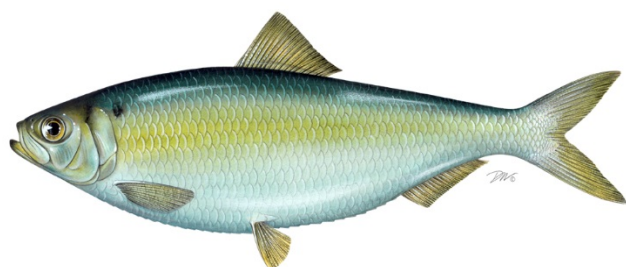
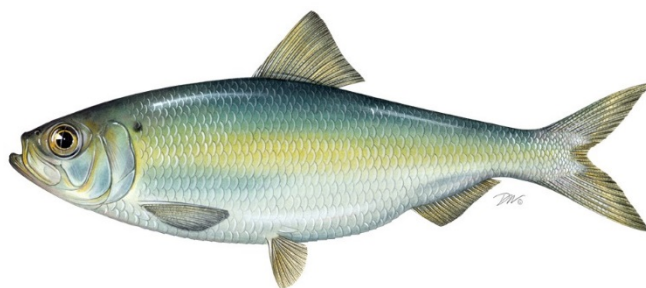
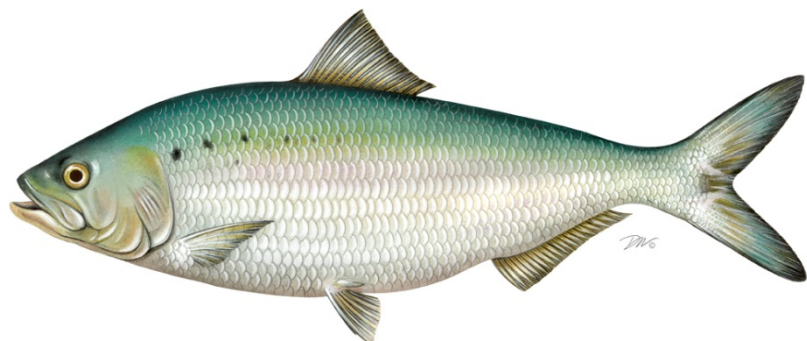


**REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR SHAD AND RIVER HERRING
(*Alosa spp.*) FOR THE 2019 FISHING YEAR**



Shad & River Herring Plan Review Team

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Approved February 4, 2021

**REVIEW OF THE ASMFC FISHERY MANAGEMENT PLAN FOR
SHAD AND RIVER HERRING (*Alosa spp.*)**

I. Status of the Fishery Management Plan

<u>Date of FMP Approval:</u>	October 1985
<u>Amendments:</u>	Amendment 1 (April 1999) Amendment 2 (August 2009) Amendment 3 (February 2010)
<u>Addenda:</u>	Technical Addendum #1 (February 2000) Addendum I (August 2002)
<u>Management Unit:</u>	Migratory stocks of American shad, hickory shad, alewife, and blueback herring from Maine through Florida
<u>States With Declared Interest:</u>	Maine through Florida, including the Potomac River Fisheries Commission (PRFC) and the District of Columbia
<u>Active Boards/Committees:</u>	Shad & River Herring Management Board, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, Plan Review Team, Plan Development Team

The 1985 Fishery Management Plan (FMP) for Shad and River Herring was one of the first FMPs developed by the ASMFC. Amendment 1 was initiated in 1994 to require and recommend specific monitoring programs to inform future stock assessments—it was implemented in October 1998. A Technical Addendum to Amendment 1 was approved in 1999 to correct technical errors.

The Shad and River Herring Management Board (Board) initiated Addendum I in February 2002 to change the conditions for marking hatchery-reared alosines; clarify the definition and intent of *de minimis* status for the American shad fishery; and modify and clarify the fishery-independent and dependent monitoring requirements. These measures went into effect on January 1, 2003.

In May 2009, the Board approved Amendment 2 to restrict the harvest of river herring (blueback herring and alewife) due to observed declines in abundance. The Amendment prohibited commercial and recreational river herring harvest in state waters beginning January 1, 2012, unless a state or jurisdiction has a sustainable fishery management plan (SFMP) reviewed by the Technical Committee and approved by the Board. The Amendment defines a sustainable fishery as “a commercial and/or recreational fishery that will not diminish the potential future stock reproduction and recruitment.” Catch and release only fisheries may be maintained in any river system without an SFMP. SFMPs have been approved by the Management Board for Maine, New Hampshire, Massachusetts, New York, and South Carolina (Table 1). Amendment 2 also required states to implement fishery-dependent and independent monitoring programs.

In February 2010, the Board approved Amendment 3 in response to the 2007 American shad stock assessment, which found most American shad stocks at all-time lows. The Amendment requires similar management and monitoring for shad as developed in Amendment 2 (for river herring). Specifically, Amendment 3 prohibits shad commercial and recreational harvest in state waters beginning January 1, 2013, unless a state or jurisdiction has a SFMP reviewed by the Technical Committee and approved by the Board. The Amendment defines a sustainable fishery as “a commercial and/or recreational fishery that will not diminish the potential future stock reproduction and recruitment.” Catch and release only fisheries may be maintained in any river system without an SFMP. SFMPs have been approved by the Board for Massachusetts, Connecticut, the Delaware River Basin Fish Cooperative (on behalf of New York, Delaware, New Jersey, and Pennsylvania), PRFC, North Carolina, South Carolina, Georgia, and Florida (Table 1). All states and jurisdictions are also required to identify local significant threats to American shad critical habitat and develop a plan for mitigation and restoration. All states and jurisdictions habitat plans have been accepted and approved.

