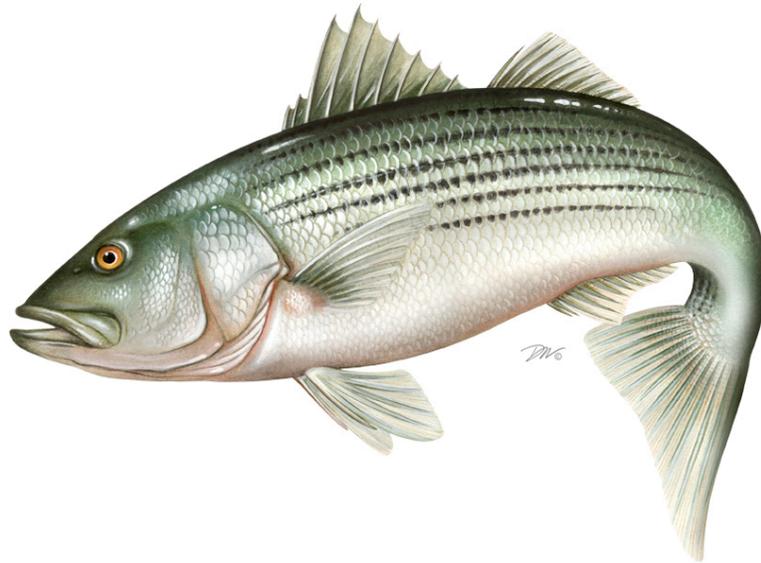


Atlantic States Marine Fisheries Commission

**ADDENDUM VI TO AMENDMENT 6
TO THE ATLANTIC STRIPED BASS
INTERSTATE FISHERY MANAGEMENT PLAN**



Approved October 30, 2019



Sustainable and Cooperative Management of Atlantic Coastal Fisheries

1.0 Introduction

Atlantic striped bass (*Morone saxatilis*) are managed through the Commission in state waters (0-3 miles) and through NOAA Fisheries in federal waters (3-200 miles). The management unit includes the coastal migratory stock between Maine and North Carolina. Atlantic striped bass are currently managed under Amendment 6 to the Interstate Fishery Management Plan (FMP) and Addenda I – VI.

In May 2019, the Atlantic Striped Bass Management Board (Board) reviewed results of the 2018 benchmark stock assessment which indicated the striped bass stock is overfished and experiencing overfishing. Based on these findings and the tripping of Amendment 6's biological reference point management triggers, the Board initiated the development of Addendum VI to reduce fishing mortality to the target level. The Board approved Draft Addendum VI for public comment in August 2019 and public comment was received through October 7th. Also at the May 2019 meeting, the Board discussed a motion to initiate an Amendment to address other striped bass fishery management issues, including rebuilding the biomass to the target level. The motion was postponed twice and will come back to the Board at the 2020 Spring Meeting.

The Board approved Addendum VI in October 2019. The Addendum implements measures to reduce total striped bass removals by 18% relative to 2017 levels in order to achieve the fishing mortality target in 2020. The Addendum applies the needed reductions equally (proportionally) to both commercial and recreational sectors. Specifically, the Addendum reduces all commercial quotas by 18% and changes recreational bag and size limit requirements to achieve an 18% reduction in recreational removals relative to 2017 levels. Additionally, since recreational release mortality contributes significantly to overall mortality, Addendum VI implements the mandatory use of circle hooks when fishing with bait in recreational fisheries. Circle hook requirements must be implemented by January 1, 2021, and all other regulations herein by April 1, 2020 for all jurisdictions.

2.0 Overview

2.1 Statement of the Problem

The 2018 benchmark stock assessment indicated the stock is overfished and experiencing overfishing relative to the updated reference points defined in the assessment. Female spawning stock biomass (SSB) was estimated below the SSB threshold and total fishing mortality (F) was estimated above the F threshold. The benchmark assessment's single-stock statistical catch-at-age model was endorsed by the Peer Review Panel and accepted by the Board for management use.

By accepting the assessment for management use, the reference point management triggers in Amendment 6 have been tripped – the management triggers require the Board to take action to address both overfishing and overfished status. Specifically, Addendum VI addresses overfishing status by implementing measures to reduce F back to F target in 2020, while overfished status and other management issues will be addressed in a subsequent management document.

Roughly 90% of annual Atlantic striped bass recreational catch is released alive, of which 9% are estimated to die as a result of being caught (referred to as “release mortality” or “dead releases”). Catch and release fishing has been perceived to have a minimal impact on the population, however, a large component of annual striped bass mortality is attributed to release mortality – accounting for roughly 48% of total removals in 2017 (49% in 2018). The current recreational striped bass management program uses bag and size limits to restrict harvest, but is not designed to limit fishing effort and the number of fish caught and released. To improve post release survival of striped bass, Addendum VI requires the mandatory use of circle hooks when fishing with bait to reduce discard mortality in recreational fisheries.

2.2 Background

2.2.1 Status of the Stock

The 2018 benchmark stock assessment for Atlantic striped bass is the latest and best information available on the 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. 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 female SSB, F, and recruitment.

The results of the 2018 benchmark indicate that the Atlantic striped bass stock is overfished and overfishing is occurring. Female SSB in 2017 was estimated at 68,576 metric tons (151 million pounds), which is below the SSB threshold of 91,436 metric tons (202 million pounds) (Figure 1). Female SSB peaked in 2003 and has been declining since then; SSB has been below the threshold level since 2013. Total F in 2017 was estimated at 0.31, which is above the F threshold of 0.24 (Figure 2). Total F has been at or above the threshold in 13 of the last 15 years of the assessment (2003-2017). Recruitment in 2017 was estimated at 108.8 million age-1 fish, which is below the time series average of 140.9 million fish (Figure 1). Striped bass experienced a period of lower recruitment from 2005-2011 which contributed to the decline in female SSB that the stock has experienced since 2010. Recruitment 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 average in 2013, 2014, and 2017.

The reference points currently used for management are based on female SSB levels during the 1995 reference year. The 1995 female SSB estimate is used as the threshold because many stock characteristics (e.g., an expanded age structure) were reached by this year and the stock was declared rebuilt. The female SSB target is 125% of SSB threshold. To estimate the associated F reference points, population projections are made using a constant F and changing the value until the female SSB threshold and target are achieved. For the 2018 benchmark, the reference point definitions remained the same, but the values have been updated. The 2018 benchmark was the first assessment for striped bass to use the improved Marine Recreational Information Program (MRIP) survey methods to estimate recreational fishery catches. The new MRIP removals estimates are on average 2.3 times higher than recreational removals used in

previous stock assessments, resulting in higher estimates of female SSB and, therefore, higher estimates for the SSB reference points.

2.2.2 History of the Fishery Management Plan

The first Interstate FMP for Atlantic Striped Bass was approved in 1981 in response to declining juvenile recruitment and landings occurring along the coast from Maine through North Carolina. The FMP and subsequent amendments and addenda focused on addressing the depleted spawning stock and recruitment failure. Despite these management efforts, the Atlantic striped bass stock continued to decline prompting many states (beginning with Maryland in 1985) to impose a complete harvest moratorium for several years. State fisheries reopened in 1990 under Amendment 4 which aimed to rebuild the resource rather than maximize yield. The stock was ultimately declared rebuilt in 1995 and as a result, Amendment 5 to the Atlantic Striped Bass FMP was adopted which relaxed both recreational and commercial regulations along the coast.

