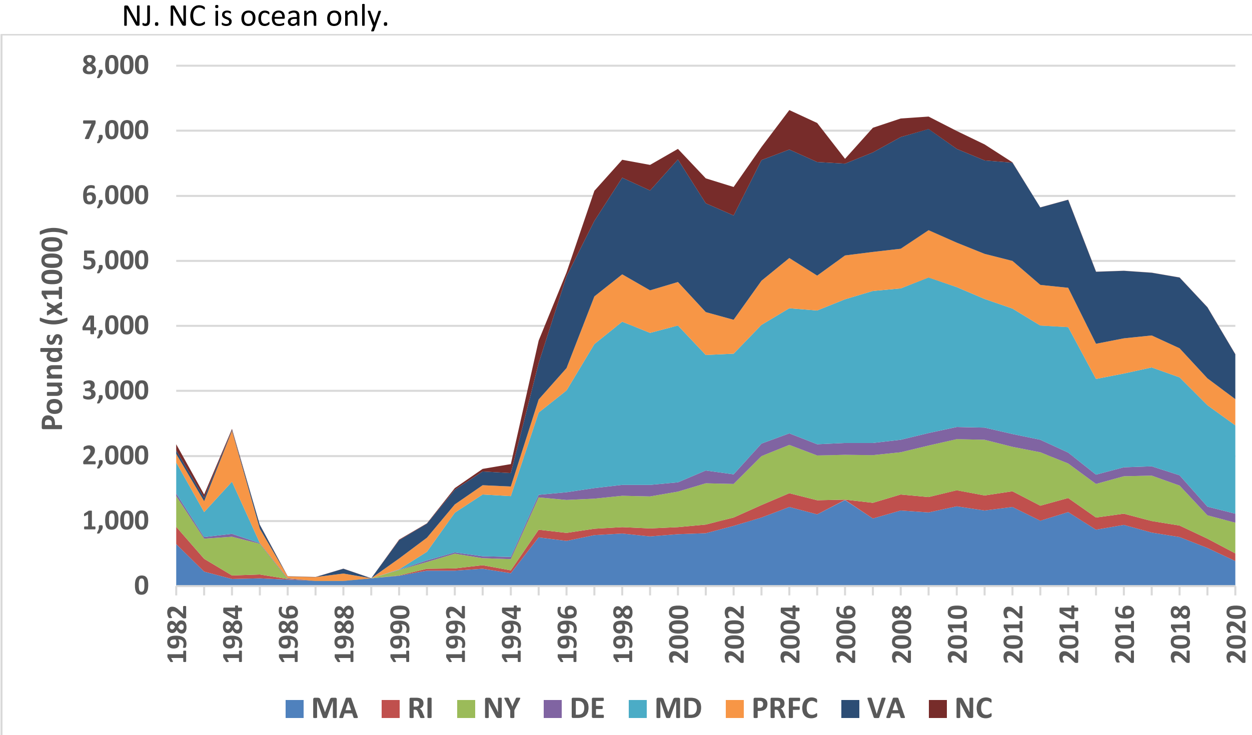
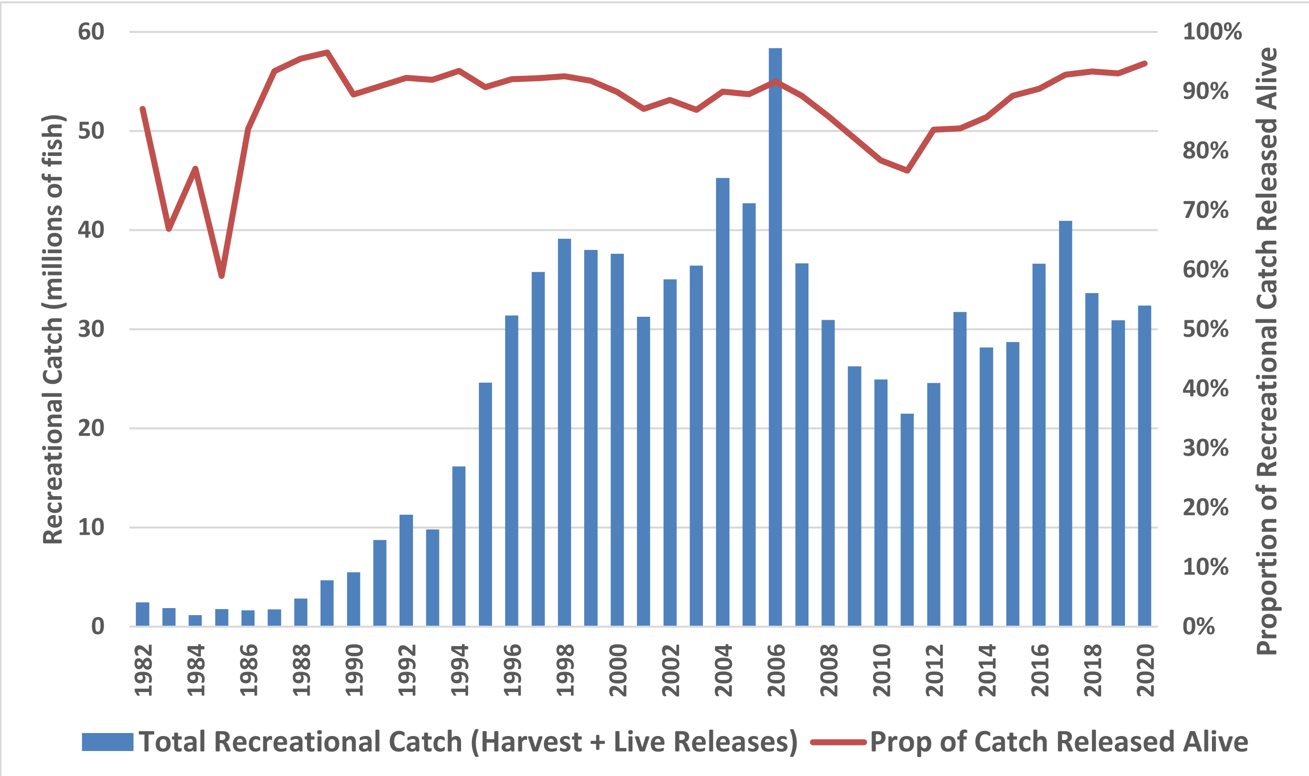