Table 1. States/jurisdictions with approved sustainable fishery management plans (SFMPs) for river herring or shad. Includes year of original Board approval and approved updates¹.

State	River Herring SFMP	Shad SFMP
Maine	Approved (2010, 2017, 2020)	Approved (2020)
New Hampshire	Approved (2011, 2015, 2020)	
Massachusetts	Approved (2016)	Approved (2012, 2019)
Connecticut		Approved (2012, 2017)
Rhode Island		
Pennsylvania		Approved* (2012, 2017, 2020)
New York	Approved (2011, 2017)	Approved* (2012, 2017, 2020)
New Jersey		Approved* (2012, 2017, 2020)
Delaware		Approved* (2012, 2017, 2020)
PRFC		Approved (2012, 2017)
Maryland		
Virginia		
North Carolina		Approved (2012, 2017, 2020)
South Carolina	Approved (2010, 2017, 2020)	Approved (2011, 2017, 2020)
Georgia		Approved (2012, 2017, 2020)
Florida		Approved (2011, 2017, 2020)

*The Delaware River Basin Fish and Wildlife Management Co-op has a Shad SFMP, though Delaware and New Jersey are only states that have commercial fisheries. All states have recreational measures, with limited to no catch in the upper Delaware River (New York & Pennsylvania).

¹ SFMPs must be updated and re-approved by the Board every five years.

II. Status of the Stocks

While the FMP addresses four species: two river herrings (blueback herring and alewife) and two shads (American shad and hickory shad)—these are collectively referred to as shad and river herring, or SRH.

The most recent American Shad Benchmark Stock Assessment (ASMFC 2020) indicates American shad remain depleted on a coastwide basis. Multiple factors, such as overfishing, inadequate fish passage at dams, predation, pollution, water withdrawals, channelization of rivers, changing ocean conditions, and climate change are likely responsible for shad decline from historic abundance levels. Additionally, the assessment finds that shad recovery is limited by restricted access to spawning habitat. Current barriers partly or completely block 40% of historic shad spawning habitat, which may equate to a loss of more than a third of spawning adults.

Of the 23 river-specific stocks of American shad for which sufficient information was available, adult mortality was determined to be unsustainable for three stocks (Connecticut, Delaware, and Potomac) and sustainable for five stocks (Hudson, Rappahannock, York, Albemarle Sound, and Neuse). The terms “sustainable” and “unsustainable” were used instead of “not overfishing” and “overfishing” because fishing mortality cannot be separated from other components contributing to total mortality. The assessment was only able to determine abundance status for two stocks: abundance for the Hudson is depleted, and abundance for the Albemarle Sound is not overfished. For the Hudson and coastwide metapopulation, the “depleted” determination was used instead of “overfished” because the impact of fishing on American shad stocks cannot be separated from the impacts of all other factors responsible for changes in abundance.

The status of 15 additional stocks could not be determined due to data limitations, so trends in YOY and adult abundance were provided for information on abundance changes since the 2005 closure of the ocean-intercept fishery. For YOY indices, two systems experienced increasing trends while one system experienced a decreasing trend since 2005. All other systems experienced either no trend (eight systems), conflicting trends among indices (one system), or had no data (11 systems). For adult indices, four systems experienced increasing trends while no systems experienced decreasing trends since 2005. All other systems experienced either no trend (11 systems), conflicting trends among indices (seven systems), or had no data (one system). Trend analyses also indicate a continued lack of consistent increasing trends in coastwide metapopulation abundance since 2005.

Taken in total, American shad stocks do not appear to be recovering. The assessment concluded that current restoration actions need to be reviewed and new efforts need to be identified and applied. Because multiple factors are likely responsible for shad decline, the recovery of American shad will need to address multiple factors including improved monitoring, anthropogenic habitat alterations, predation by non-native predators, and exploitation by fisheries. There are no coastwide reference points for American shad. There is no stock assessment available for hickory shad.

The most recent *River Herring Benchmark Assessment Report* (ASMFC 2012) indicated that of the 24 river herring stocks for which sufficient data were available to make a conclusion, 23 were depleted relative to historic levels and one was increasing. The status of 28 additional stocks could not be determined because the time-series of available data was too short.

Estimates of coastwide abundance and fishing mortality could not be developed because of the lack of adequate data. The “depleted” determination was used instead of “overfished” because of the many factors that have contributed to the declining abundance of river herring, which include not just directed and incidental fishing, but likely also habitat issues (including dam passage, water quality, and water quantity), predation, and climate change. There are no coastwide reference points.

The river herring stock assessment was updated in 2017 (ASMFC 2017) with additional data from 2011-2015, and concluded that river herring remain depleted at near historic lows on a coastwide basis. Total mortality estimates over the final three years of the data time series (2013-2015) were generally high and exceed region-specific reference points for some rivers. However, some river systems showed positive signs of improvement. Total mortality estimates for 2 rivers fell below region-specific reference points during the final three years of the data time series. No total mortality estimates were below reference points at the end of the 2012 stock assessment data time series. Of the 54 stocks with available data, 16 experienced increasing abundance trends, 2 experienced decreasing abundance trends, 8 experienced stable abundance and 10 experienced no discernable trend in abundance over the final 10 years of the time series (2006-2015).