The Atlantic striped bass stock is currently managed under Amendment 6 and its subsequent addenda, the most recent being Addendum IV which implemented new commercial and recreational regulations beginning with the 2015 season. The Addendum was initiated in response to the findings of the 2013 benchmark stock assessment which triggered management action; female SSB was below the target for two consecutive years and F was above the target in at least one of those years. Although the stock was not overfished, a steady decline in female SSB had occurred since the mid-2000s. The Addendum established new F reference points (target and threshold) and a suite of regulatory measures aimed to bring F back down to the new F target. All states/jurisdictions (hereafter referred to as states) were required to implement regulations to achieve a 25% reduction from 2013 removals in the ocean fishery, and Chesapeake Bay fisheries were required to implement regulations to achieve a 20.5% reduction from 2012 removals. To achieve this, the ocean commercial quota was reduced by 25% and the Chesapeake Bay commercial quota was set at the 2012 harvest level, less 20.5%. For the recreational fishery, states implemented a 1 fish bag limit with a minimum size of 28 inches in the ocean fishery, and Chesapeake Bay jurisdictions submitted implementation plans to achieve the required reductions. Several states also had conservation equivalency proposals approved which allowed them to adopt different management programs while still achieving the required reductions.

The U.S. Exclusive Economic Zone (EEZ; 3-200 miles from shore) has been closed to the harvest, possession, and targeting of striped bass since 1990, with the exception of a defined route to and from Block Island in Rhode Island to allow for the transit of vessels in possession of striped bass legally harvested in adjacent state waters. A recommendation was made in Amendment 6 to re-open federal waters to commercial and recreational fisheries. However, NOAA Fisheries concluded opening the EEZ to striped bass fishing was not warranted at that time. Following the completion of the 2018 benchmark stock assessment, NOAA Fisheries, in consultation with the Commission, is directed to review the federal moratorium on Atlantic striped bass, and to consider lifting the ban on striped bass fishing in the Federal Block Island Transit Zone (Consolidated Appropriations Act, 2018).

2.2.3 Status of the Fishery

Atlantic striped bass is arguably the most iconic finfish on the Atlantic coast and has supported valuable fisheries for centuries. The current fishery is predominantly recreational with the sector accounting for roughly 90% of total harvest by weight since 2004 (commercial and recreational harvest, combined; Table 1). In 2017, total striped bass removals (harvest and dead discards/release mortality from both sectors) were estimated at 7.06 million fish, 90% of which was attributed to the recreational sector (Table 2; Figure 3). In 2018, total removals were estimated at 5.8 million fish, with 88% attributed to the recreational sector.

Commercial Fishery Status

The commercial fishery is managed via a quota system resulting in relatively stable landings since 2004 (refer to *Appendix 1* for a summary of striped bass regulations by state in 2017). There are two regional quotas; one for Chesapeake Bay and one for the ocean region. 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.

From 2004 to 2014, coastwide commercial landings averaged 6.8 million pounds (1 million fish) annually (Table 1; Table 2). From 2015-2018, commercial landings decreased to an average of 4.8 million pounds (611,000 fish) due to implementation of Addendum IV and a reduction in the commercial quota. In 2017, commercial landings were estimated at 4.8 million pounds (592,670 fish) and at 4.7 million pounds (622,451 fish) in 2018. Commercial dead discards (the portion of commercially caught striped bass that are released and assumed to die) account for approximately 13% of total commercial removals in numbers of fish since 2004. In 2017, commercial removals (landings plus dead discards) accounted for 10% of total removals (commercial plus recreational) in numbers of fish, and 12% of total removals in 2018.

The majority of commercial striped bass landings come from Chesapeake Bay; roughly 60% by weight annually since 1990, and 80% in numbers of fish. The differences between landings in weight and in numbers of fish is primarily attributed to the availability of smaller fish and lower size limits in Chesapeake Bay relative to the ocean fishery.

Unlike the commercial fishery in Chesapeake Bay, the ocean fishery regularly underutilizes the quota. The ocean quota underage is mainly attributed to designated game fish status in several states including Maine, New Hampshire, Connecticut, and New Jersey which collectively share about 10% of the commercial quota in the ocean region. 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).

Recreational Fishery Status

The Atlantic striped bass recreational fishery is managed via bag and size limits to restrict harvest (refer to *Appendix 1* for a summary of striped bass regulations by state in 2017). Approximately 90% of recreational catch is released alive (Figure 4), either due to angler preference (e.g., catch and release fishing) or regulation (e.g., undersized, or the angler already

caught the bag limit). The assessment assumes, based on previous studies, that 9% of the fish that are released alive die as a result of being caught.

Total recreational removals (harvested fish plus released fish that died as a result of being caught) increased from a low of 2.7 million pounds (434,665 fish) in 1984 to a high of 75.8 million pounds (7.6 million fish) in 2013. Total removals decreased to an average of 53.5 million pounds (5.8 million fish) since the implementation of Addendum IV in 2015. In 2017, recreational removals were estimated at 53.7 million pounds (6.4 million fish). Of those removals, 37.9 million pounds (2.9 million fish) were harvested (Table 3). In 2017, 38.0 million striped bass (equivalent to 176 million pounds) were released alive resulting in an estimated 3.4 million dead releases (15.8 million pounds), which accounted for 48% of total striped bass removals in numbers of fish (Table 4). In 2018, 49% of total removals were attributed to dead releases (2.8 million fish or 12.3 million pounds). Recreational dead releases make up a large portion of total removals because most of the catch is released.

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 2015-2018, that percentage increased to 45%, likely as a result of the strong 2011, 2014, and 2015 year classes moving through the fishery.

2.2.4 Performance of Addendum IV and the Effects of Changes in Effort and the Availability of Strong Year Classes

In 2016, following the first full year under Addendum IV measures, the Striped Bass Plan Review Team compared observed removals in 2015 to the reference period (2013 for the ocean fishery and 2012 for Chesapeake Bay) to evaluate whether the reductions needed to bring F back down to the target had been achieved. The results indicated the overall reduction was nearly the same as the predicted reduction on a coastwide level. The observed commercial reduction was very close to the predicted reductions, but the observed recreational reduction in the ocean and Chesapeake Bay fisheries diverged significantly from the predicted values. The recreational ocean fishery saw a greater reduction than what was predicted, while recreational fishery in Chesapeake Bay experienced an increase relative to the reference period. Upon further review, the Technical Committee (TC) identified changes in effort and changes in the size, age structure, and the distribution of the 2011 year class in the ocean relative to the Chesapeake Bay as the most significant variables contributing to the large differences in the observed harvest compared to that predicted by the TC during the development of Addendum IV.

At that time, the 2011 year class was the largest recruitment event since the early 2000s. Those fish continued to grow and migrate to the ocean, becoming increasingly available to ocean fisheries and leading to significant increases in removals in 2016 and 2017 under the same management program¹. It should also be noted that decreased effort in the ocean fishery in

¹ The 2016 stock assessment update indicated that Addendum IV successfully reduced F below the target in 2015. As a result, the Board initiated Draft Addendum V to consider relaxing coastwide measures to bring F back up to the target level. However, the Board withdrew Draft Addendum V from consideration after preliminary MRIP estimates revealed that 2016 removals increased without changing regulations.

2018 resulted in roughly an 18% reduction in total removals relative to 2017 (and a 5% reduction from 2015 levels) under the same management measures. The decrease in effort was observed across all recreational fisheries, not just effort directed at striped bass. These annual fluctuations in catch (and in F) under constant regulations highlight the effect of changes in effort and strong year classes on future catch, and the degree of uncertainty associated with bag and size limit analyses.