Figure 9. Total recreational catch and the proportion of fish released alive, 1982-2020. Source: MRIP/ASMFC. Estimates exclude inshore harvest from Albemarle Sound-Roanoke River.



APPENDIX 1: SUMMARY OF FISHERY DEPENDENT AND INDEPENDENT MONITORING PROGRAMS

Table A-1. Summary of juvenile abundance index surveys including the state/agency responsible for conducting each survey.

RESPONSIBLE STATE AND AGENCY	SAMPLING AREAS
Maine: *Department of Natural Resources*	Kennebec River
New York: *Department of Environmental Conservation*	Hudson River
New Jersey: *Department of Environmental Protection*	Delaware River
Maryland: *Department of Natural Resources*	Chesapeake Bay Tributaries
Virginia: *Marine Resources Commission*	Chesapeake Bay Tributaries
North Carolina: *Division of Marine Fisheries*	Albemarle Sound

Table A-2. Summary of spawning stock biomass surveys including the state/agency responsible for conducting each survey.

RESPONSIBLE STATE AND AGENCY	SAMPLING AREAS
New York: *Department of Environmental Conservation*	Hudson River[1]
Pennsylvania: *Fish and Boat Commission*	Delaware River[2]
Delaware: *Division of Fish and Wildlife*	Delaware River[3]
Maryland: *Department of Natural Resources*	Upper Chesapeake Bay[4] Potomac River[5]
Virginia: *Marine Resources Commission*	Rappahannock River[6] James River[7]
North Carolina: *Wildlife Resources Commission* *Division of Marine Fisheries*	Roanoke River[8] Albemarle Sound[9]

[1] Hudson River, West Point to Catskill
[2] Delaware River, State line to the Tacony-Palmyra Bridge
[3] Delaware River, Delaware Memorial Bridge to state line
[4] Upper Chesapeake Bay, Worton Point to Elkton
[5] Potomac River, Maryland Point to White Stone Point
[6] Rappahanock River, Tappahannock to Federicksburg
[7] James River, Dancing Point to Tax Point
[8] Roanoke River, upriver to spawning grounds
[9] Albemarle Sound, Western sound approaches to river

Table A-3. Required Fishery-Dependent Monitoring Programs under Amendment 7.

STUDY CATEGORY	NEEDS & GENERAL GUIDELINES	RESPONSIBLE STATE/ AGENCIES
Commercial catch composition	**NEED:** Define structure of exploitation, calculation of mortality rates **GUIDELINES:** Samples should be representative of location and seasonal distribution of catch, and should include size and sex composition. Collection of scales is conditional; if scale:age relationships from previous years are validated, indirect methods may be used.	MA, RI, NY, DE, MD, VA, PRFC, NC
Commercial catch and effort	**NEED:** Track mortality in a general way **GUIDELINES:** Surveys should produce reliable measures of catch (numbers and weight) and effort in gear days fished.	MA, NY, DE, MD, VA, PRFC
Recreational catch composition	**NEED:** Define structure of exploitation, calculation of mortality rates **GUIDELINES:** Samples should be representative of location, seasonal distribution, and age and size frequency (including sublegals).	MA, RI, CT, NY, NJ, MD, VA, PRFC
Recreational catch and effort	**NEED:** Track mortality in a general way **GUIDELINES:** States should report data from the Marine Recreational Information Program (MRIP) (refer to Section 3.4). States may supplement MRIP with specialized striped bass surveys to better assess harvest.	NMFS, MA, RI, CT, NY, NJ, MD, VA, PRFC