III. Status of the Fisheries

Shad and river herring formerly supported the largest and most important commercial and recreational fisheries throughout their range. Historically fishing took place in rivers (both freshwater and saltwater), estuaries, tributaries, and the ocean. Although recreational harvest data are scarce, today most harvest is believed to come from the commercial industry. Commercial landings for these species have declined dramatically from historic highs. Details on each fishery are provided below.

AMERICAN SHAD:

Total commercial landings throughout the 1950s fluctuated around 8 million pounds, then declined to just over two million pounds in 1976. A period of moderate increase occurred through the mid-1980s, followed by further declines through the remainder of the time series. Since the closure of the ocean intercept fishery in 2005, landings have been substantially lower, falling below one million pounds. Since 2015, landings have remained below half a million pounds.

The total commercial landings (directed and bycatch) reported in compliance reports from individual states and jurisdictions in 2019 were 273,450 pounds, representing a 4% decrease from landings in 2018 (285,523 pounds) (Table 2). Bycatch landings accounted for approximately 48% of the total commercial landings of American shad in 2019. Landings from South Carolina, North Carolina, and Georgia accounted for 31%, 29%, and 21% of the directed coastwide commercial fishery removals in 2019, respectively. The remainder of the directed

landings came from New Jersey, Connecticut, and Delaware. Maryland commercial fishermen are permitted a bycatch allowance of two fish per day of dead American shad for personal use, provided that shad are captured by gear legally deployed for the capture of other fish species; no sale is permitted. Landings from Virginia, District of Columbia, and PRFC are attributed to limited bycatch allowances for American Shad.

Substantial recreational shad fisheries occur on the Connecticut (CT and MA), Delaware (NY, PA NJ, and DE), Susquehanna (MD), Santee and Cooper (SC), and St. Johns (FL) Rivers. Shad recreational fisheries are also pursued on several other rivers in Massachusetts, District of Columbia, Virginia, North Carolina, South Carolina, and Georgia. Though shad are recreationally targeted in these locations, many fisheries are catch and release only. Hook and line shad catch levels are not well understood; actual harvest and/or effort is only estimated by a few states through annual creel surveys (e.g. Maryland, North Carolina, Georgia, and Florida). Harvest may only amount to a small portion of total catch (landings and discards), but hooking mortality could increase total recreational fishery removals substantially.

Since 2009, recreational harvest data from the Marine Recreational Information Program (MRIP) are generally not provided for American shad due to high proportional standard errors (PSEs). This is a result of the MRIP survey design, which focuses on active fishing sites along coastal and estuarine areas and is unsuitable for capturing inland harvest. However, North Carolina and Florida reported American shad recreational harvest estimates for 2019 (Table 3).

HICKORY SHAD:

In 2019, North Carolina, South Carolina, and Georgia reported directed commercial hickory shad landings; Rhode Island, New York, New Jersey, Virginia, and North Carolina reported bycatch landings. North Carolina accounts for a vast majority of directed landings, contributing 90% of the total. Coastwide commercial and bycatch landings in 2019 totaled 143,851 pounds, representing a 48% increase from 2018 landings (97,284 pounds) (Table 2). Only North Carolina reported recreational harvest: 8,517 fish in 2019.

RIVER HERRING (BLUEBACK HERRING/ALEWIFE COMBINED):

Commercial landings of river herring declined 95% from over 13 million pounds in 1985 to about 733 thousand pounds in 2005. Recent commercial landings continue to increase, despite the closure of the ocean-intercept fishery in 2005 and North Carolina implementing a no-harvest provision for commercial and recreational fisheries of river herring in coastal waters of the state in 2007. In 2019, the coastwide directed commercial river herring landings reported in state compliance reports were 2.5 million pounds, an 11% increase from 2018 (2.3 million pounds). Landings including bycatch in 2019 totaled 3.2 million pounds, a 32% increase from the 2018 total of 2.45 million pounds (Table 2). Confidential data preclude reporting commercial landings by state. Maine, New Hampshire, and Massachusetts provided estimates of recreational river herring harvest in 2019 (Table 3).

Table 2. Shad and river herring total commercial fishery removals (directed landings and bycatch¹, in pounds) provided by states, jurisdictions and NOAA Fisheries for 2019.

	American Shad	Hickory Shad	River Herring
Maine	C	C	
New Hampshire	0	0	
Massachusetts	104,058	0	
Rhode Island	0	12,944	
Connecticut	5,596	C	
New York	1,581	C	
New Jersey	18,303	C	
Pennsylvania	0	0	
Delaware	2,404	0	
Maryland	0	0	
D.C.	0	0	
PRFC	17,454	0	
Virginia	3,821	414	
North Carolina	46,151	117,655	
South Carolina	43,290	C	
Georgia	30,356	12,104	
Florida	0	0	
Total Directed	140,920	124,091	2,502,011
Total Bycatch	132,530	19,760	720,111
Total	273,450	143,851	3,222,122

*All values for river herring by state are not shown due to confidential data. Confidential values by state for American shad and hickory shad are indicated by "C."