It is difficult to account for changes in effort and the impacts of emerging year classes in bag and size limit analyses, and harvest reduction calculations. The 2011, 2014, and 2015 year classes (corresponding to the 2012, 2015, and 2016 recruitment estimates) have all been above average with the 2015 year class being the largest recruitment event since 2004. It is expected the availability of the 2014 and 2015 year classes in 2020 will be similar to what was observed for the 2011 year class in 2016 and 2017. These strong year classes become available to the Chesapeake Bay fishery first and become more readily available to the ocean fishery as they grow and migrate to the ocean. While strong year classes are a positive sign for the population, the abundance of undersized striped bass often leads to anglers catching and releasing a larger number of fish, thus driving up the number of recreational releases. When considering management changes, it is important to consider the impact such changes could have on strong year classes and to account for the emergence of strong year classes to the extent possible in supporting analyses.

2.2.5 Socioeconomic Impacts

Overall, there are many potential socioeconomic impacts that could result from striped bass harvest reductions. In general, the reduction in striped bass removals is likely to translate into a short-term negative impact on the regional economy and jobs associated with the fishing industry for this species. However, the positive long-term economic impacts stemming from stock recovery and subsequent catch increases in successive years will likely outweigh the short-term impacts.

The impacts associated with a reduction in removals will be different for the commercial and recreational sectors, primarily because the two sectors do not contribute equally to the local economy. A recent 2019 report from Southwick Associates² indicates 97% of total economic contribution 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

² 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.

demonstrate the economic significance of striped bass to local economies. It should also be noted that these numbers are an average 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 approved through this Addendum can be qualified as follows: for the recreational sector, further limitations on the size and number of fish that can be kept can lead to increased effort 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. For the commercial sector, a reduction in quota will likely reduce profits and may increase the consumer price of striped bass. 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.

2.2.6 Management Program Equivalency

The use of management program equivalency (hereafter referred to as "conservation equivalency") is an integral component of the Commission's Interstate Fisheries Management Program, particularly for Atlantic striped bass. Conservation equivalency provides states flexibility to develop alternative regulations that address specific state or regional differences while still achieving the goals and objectives of the FMP. Under Amendment 6, a state may submit a proposal for a change to its regulatory program for any mandatory compliance measure. It is the responsibility of the state to demonstrate the proposed management program is equivalent to the measures herein. All conservation equivalency proposals are subject to TC review and Board approval.

Several states currently use conservation equivalency. For example, the use of closed seasons have been used as an effective tool to implement smaller size limits or increased bag limits while still achieving the same quantified level of conservation. Note that Addendum VI does not implement closed seasons because the impacts are expected to vary by state and fishery. While closed seasons could be very effective in regions and seasons when striped bass is the only viable fishing choice, closed seasons may have little or no impact in fisheries that operate as catch and release or in areas where other species are available for harvest. For example, Atlantic mackerel and bluefish are commonly caught with striped bass, so trips that target those species may still catch striped bass and contribute to striped bass release mortality even if striped bass are not targeted or retained.

States should consult the Commission's [Conservation Equivalency Policy and Technical Guidance Document](#) before considering the development and submission of conservation equivalency proposals. The TC also established criteria for the development of conservation

equivalency proposals with Addendum VI which are detailed in [Memo 19-084](#) (the memo is also available at www.asmf.org on the Atlantic striped bass webpage).

3.0 Management Program

The striped bass ocean fishery 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 (A-R) management areas. The Chesapeake Bay fishery is defined as all fisheries operating within Chesapeake Bay. Addendum VI does not implement changes to the A-R management program.

Projecting Harvest Reductions to Achieve the Fishing Mortality Target

The Plan Development Team (PDT) used the same forward projecting methodology used in the 2018 benchmark assessment to estimate the removals needed to achieve F target (0.20) in 2020 with a 50% probability (Figure 5). The projections account for uncertainty in the stock assessment estimates of striped bass abundance and recruitment, and so for a given level of removals in 2020, there is some uncertainty about the F rate that results. A 50% probability of achieving F target means in 2020, the projected F rate will be centered around F target, with a 95% chance F will be between 0.17 and 0.23 (Figure 5). There is also a 95% chance F will be below F threshold in 2020, meaning striped bass will not be experiencing overfishing even if F is above F target. Importantly, there is a 99.8% chance of F being lower than F in 2017 ($F_{2017} = 0.31$).

The projections were made using final 2018 landings and dead discard estimates, and average removals from 2016-2018 were used as a proxy for 2019 to account for interannual variability in removals. Results indicate an 18% reduction from 2017 total removals is needed to achieve F target in 2020. If the stock continues to be fished at F target, female SSB is projected to be above the SSB threshold by 2023 and be at 93% of the SSB target in 2027 (Figure 6). Additional reductions may be needed to achieve the female SSB target within the timeframe required by the Amendment 6 management triggers (i.e., stock rebuilding schedule not to exceed 10 years).

3.1 Fishery Management Program

Addendum VI continues to use bag and size limits to manage recreational striped bass fisheries, and quotas and minimum size limits to regulate the striped bass commercial fisheries.

States must submit for conservation equivalency if deviating from the management programs herein, although states may voluntarily implement management programs that are more conservative than those required. Any state submitting a conservation equivalency proposal as part of initial implementation of Addendum VI must demonstrate an 18% reduction in total removals from 2017 levels (commercial and recreational combined) and follow the criteria set by the TC in Memo 19-084. Note all subsequent conservation equivalency proposals with Addendum VI need only demonstrate the proposed measures are equivalent to the state's current measures in terms of total removals.

3.1.1 Recreational Fishery Management

This section replaces Sections 3.1 in Addendum IV to Amendment 6.

All recreational fisheries operating in the ocean region are constrained by a one fish bag limit and a slot limit of 28 inches to less than 35 inches. All recreational fisheries operating in Chesapeake Bay are constrained by a one fish bag limit and an 18 inches minimum size limit. All bag limits are per person per day. All minimum size and slot size limits are in total length. States are required to maintain the same seasons that were in place in 2017. States do not need to pursue conservation equivalency to maintain trophy fish regulations that were in place in 2017 in the ocean and Chesapeake Bay.

The recreational management measures herein were developed using MRIP catch and harvest estimates. To account for year class strength, the PDT used catch-at-length data from 2016 and 2017 to characterize the catch in 2020. The PDT also assumed the same level of non-compliance observed in 2016 and 2017 would occur in 2020, including undersized fish harvested legally through conservation equivalency.

3.1.2 Commercial Fishery Management

This section replaces Sections 3.2 and 3.4 in Addendum IV to Amendment 6.

The table below indicates the commercial quota in pounds for the ocean region and for Chesapeake Bay.

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

The Chesapeake Bay commercial quota is allocated to Maryland, Virginia, and the Potomac River Fisheries Commission per the state/jurisdiction’s mutual agreement. Each states commercial quota for the ocean region is detailed in the table below.

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

* Commercial harvest/sale prohibited.

† Under Addendum IV, New Jersey and Connecticut reallocated its commercial quota to the recreational sector through conservation equivalency but must resubmit for conservation equivalency in order to maintain these recreational fishery bonus programs under Addendum VI. Accordingly, the quota presented herein is an 18% reduction from the quota as listed in Addendum IV.

^ Rhode Island (181,572 lbs) and Maryland (90,727 lbs) implemented reduced quotas through conservation equivalency under Addendum IV. An 18% reduction is calculated relative to these reduced quotas.

All quotas represent an 18% reduction from the Addendum IV quotas. Quotas are allocated on a fishing year basis. 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. All commercial fisheries are required to maintain their 2017 size limits.