Table 3. Recreational harvest information for river herring and American shad in 2019 from MRIP and state compliance reports.

State	River Herring Harvest	American Shad Harvest	Source of Estimates
Maine	733.4 lbs		MRIP*
New Hampshire	17719.5 lbs		APAIS and mandatory-reporting for net and pot fishing
Massachusetts	2,090 fish		MRIP*
North Carolina		3,039 fish	Recreational creel surveys on the Roanoke, Tar, Neuse, and Cape Fear rivers
Florida		622 lbs	Access point creel survey on St. Johns River

*MRIP estimate considered highly uncertain, with a PSE of 90.8. Spatial coverage of MRIP sampling may not align with recreational harvest areas for shad. In Maine, only 3 shad were sampled in 2018 and fewer than 56 shad have been sampled since 1996.

IV. Status of Research and Monitoring

Amendment 2 (2009) and Amendment 3 (2010), required fishery-independent and fishery-dependent monitoring programs for select rivers. Juvenile abundance index (JAI) surveys, annual spawning stock surveys (Table 4), and hatchery evaluations are required for specified

¹ Available information on shad and river herring bycatch varies widely by state. Estimates may not capture all bycatch removals occurring in state waters.

states and jurisdictions. States are required to calculate mortality and/or survival estimates, and monitor and report data relative to landings, catch, effort, and bycatch. States must submit annual reports including all monitoring and management program requirements on or before July 1 of each year.

In addition to the mandatory monitoring requirements stipulated under Amendments 2 and 3, some states and jurisdictions continue important voluntary research initiatives for these species. For example, Massachusetts, Pennsylvania, Delaware, Maryland, District of Columbia, North Carolina, South Carolina, and the United States Fish and Wildlife Service (USFWS) are actively involved in shad restoration using hatchery-cultured fry and fingerlings. All hatchery fish are marked with oxytetracycline marks on otoliths to allow future distinction from wild fish. During 2019, several jurisdictions reared American shad, stocking a total of 11,964,361 American shad, a decrease of 47% from the 22,754,925 shad stocked in 2018 (Table 5). In addition 1,195,808 river herring (both alewife and blueback) larvae were stocked in Harrison Lake, part of the James River system, in 2019.

V. Status of Management Measures

All state programs must implement commercial and recreational management measures or an alternative program approved by the Management Board (Table 1). The current status of each state's compliance with these measures is provided in the Shad and River Herring Plan Review Team Report (Table 6).

Amendment 2 (2009) prohibits river herring commercial and recreational harvest in state waters beginning January 1, 2012, unless a state or jurisdiction submits a sustainable fishery management plan and receives approval from the Board. Amendment 3 (2010) also requires the development of a SFMP for any jurisdiction maintaining a shad commercial or recreational fishery after January 1, 2013 (with the exception of catch and release recreational fisheries). States are required to update SFMPs every five years. In 2017, states reviewed their SFMPs and made changes based on fishery performance or observations (e.g., revised sustainability targets) where necessary. At a minimum, states updated data for their commercial and/or recreational fisheries and recommended the current sustainability measures be carried forward in the next plan. To date the Board has reviewed and approved updated SFMPs for all states, with the updated Massachusetts SFMP for shad being approved in February 2019.

Under Amendments 2 and 3 to the FMP, states may implement, with Board approval, alternative management programs for river herring and shad that differ from those required by the FMP. States and jurisdictions must demonstrate that the proposed management program will not contribute to overfishing of the resource or inhibit restoration of the resource. The Management Board can approve a proposed alternative management program if the state or jurisdiction can show to the Management Board's satisfaction that the alternative proposal will have the same conservation value as the measures contained in the FMP. In August 2020, the Board approved alternative management plans for recreational fishery regulations in South Carolina, Georgia, and Florida.

Table 4. American shad and river herring passage counts at select rivers along the Atlantic coast in 2019.

State/River	Shad	River Herring
Maine		
Androscoggin	63	81,025
Saco	1,139	55,028
Kennebec	44	240,594
Sebasticook	114	3,287,702*
Penobscot	2,489	1,986,910
St. Croix		486,500
New Hampshire		
Cocheco	0	1,682
Exeter	0	28
Oyster	0	4,969
Lamprey	0	34,684
Winnicut	0	0
Massachusetts		
Merrimack	18,653	143,541
Rhode Island		
Gilbert Stuart	0	35,832
Nonquit	0	101,714
Buckeye Brook	0	38,418
Connecticut River		
Holyoke Dam	314,361	5,052
Pennsylvania		
Schuylkill (Fairmont Dam)	415	
Pennsylvania/Maryland/Delaware		
Susquehanna (Conowingo)**	4,787	15
Susquehanna (Holtwood)**	570	
Susquehanna (Safe Harbor)**	316	
South Carolina		
St. Stephen Dam	95,788	39,938
Total 2019	437,853	6,543,632
Total 2018	642,688	9,404,020
Total 2017	761,386	5,876,375
Total 2016	540,917	5,514,890
Total 2015	611,368	3,825,435

*Passage after harvest removals.

**Passage numbers on Susquehanna River are cumulative and listed in ascending order of passage mile with Conowingo being nearest the river's mouth.

Table 5. Stocking of Hatchery-Cultured Alosine Larvae (Fry) in State Waters, 2019.