3.2 Circle Hook Provision

The use of circle hooks, as defined herein, is required when recreationally fishing for striped bass with bait. A circle hook is "a non-offset hook where the point is pointed perpendicularly back towards the shank" (Figure 7). 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. 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. The intent of the requirement is to reduce striped bass discard mortality in the recreational fishery.

Discard mortality accounts for a considerable amount of removals in the Atlantic striped bass fishery along the east coast. The latest assessment assumes 9% of fish that are released alive die as a result of being caught, although there is some evidence it may be higher, particularly in the summer months. Management measures that increase the minimum size limit or reduce bag limits can lead to an increase in the number of striped bass released.

The use of circle hooks by anglers targeting striped bass with bait, live or chunk, has been identified as a method to reduce the discard 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, and hooking location among others (Nelson 1994; 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.

4.0 Compliance Schedule

To be in compliance with Addendum VI to Amendment 6 to the Atlantic Striped Bass Interstate FMP, states must implement Addendum VI measures according to the following schedule:

November 30, 2019: States submit proposals to meet requirements of Addendum VI.

February 2020: Management Board reviews and considers approval of state proposals.

April 1, 2020: States implement fishery regulations as specified in *Section 3.1*.

January 1, 2021: States implement circle hook requirements as specified in *Section 3.2*.

5.0 Literature Cited

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6.0 Tables and Figures

Table 1. Total removals (harvest and discards/release mortality) of Atlantic striped bass by sector in pounds, 2004-2018. Note: Harvest is from ACCSP/MRIP, dead discards and release mortality is from ASMFC. Estimates exclude inshore catch and harvest from North Carolina.

Year	Commercial		Recreational		Total Removals
	Harvest	Dead Discards	Harvest	Release Mortality	
2004	7,335,116	1,262,136	54,221,282	14,307,082	76,144,795
2005	7,121,319	1,078,391	57,587,212	14,412,620	79,581,675
2006	6,785,006	1,333,235	50,674,893	16,303,942	74,333,557
2007	7,047,195	1,181,533	42,841,560	12,680,939	63,054,061
2008	7,190,685	953,364	56,665,831	12,436,713	76,637,612
2009	7,216,792	1,076,465	54,411,882	11,236,287	73,903,661
2010	6,996,713	920,564	61,528,673	10,833,398	80,236,228
2011	6,789,792	809,577	59,592,631	7,569,260	74,729,834
2012	6,516,868	1,411,621	53,257,096	8,046,178	69,269,469
2013	5,819,678	901,326	65,057,882	10,731,891	82,432,216
2014	5,937,949	1,167,696	47,949,041	8,177,402	63,484,692
2015	4,830,124	1,031,887	39,899,162	11,621,265	57,294,717
2016	4,831,442	1,085,060	43,687,890	11,655,870	61,229,668
2017	4,803,867	1,110,833	37,896,893	15,818,534	59,392,844
2018	4,714,661	870,348	23,069,028	12,343,941	40,997,978

Table 2. Total removals (harvest and discards/release mortality) of Atlantic striped bass by sector in numbers of fish, 2004-2018. Note: Harvest is from ACCSP/MRIP, dead discards and release mortality is from ASMFC. Estimates exclude inshore catch and harvest from North Carolina.

Year	Commercial		Recreational		Total Removals
	Harvest	Dead Discards	Harvest	Release Mortality	
2004	879,768	160,196	4,553,027	3,665,234	9,258,224
2005	970,403	145,094	4,480,802	3,441,928	9,038,227
2006	1,047,648	158,260	4,883,960	4,812,332	10,902,201
2007	1,015,226	166,397	3,944,679	2,944,253	8,070,556
2008	1,027,837	108,962	4,381,186	2,391,200	7,909,184
2009	1,049,959	128,191	4,700,222	1,942,061	7,820,433
2010	1,031,430	133,064	5,388,440	1,760,759	8,313,693
2011	944,777	87,924	5,006,358	1,482,029	7,521,088
2012	870,606	191,577	4,046,299	1,847,880	6,956,361
2013	784,379	112,097	5,157,760	2,393,425	8,447,661
2014	750,263	121,253	4,033,747	2,172,342	7,077,604
2015	623,313	101,343	3,085,725	2,307,133	6,117,515
2016	607,084	105,119	3,500,434	2,981,430	7,194,066
2017	592,670	108,475	2,934,293	3,419,651	7,055,089
2018	622,451	90,092	2,244,766	2,826,667	5,783,976

Table 3. Total recreational harvest of Atlantic striped bass by state in numbers of fish, 2004-2018. Harvest is from MRIP. *Estimates exclude inshore harvest from North Carolina.

Year	ME	NH	MA	RI	CT	NY	NJ^	DE	MD	VA	NC*	total
2004	118,305	22,104	666,703	159,552	134,502	458,148	1,042,093	66,567	668,512	893,302	323,239	4,553,027
2005	118,323	35,480	536,058	195,580	202,636	854,633	958,051	48,815	819,052	517,320	194,854	4,480,802
2006	140,868	20,865	483,187	129,264	168,265	614,759	972,248	44,453	1,342,324	833,543	134,184	4,883,960
2007	95,474	8,146	471,873	135,771	163,871	602,845	722,166	17,171	1,127,310	518,275	81,777	3,944,679
2008	133,379	11,884	514,064	73,408	132,755	1,169,855	791,013	67,708	779,700	670,543	36,877	4,381,186
2009	146,497	17,291	694,992	138,357	100,267	574,188	1,141,495	64,776	1,104,647	711,164	6,548	4,700,222
2010	37,299	21,383	808,175	162,049	170,199	1,449,043	1,091,368	61,374	1,151,822	368,584	67,144	5,388,440
2011	48,517	54,202	873,496	202,237	91,104	1,005,255	1,038,894	43,662	1,112,977	328,404	207,610	5,006,358
2012	31,379	37,302	1,010,563	130,689	137,125	927,503	742,420	51,320	719,622	258,376	0	4,046,299
2013	73,345	63,157	658,713	308,312	269,562	902,452	1,324,245	70,635	1,185,023	302,316	0	5,157,760
2014	86,409	16,522	523,531	171,984	131,829	804,490	501,949	26,171	1,639,631	131,231	0	4,033,747
2015	14,434	10,036	485,317	67,036	140,783	406,786	600,269	41,895	1,111,503	207,666	0	3,085,725
2016	14,180	17,627	230,069	128,354	63,334	697,675	659,574	5,892	1,545,587	138,142	0	3,500,434
2017	22,042	37,723	392,347	59,582	94,536	472,321	625,909	27,786	1,091,645	110,402	0	2,934,293
2018	16,025	13,378	389,457	39,169	85,467	181,681	465,289	4,174	993,305	56,821	0	2,244,766

Table 4. Total recreational releases of Atlantic striped bass by state in numbers of fish x1000, 2004-2018. Recreational releases are from MRIP and a 9% mortality rate is applied to calculate release mortality. *Estimates exclude inshore harvest from North Carolina.

Year	ME	NH	MA	RI	CT	NY	NJ^	DE	MD	VA	NC*	Total Releases	Release Mortality (9% of Total Releases)
2004	1,597	593	13,338	1,899	1,414	4,568	3,685	373	8,748	4,263	247	40,725	3,665
2005	4,729	1,001	9,043	2,052	4,172	3,468	3,078	560	7,492	2,469	179	38,244	3,442
2006	8,059	889	19,279	2,094	2,016	4,407	3,605	685	9,024	3,375	37.2	53,470	4,812
2007	1,927	451	10,840	1,485	1,863	3,011	4,673	597	5,660	2,185	22.5	32,714	2,944
2008	1,157	197	7,496	778	5,063	2,782	3,668	633	3,222	1,547	26.4	26,569	2,391
2009	674	124	5,989	1,070	2,427	2,262	3,503	444	4,011	1,072	1.00	21,578	1,942
2010	522	161	5,090	619	1,416	3,036	2,436	256	5,390	586	51.4	19,564	1,761
2011	453	191	4,036	621	1,571	2,692	2,447	338	3,484	389	245	16,467	1,482
2012	657	164	3,629	1,292	892	2,428	1,822	358	9,001	289	0.00	20,532	1,848
2013	985	295	4,670	2,574	2,312	3,956	4,349	273	6,676	503	0.00	26,594	2,393
2014	1,023	316	6,425	438	740	2,784	2,840	530	8,304	738	0.00	24,137	2,172
2015	824	262	4,471	1,653	1,761	3,682	2,440	309	8,524	1,709	0.00	25,635	2,307
2016	2,162	819	6,299	1,416	1,208	3,739	1,808	218	13,781	1,638	39.2	33,127	2,981
2017	2,719	1,418	12,866	1,543	4,993	2,761	2,316	254	7,788	1,333	5.15	37,996	3,420
2018	2,174	356	5,377	2,180	7,514	1,989	2,756	352	7,458	1,247	3.49	31,407	2,827

Figure 1. Female spawning stock biomass (SSB) and recruitment (age-1 fish), 1982-2017. Source: 2018 benchmark stock assessment for Atlantic striped bass.

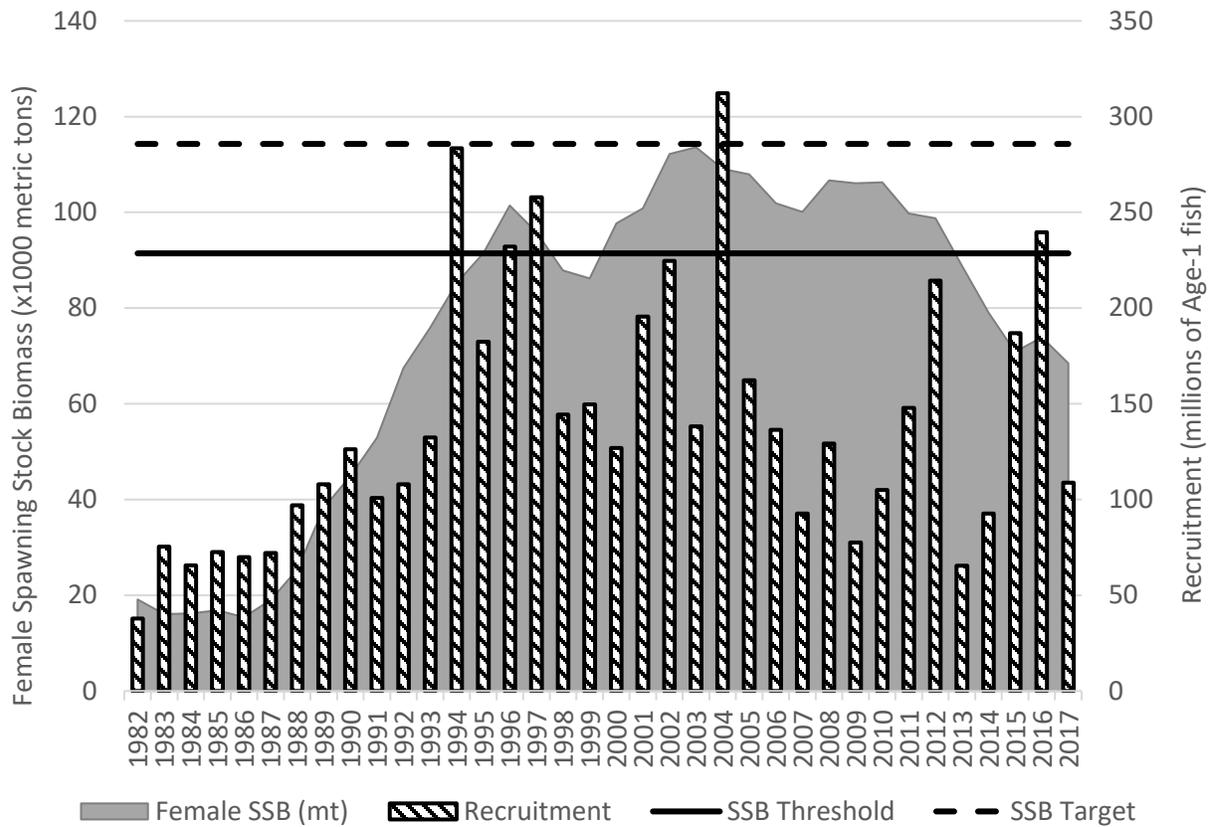


Figure 2. Total fishing mortality (F), 1982-2017. Source: 2018 benchmark stock assessment for Atlantic striped bass.

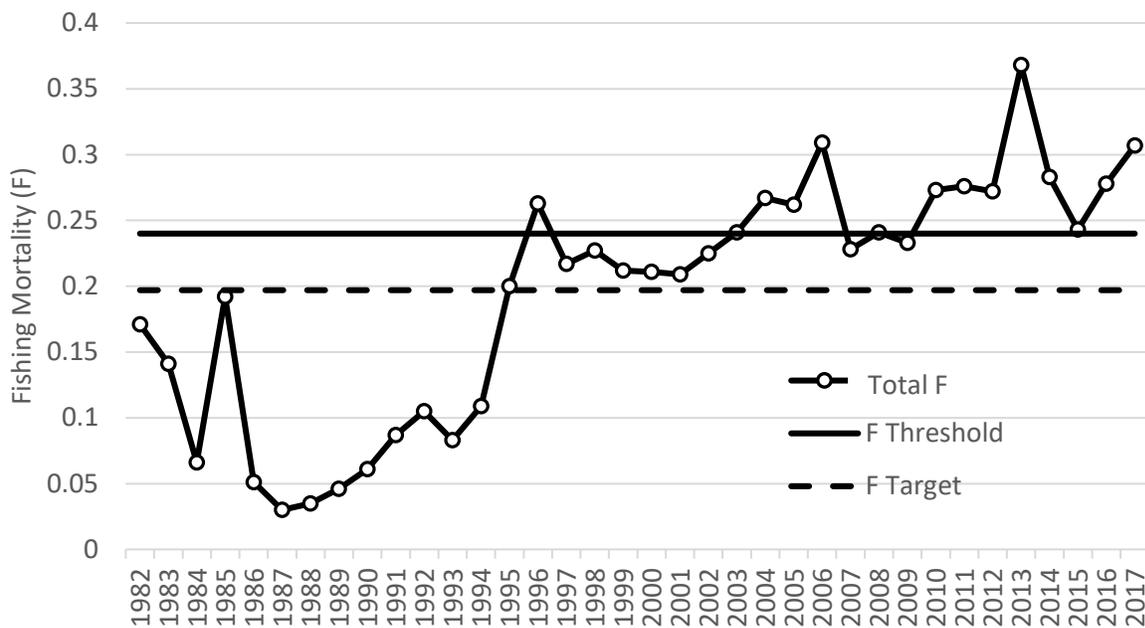


Figure 3. Total striped bass removals by sector in numbers of fish, 1982-2018. Note: Harvest is from ACCSP/MRIP, dead discards and release mortality is from ASMFC. Estimates exclude inshore catch and harvest from North Carolina.