State	American Shad	River Herring
New Hampshire		
Lamprey River	2,829,219	
Massachusetts		
Merrimack River	271,155	
Nashua River	323,442	
Rhode Island		
Pawcatuck River	0	
Pawtuxet River	0	
Pennsylvania		
Susquehanna River	832,000	
Lehigh River	0	
Schuykill River	0	
Delaware		
Nanticoke River	858,000	
Maryland		
Choptank River	2,805,000	
District of Columbia/PRFC		
Potomac River**	9,500	
Virginia		
James River	0	1,195,808
North Carolina		
Neuse River	0	
Roanoke River	0	
South Carolina		
Edisto River	28,799	
Wateree River	4,007,246	
Georgia		
Altamaha River	0	
Oconee River	0	
Total	11,964,361	1,195,808

*In Maine and Massachusetts river herring of wild origin are stocked as adult pre-spawning individuals through trap and transfer programs. These are not counted toward the total because they are not of hatchery origin.

**Numbers of fry stocked from combined efforts of PRFC, DC, and MD.

VI. Prioritized Research Needs

Due to the large number of research recommendations identified during stock assessments of these alosine species, only research recommendations identified as high priority are presented below. Recommendations are categorized by the expected time frame necessary to complete the recommendation (short term vs. long term). See the most recent benchmark stock assessment of each species (2020 for American shad, 2012 for blueback herring and alewife) for additional important research recommendations.

AMERICAN SHAD

Short Term

- Otoliths should be collected as the preferred age structure. If collection of otoliths presents perceived impact to conservation of the stock, an annual subsample of paired otolith and scales (at least 100 samples if possible) should be collected to quantify error between structures.
- Error between structures, if scales are the primary age structure collected, and for spawn mark count estimates (either between multiple readers or within reader) should be quantified on an annual basis. A mean coefficient of variation (CV) of 5% and detection of no systematic bias should serve as targets for comparisons.
- Two readers should determine consensus ages and spawn mark counts based on improvements in ageing error in the Delaware system when consensus-based estimates were part of the ageing protocol.

Long Term

- Develop a centralized repository for agencies to submit and store genetic sampling data for future analysis. The Atlantic sturgeon repository at the United States Geological Survey (USGS) Leetown Science Center should serve as an example.
- Collect genetic samples from young-of-year (YOY) and returning mature adults during spawning runs for future analysis of baseline genetic population structure and site fidelity/straying rates. These data will help define stock structure, identify stock composition from genetic sampling of American shad catch in mixed-stock fisheries, and provide information on recolonization capabilities in defunct American shad systems.
- Conduct annual stock composition sampling through existing and new observer programs from all mixed-stock fisheries (bycatch and directed). Potential methods include tagging (conventional external tags or acoustic tags) of discarded catch and genetic sampling of retained and discarded catch. Mortality rates of juvenile fish in all systems remain unknown and improvement in advice from future stock assessments is not possible without this monitoring. Known fisheries include the Delaware Bay mixed-stock fishery and all fisheries operating in the Atlantic Ocean (U.S. and Canada) that encounter American shad (see Section 4.1.4 in the stock assessment report).
- Implement fishery-independent YOY and spawning run surveys in all systems with open fisheries. Surveys should collect catch rates, length, individual weight, sex (spawning runs), and age (spawning runs) data at a minimum to allow for assessment of stocks with legal harvest. Require these surveys be in operation in systems with requested fisheries before opening fisheries.

- Conduct complete in-river catch monitoring in all systems with open fisheries. Monitoring programs should collect total catch, effort, size, individual weight, and age data at a minimum. Require these surveys be in operation in systems with requested fisheries before opening fisheries.
- Conduct maturity studies designed to accommodate the unique challenges American shad reproductive behavior (i.e., segregating by maturity status during spawning runs) poses on traditional monitoring programs. This information will also improve understanding of selectivity by in-river fisheries and monitoring programs.
- Conduct fish passage research at barriers with adults for both upstream and downstream migration and movements and with juveniles for downstream as discussed in Section 1.1.9.5 of the stock assessment report.

RIVER HERRING

Short Term

- Analyze the consequences of interactions between the offshore bycatch fishery and population trends in the rivers.
- Continue genetic analyses to determine population stock structure along the coast and enable determination of river origin of incidental catch in non-targeted ocean fisheries.
- Continue to assess current ageing techniques for river herring, using known-age fish, scales, otoliths, and spawning marks.
- Improve reporting of harvest by waterbody and gear.
- Develop and implement monitoring protocols and analyses to determine river herring population responses and targets for rivers undergoing restoration (dam removals, fishways, supplemental stocking, etc.).
- Explore the sources of and provide better estimates of incidental catch in order to reduce uncertainty in incidental catch estimates.

Long Term

- Encourage studies to quantify and improve fish passage efficiency and support the implementation of standard practices.
- Determine and quantify which stocks are impacted by mixed stock fisheries (including bycatch fisheries). Methods to be considered could include otolith microchemistry, oxytetracycline otolith marking, genetic analysis, and/or tagging.
- Validate [better estimate] the different values of natural mortality (M) for river herring stocks and improve methods for calculating M .
- Conduct biannual ageing workshops to maintain consistency and accuracy in ageing fish sampled in state programs.
- Investigate the relation between juvenile river herring production and subsequent year class strength, with emphasis on the validity of juvenile abundance indices, rates and sources of immature mortality, migratory behavior of juveniles, and life history requirements.
- Expand observer and port sampling coverage to quantify additional sources of mortality for alosine species, including bait fisheries, as well as rates of incidental catch in other fisheries.