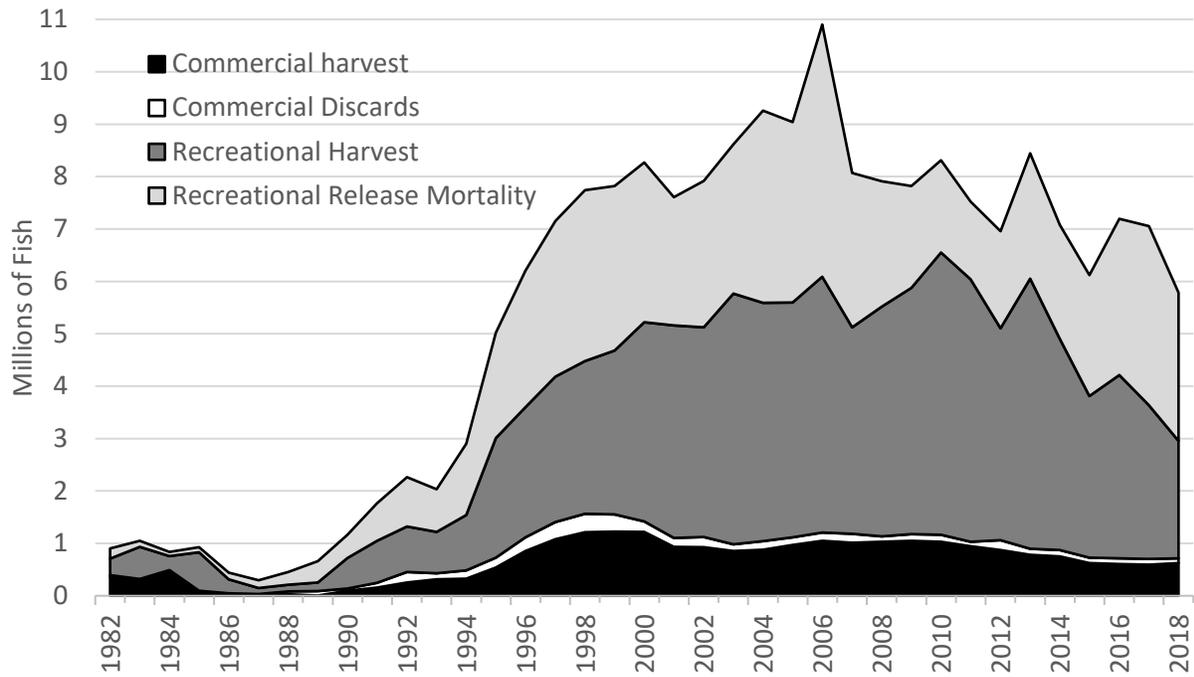


Figure 4. The proportion of recreational fish caught and released alive, 1982-2018. Source: MRIP. Excludes inshore catch from North Carolina.

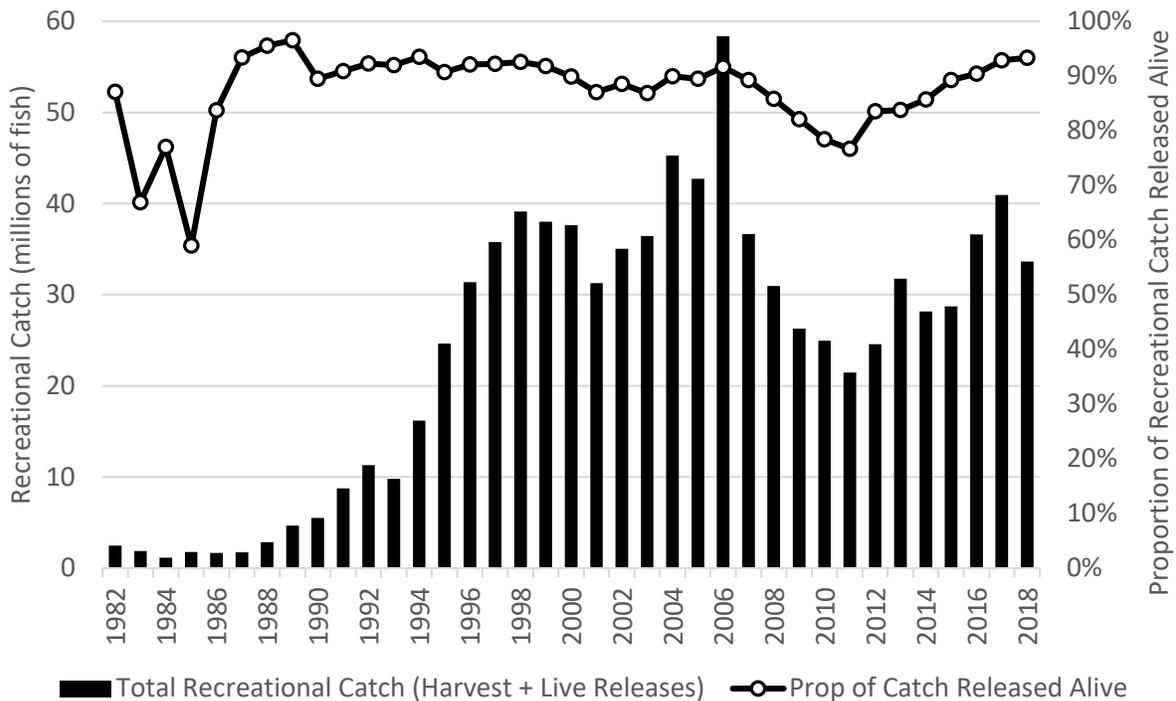


Figure 5. Projected fishing mortality and 95% confidence intervals if total removals in 2020 equal an 18% reduction from 2017 removals, plotted with the F target, F threshold, and F in 2017.

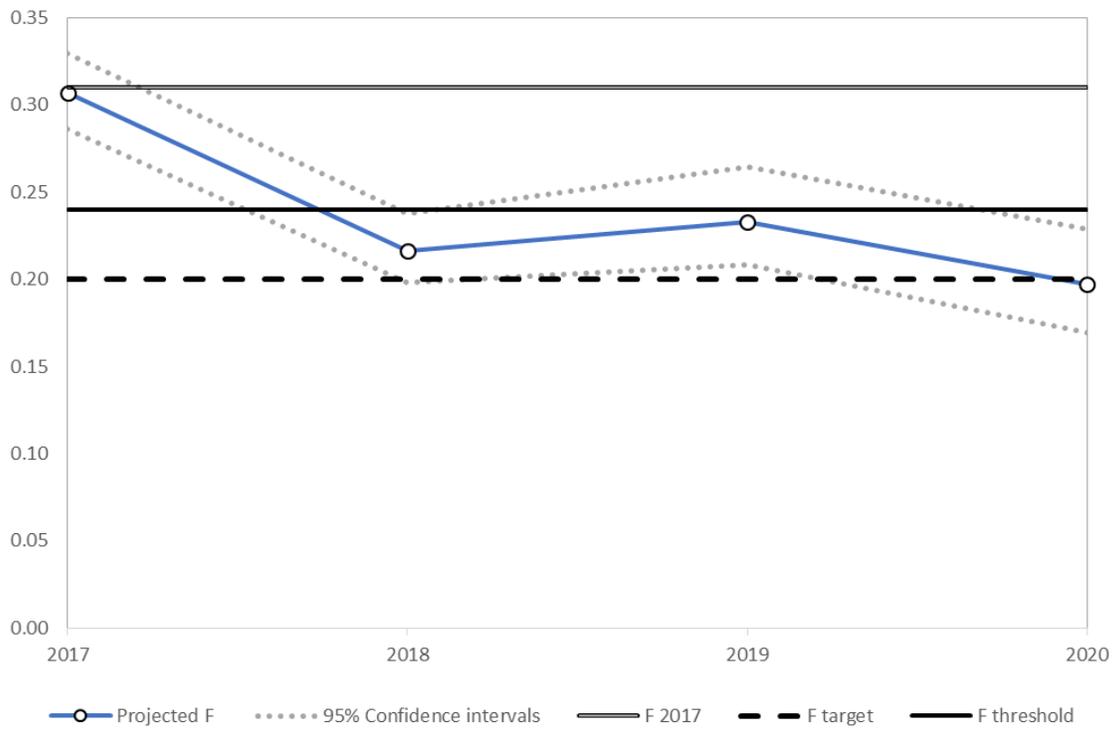


Figure 6. Projecting female spawning stock biomass (SSB) forward until SSB target is achieved while fishing at the fishing mortality target (F = 0.20) beginning in 2020.

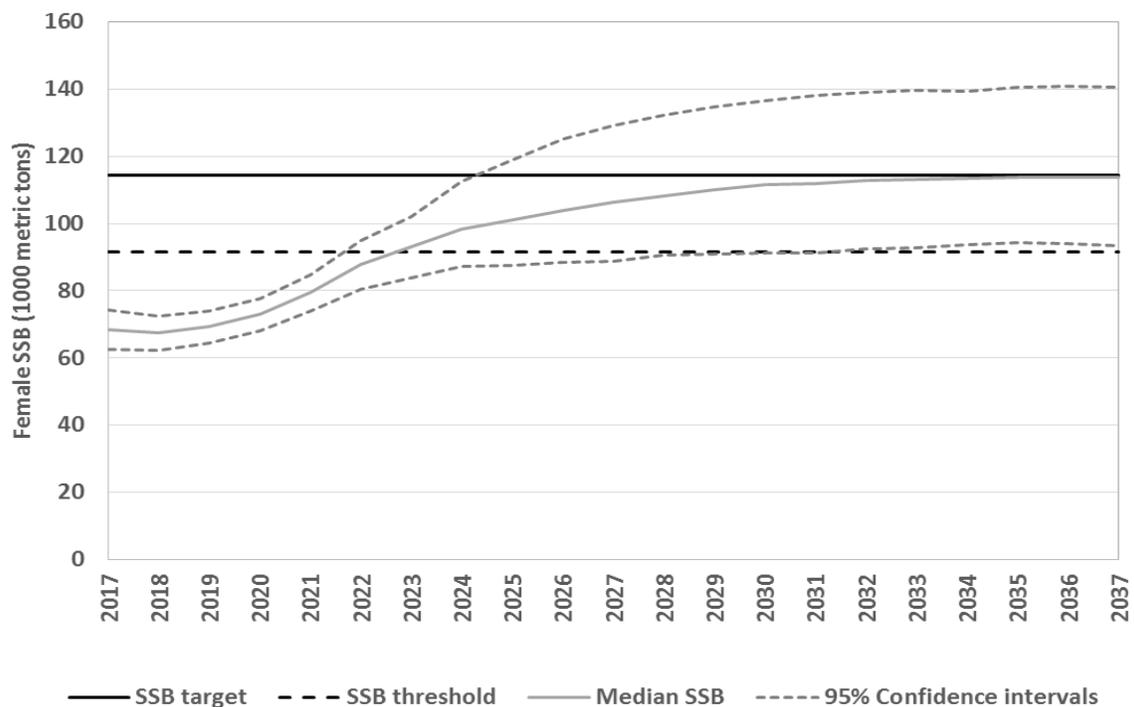
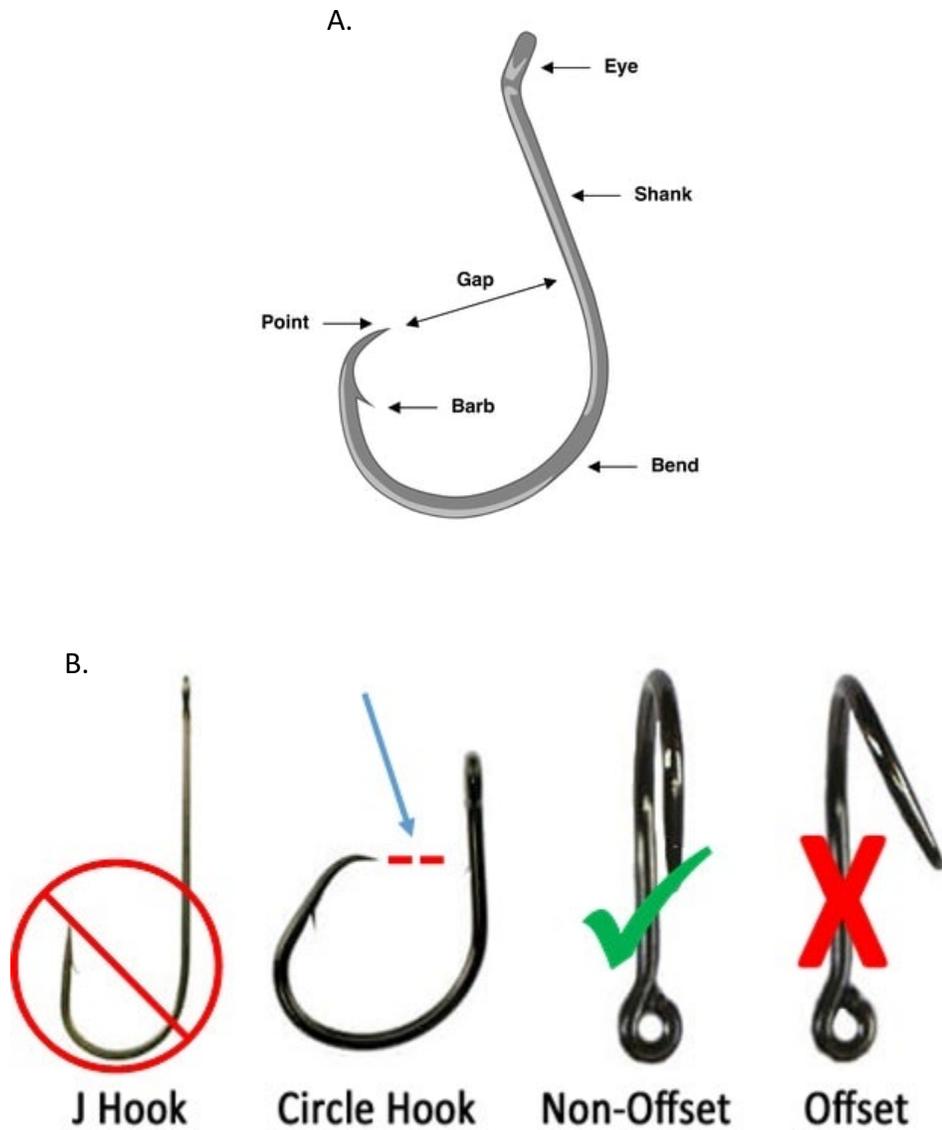


Figure 7. Anatomy of a circle hook (A) and hook-type comparison (B). Addendum VI mandates the use of non-offset circle hooks when fishing with bait in the recreational sector. The ASMFC defines circle hook as “a non-offset hook where the point is pointed perpendicularly back towards the shank.” The term “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).



Appendix 1. Summary of Atlantic striped bass regulations in 2017. Source: 2018 State Compliance Reports. Minimum size limits and slot size limits are in total length (TL). *commercial quota reallocated to recreational bonus fish program

Commercial regulations in 2017.