VII. Status of Implementation of FMP Requirements

In accordance with the Shad and River Herring Fishery Management Plan, the states are required to submit an annual compliance report by July 1st of each year. The Plan Review Team (PRT) reviewed all state reports for compliance with the mandatory measures in Amendments 2 (River Herring) and 3 (American shad). Table 6 provides important information on each state's fisheries, monitoring programs, and compliance issues pertaining to the 2019 fishing year. Table 7 summarizes state reports of protected species interactions.

De Minimis Status

A state can request *de minimis* status if commercial landings of river herring or shad are less than 1% of the coastwide commercial total. *De minimis* status exempts the state from the sub-sampling requirements for commercial and recreational catch for biological data. The following states have met the requirements and requested continued *de minimis* status in 2019:

- Maine (American shad)
- New Hampshire (American shad and river herring)
- Massachusetts (American shad)
- Florida (American shad and river herring)

State Compliance

All states with a declared interest in shad and river herring management have submitted annual compliance reports. Virginia has also submitted a separate bycatch report in accordance with the provisions of their limited bycatch program.

Most states have regulations in place that meet the intent of the requirements of the Interstate Fisheries Management Plan for Shad and River Herring. The PRT notes the following compliance issues encountered in their review of the state reports:

1. In 2019, several states allowed recreational harvest for shad and/or river herring in absence of an approved SFMP, though Amendments 2 and 3 require all states and jurisdictions to submit SFMPs for systems that remain open to commercial and recreational harvest. These issues have been resolved through the approval of the following plans:
 - Maine SFMP for American shad (2020)
 - South Carolina: Alternative Management Plan for river herring (2020)
 - Georgia: Alternative Management Plan for river herring (2020)
 - Florida: Alternative Management Plan for river herring in all state waters, and for American shad outside of the St. Johns system (2020)
2. Several states did not report on all monitoring requirements listed under Amendments 2 and 3 (see Table 6). A few states have consistently omitted the same information from compliance reports for the past few years (CT, NY, NC, GA). These states should take note of the required monitoring programs that were not reported and make a concerted effort to report all monitoring programs in future compliance reports. The most common omissions were: characterization of other losses, variance, characterization of recreational harvest, length and age frequency, and degree of repeat spawning.

3. Many states did not submit their monitoring data in a separate Excel file along with the compliance report, as is required by Amendment 3. If data from required monitoring is provided in a separate file, the compliance report should also indicate what data were provided.

VIII. PRT Recommendations

After a thorough review of the state reports, the PRT recommends approval of the state compliance reports for the 2019 fishing year and *de minimis* requests. In addition, the PRT recommends the Board consider changes to the annual compliance report format for shad and river herring. Over the last several years the PRT and Technical Committee have continued to express concerns with the difficulty of preparing and reviewing compliance reports that contain such a large quantity of information. To streamline this process while ensuring necessary information is still reported on an annual basis, the PRT recommends the following format for annual compliance reports:

I. Introduction

Briefly highlight any significant changes in monitoring, regulations, or harvest.

II. Request for *de minimis* (If applicable)

III. Harvest and Losses

Provide a table of harvest and losses for each species, including reported commercial landings, bycatch landings, poaching, recreational harvest, catch and release mortality, fish passage mortality, discarded males, brood stock capture, research losses, etc.

V. Previous year's fishery and management program

- A. Include a copy of all current fishery regulations as an appendix to the report.
- B. Completion of Required Monitoring: include, in table format a list of each required monitoring component (fishery-dependent and -independent), whether or not it was completed for the previous year, and any additional comments (e.g. explanation of incomplete monitoring, changes to monitoring program, data caveats, or other significant information). This table should NOT include results of each monitoring component. See below for an example table.
 - a. If a state desires to provide more detailed description of changes to monitoring programs or other important information on monitoring, the state may provide this information in an additional appendix.

b.

Required Monitoring Components	Completed? (Y/N/NA)	Additional comments
<i>Fishery Dependent Monitoring</i>		
Commercial Fishery		
Landings		
Harvest Composition		
Effort		
Recreational Fishery		
Landings		
Harvest Composition		
Effort		
<i>Fishery Independent Monitoring</i>		
Spawning stock survey		
Calculation of mortality and/or survival estimates		
Juvenile abundance survey		
Hatchery evaluation		

- C. Sustainability evaluation: provide a description of any sustainability target/thresholds used in approved SFMPs, and indicate how metrics in the previous year compared to the approved targets/thresholds, and whether any management action will be taken in response.

VI. Planned management programs for the current calendar year

- A. Summarize regulations that will be in effect (copy of current regulations only if different from previous year).
- B. Summarize changes to monitoring programs that will be performed, only if different from previous year.

Amendment 3 requires states to annually submit all data from monitoring programs in Excel spreadsheets using the template provided at the same time as the annual report, unless determined otherwise by the Board. The PRT recommends that states continue to annually submit monitoring data in Excel only, but recommends they do not include those data in the written compliance report.