STATE	SIZE LIMITS	SEASONAL QUOTA	OPEN SEASON
ME	Commercial fishing prohibited		
NH	Commercial fishing prohibited		
MA	34" minimum size	869,813 lbs. Hook & line only	6.23 until quota reached, Monday and Thursdays only; 15 fish/day with commercial boat permit; 2 fish/day with rod and reel permit (striped bass endorsement required for both permits)
RI	Floating fish trap (FFT): 26" minimum size General category (GC; mostly rod & reel): 34" min.	Total: 181,540 lbs., split 39:61 between the FFT and GC. Gill netting prohibited.	FFT: 4.1 – 12.31, or until quota reached; unlimited possession limit until 70% of quota projected to be harvested, then 500 lbs/day GC: 5.28-8.31, 9.10-12.31, or until quota reached. Closed Fridays and Saturdays during both seasons.
CT*	Commercial fishing prohibited; bonus program: 22 – <28" slot size limit, 5.1 – 12.31 (voucher required)		
NY	28"-38" minimum size (Hudson River closed to commercial harvest)	795,795 lb. Pound nets, gill nets (6-8" stretched mesh), hook & line.	6.1 – 12.15, or until quota reached. Limited entry permit only.
NJ*	Commercial fishing prohibited; bonus program: 1 fish at 24 – <28" slot size limit, 9.1 – 12.31 (permit required)		
PA	Commercial fishing prohibited		
DE	Gillnet: 28" minimum size, except 20" min in Del. Bay and River during spring season. Hook and Line: 28" min	Gillnet: 137,831 lbs. Hook and line: 14,509 lbs.	Gillnet: 2.15-5.31 (2.15-3.30 for Nanticoke River) & 11.15-12.31; drift nets only 2.15-2.28 & 5.1-5.31; no fixed nets in Del. River. No trip limit. Hook and Line: 4.1–12.31, 200 lbs/day trip limit

Appendix 1, Commercial regulations in 2017 (continued).

STATE	SIZE LIMITS	SEASONAL QUOTA	OPEN SEASON
MD	Ocean: 24" minimum CB and Rivers: 18–36"	Ocean: 90,727 lbs. CB and Rivers: 1,471,888 lbs. (part of Bay-wide quota).	Ocean: 1.1-5.31, 10.1-12.31, Mon- Fri Bay Pound Net: 6.1-12.30, Mon-Sat Bay Haul Seine: 6.1-12.29, Mon-Fri Bay Hook & Line: 6.1-12.28, Mon-Thu Bay Drift Gill Net: 1.2-2.28, 12.1-12.29, Mon-Thu
PRFC	18-36" slot size limit 2.15-3.25 and 18" minimum size all other seasons	583,362 lbs. (part of Bay-wide quota). Allocated by gear and season.	Hook & line: 1.1-3.25, 6.1-12.31 Pound Net & Other: 2.15-3.25, 6.1-12.15 Gill Net: 1.1-3.25, 11.13-12.31 Misc. Gear: 2.15-3.25, 6.1-12.15
DC	Commercial fishing prohibited		
VA	Bay and Rivers: 18" min size, and 18-28" slot size limit 3.26–6.15 Ocean: 28" min	Bay and Rivers: 1,064,997 lbs. (part of Bay-wide quota). Ocean: 136,141 lbs. ITQ-system for both areas.	Bay and Rivers: 1.16-12.31 Ocean: 1.16-12.31
NC	Ocean: 28"	360,360 lbs. (split between gear types). Number of fish allocated to each permit holder. Allocation varies by permit.	Seine fishery was open for 120 days, 150 fish/permit Gill net fisher was open for 45 days, 50 fish/permit Trawl fishery was open for 70 days, 100 fish/permit

Appendix 1, Recreational regulations in 2017. C&R = catch and release

STATE	SIZE LIMITS	BAG LIMIT	GEAR RESTRICTIONS	OPEN SEASONS
ME	28" minimum size	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 catch and release only 5.1 – 6.30
NH	28" minimum size	1 fish/day	Gaffing and culling prohibited	All year
MA	28" minimum size	1 fish/day	Hook & line only; no high-grading	All year
RI	28" minimum size	1 fish/day	None	All year
CT	28" minimum size	1 fish/day	Spearing and gaffing prohibited	All year
NY	Ocean and Delaware River: 28" minimum size Hudson River: 18"-28" slot limit, or >40"	1 fish/day	Angling only. Spearing permitted in ocean waters. Catch and release only during closed season.	Ocean: 4.15 – 12.15 Hudson River: 4.1 – 11.30 Delaware River: All year
NJ	1 fish at 28" to < 43", and 1 fish ≥ 43"		Circle hooks required while fishing with natural bait during springtime spawning ground closure.	Ocean: All year All other waters: 3.1 – 12.31, except spawning ground closure from 4.1 – 5.31 in the lower Delaware River and tributaries
PA	Upstream from Calhoun St Bridge: 1 fish at ≥ 28" minimum size, year round Downstream from Calhoun St Bridge: 1 fish at ≥ 28" minimum size, 1.1 – 3.31 and 6.1 – 12.31 2 fish at 21"-25" slot size limit, 4.1 – 5.31			
DE	28" minimum size, no harvest 38-43" (inclusive)	2 fish/day	Hook & line, spear (for divers) only. Circle hooks required in spawning season.	All year except 4.1-5.31 in spawning grounds (C&R allowed). In Del. River, Bay & tributaries, may only harvest 20-25" slot from 7.1-8.31

Appendix 1, Recreational regulations in 2017 (continued). C&R = catch and release

STATE	SIZE LIMITS	BAG LIMIT	OTHER	OPEN SEASON
MD	Ocean: 28"-38" slot limit or ≥44" CB Spring Trophy: 35" minimum CB Summer/Fall^: 20" minimum and only one fish can be >28"	Ocean: 2 fish/day CB Spring Trophy: 1 fish/day CB Summer/Fall^: 2 fish/day	See compliance report for specifics.	Ocean: All year CB: C&R only 1.1-4.14^ CB Spring Trophy: 4.15-5.15 Bay Summer/Fall: 5.16-12.20
PRFC	Spring Trophy: 35" minimum Summer/Fall: 20" minimum and only 1 fish can be >28"	Trophy: 1 fish/day Summer/Fall: 2 fish/day	No more than two hooks or sets of hooks for each rod or line	Spring Trophy: 4.15 -5.15 Summer/Fall: 5.16-12.31
DC	20" minimum and only one fish can be >28"	2 fish/day	Hook & line only	5.16-12.31
VA	Ocean: 28" minimum Ocean Trophy: 36" minimum CB Trophy: 36" minimum CB Spring: 20-28" (with 1 fish >36") CB Fall: 20" minimum and only one fish can be >28"	Ocean: 1 fish/day Ocean Trophy: 1 fish/day Bay Trophy: 1 fish/day Bay Spring: 2 fish/day Bay Fall: 2 fish/day	Hook & line, rod & reel, hand line only. Gaffing is illegal in Virginia marine waters. No possession in the spawning reaches of the Bay during trophy season	Ocean: 1.1-3.31, 5.16-12.31 Ocean Trophy: 5.1-5.15 Bay Trophy: 5.1-6.15 Bay Spring: 5.16-6.15 Bay Fall: 10.4-12.31
NC	Ocean: 28" minimum	Ocean: 1 fish/day	No gaffing allowed.	Ocean: All year

^in Susquehanna Flats and Northeast River: C&R only from 1.1-5.3 and 1 fish/day at 20-26" slot size limit from 5.16-5.31