Table 6. Summary of PRT Review of 2019 State Compliance Reports.

STATE	2019 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
ME	<p>In 2019, counts of river herring were close to average on the Androscoggin (81,025), Sebasticook (3,287,702) Kennebec (240,594) and the Saco (55,028) rivers while the St. Croix River (486,500) was trending upward. Based on the following sustainability guidelines and Maine laws and regulations, eighteen municipal directed river herring harvests were approved by DMR in 2019. Commercial landings of river herring were the highest recorded since 2003. Severe drought conditions in 2016 are expected to impact the 2020 river herring run. 384 confirmed juvenile American shad collected among standard and experimental seining stations in various state waterways. Multiple dams on the Mousam, Union, and Little Androscoggin Rivers are in the process of FERC relicensing. Maine DMR is working with project partners to ensure alosid fish passage is being considered a priority.</p>	<p>Maintained recreational shad fishery with bag limit of 2 fish per day; Shad SFMP was approved in 2020. Representative biological sampling for shad was not conducted on Androscoggin and Saco Rivers. Low run sizes discourage handling of fish. As a result, size, age, sex composition, and mortality were not calculated. Monitoring of shad recreational fishery is minimal; information presented is unlikely to reflect actual harvest. No monitoring of RH recreational catch composition. Missing biological data characterizing the spawning stock on the St. Croix and Saco Rivers. No age samples were taken on the Saco River, so mortality was not calculated. Two summons and eleven warnings were issued for either exceeding the 25-fish limit on river herring or fishing in a closed area or during a closed period.</p>
NH	<p>The relative abundance of juvenile alewife and blueback herring declined in 2019. Various agencies are working to remove dams for the benefit of anadromous fish on the Cocheco (Gonic dams) and Bellamy (Sawyer Mill dams) Rivers. No adult American shad and only one juvenile detected by fishery independent surveys in the Exeter River in 2019. US Fish and Wildlife Service stocked 2,829,219 marked American shad fry in the Lamprey River in 2019.</p>	NA
MA	<p>143,541 river herring were counted at the Essex dam fish lift on the Merrimack River in 2019. This was above the time series average of 84,350. 4,006 gravid river herring were trapped and transported into four coastal systems within Massachusetts for restoration efforts. Additionally, 26,445 alewives were trapped in Massachusetts and released into 2 Rhode Island coastal systems (2,000 fish) and 5 New Hampshire coastal systems (24,445 fish). In 2019, MA DMF staff contributed time to approximately 25 different habitat restoration projects in various stages of development and implementation. Highlights for 2019 include the completion of a new fishway at the Draka Dam on the Three Mile River, a new fish ladder at Forge Pond Dam on the Jones River, and the improvement of fish passage at the historic Herring Brook Park. 18,653 American shad were counted at the Essex Dam fish lift on the</p>	<p>RH: MA did not implement juvenile RH abundance survey in Merrimack or Connecticut rivers. In 2019 fourteen violations (11 civil, 3 criminal) were reported by the Massachusetts Environmental Police involving illegal catching and possession of river herring. Shad: Juvenile abundance monitoring not conducted in the Merrimack River. No report of adult mortality/survival</p>

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STATE	2019 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
	<p>Merrimack River in 2019, below the time series average of 29,037 fish. 314,361 American shad were counted at the Holyoke Dam fish lift on the Connecticut River in 2019, above the time series average of 269,755 fish. An additional 2,401 fish were transferred to trucks for transport and 67 fish were sacrificed for agency studies. MA DMF has identified the Charles and Palmer Rivers as restoration priorities for American shad. In partnership with USFWS, MA DMF participated in a feasibility study for the removal of the Watertown Dam on the Charles River.</p>	<p>and no juvenile abundance information reported for the Connecticut River.</p>
RI	<p>During the 2019 season, 35,832 river herring passed through the Gilbert Stuart fishway, 101,714 passed through the Nonquit fishway and 38,418 were estimated at Buckeye Brook. Nonquit and Buckeye Brook increased compared to 2018, while Gilbert Stuart counts fell. CPUE of river herring in the Narragansett Bay seine survey (all life stages included) increased substantially in 2019 to the highest index value on record. Only 5 juvenile shad in 50 seine hauls were collected during the juvenile abundance survey. JAI was lower than average in 2019. 115 adult shad passed through the Potter Hill fishway on the Pawcatuck River in 2019. This is about average for years from 2005 onwards. The USFWS North Attleboro hatchery that previously provided juveniles/eggs for stocking in Rhode Island could not receive shad in 2019. As a result, 242 adult shad were stocked to Rhode Island rivers from the Connecticut River in 2019.</p>	<p>RH: 1) Pawcatuck - missing spawning stock survey, biological sampling of the spawning stock, and mortality/survival estimates; 2) Buckeye Brook - missing the accompanying biological samples for spawning stock count. Shad: No monitoring of the recreational fishery on Pawcatuck River. Did not report on progress in implementing shad habitat recommendations.</p>
CT	<p>Adult blueback herring collection efforts were not conducted by CT DEEP in 2019 due to funding and staffing shortages. The CT DEEP FD Diadromous Group is continuously pursuing opportunities to expand the population with improvements to upstream and downstream fish passage at three main stem dams and some tributary dams. 2019 represented historic lows in the number of commercial shad fishers (5), fishing trips (56), and pounds of American shad landed (5,596) in the time series. None of the three fishery independent benchmarks for shad (Lift counts, escapement, and JAI) were exceeded in 2019.</p>	<p>The commercial shad fishery was not sampled for catch composition (except for sex) and effort estimation was not provided. This was due to the small size of the fishery, limited budget, and staffing shortages. A shad creel survey was not conducted in 2019 due to budget constraints and limited staff availability. CT staff believe age structure and length frequency collected through their fishery independent monitoring efforts are representative of those in the recreational fishery.</p>
NY	<p>The 2019 JAIs for both blueback and alewife were low below their established 25th quartile benchmarks. New York will closely monitor this index over the next several years, and a proactive approach will be taken if low catch rates continue. The 2019 American shad JAI marks the fifth consecutive year below recruitment failure.</p>	<p>A river herring recreational creel survey was not conducted in 2019 due to funding constraints. Did not report on progress in implementing habitat recommendations.</p>

Table 6. Summary of PRT Review of 2019 State Compliance Reports.

STATE	2019 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
NJ	For blueback herring in the trawl survey the geometric mean ranked 6th out of 31 years and alewife ranked 29th. The geometric mean CPUE of American shad caught during the ocean trawl survey ranked 28th in the 31-year time series.	Did not include harvest and losses table, copy of regulations for commercial and rec fishery, nor summary of monitoring programs for following year. No review of progress in implementing habitat recommendations. Did not report on progress in implementing habitat recommendations.
PA	No juvenile river herring were sampled or recovered from Pennsylvania portions of the Susquehanna River in 2019. The lack of juvenile river herring from this survey is typical, as very few to no adult river herring successfully migrate upriver of Safe Harbor Dam. Passage of adult American Shad at Conowingo (4,787), Holtwood (570) and Safe Harbor (316) dams in 2019 continued a depressed passage trend observed since the early 2000s. Further, 2019 marked the lowest year of shad passage and catch recorded since the East Fish Lift at the Conowingo Dam began operations in 1991. However, fish lift operations in 2019 were partly impacted by two high flow events in later April and mid-May. Evaluation of otoliths for hatchery administered tetracycline marks from adult American Shad sampled in 2019 found 31.7% to be hatchery origin fish, which is third lowest proportion of hatchery fish identified in annual catches since 1989.	Did not include copy of commercial and recreational regulations that were in effect.
DELAWARE BASIN COOP	Commercial landings for American shad in the Delaware Estuary and Bay as reported to NJ in their directed fishery (18,299 lbs) for 2019 were well below average since 2000. Catch of adult American shad in Lewis Haul Seine survey was near record low in 2019, however, high river flows influenced gear efficacy. There is no estimation of recreational angler use and harvest for American shad in the Delaware River Basin for the 2019 season. There was a noticeable decrease in the Alewife YOY relative abundance in 2019 (0.12 geo mean) for Delaware's bottom trawl survey compared to 2018 (0.46 geo mean). Relative abundance of juvenile alewives and blueback herring in the Maurice River decreased in 2019 from 2018 levels.	Did not include copy of commercial and recreational regulations that were in effect. Otoliths and scales collected but not aged.
DE	The 2019 haul seine JAI of American shad increased from 2018. The 2019 adult electrofishing CPUE for American shad increased from 2018 and ranked sixth highest in 18-year time series. An estimated 858,000 American shad fry were stocked in the Nanticoke River tributaries during the spring of 2019. The geometric mean pf blueback herring increased from 2018 to the fifth lowest in the time series. Alewife abundance increased from 2018 to the eighth highest value in the time series.	No report on protected species interactions. Missing copy of regulations. No review of progress implementing habitat recommendations.

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STATE	2019 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
MD	<p>River Herring abundance in Nanticoke River continues to be low and sizes have decreased; North East River gillnet survey sampled 1216 river herring, with relative abundance of alewife similar to 2018 and relative abundance of blueback increasing substantially. Juvenile abundance index in Upper Chesapeake Bay showed substantial increase in 2019. Estimates of abundance for adult American shad in the lower Susquehanna River in 2019 were below those observed in 2018, and remain well below time series peak values observed in the early 2000s. Relative abundance of adult American shad in the Nanticoke River (1989-2019) is highly variable year to year, and was above the time series mean in 2019. The Potomac River (1996-2019) adult American shad abundance index has significantly increased over the time series; in 2019, relative abundance increased for the third consecutive year and reached the highest value on record. The American shad juvenile abundance index (JAI) increased in the Potomac River in 2019, while the JAI in the Upper Chesapeake Bay declined. The Potomac River American shad JAI continues to be the highest index in Maryland’s portion of Chesapeake Bay.</p>	NA
DC	<p>No juvenile shad were stocked in 2019. The fisheries research branch has been active in restoring and increasing spawning habitat in Rock Creek by removing barriers and installing a fish ladder at Pierce Mill Dam. The geometric mean for the seining survey increased for blueback herring and shad. The geometric mean for the push net survey increased for shad. The CPUE for the spawning stock survey increased for alewives and decreased for blueback herring.</p>	<p>No ages calculated to conduct mortality or survival estimates.</p>
PRFC	<p>The alewife index decreased to 0.06 in 2019 and the blueback herring index decreased to 0.61. There continues to be no directed harvest of RH in PRFC. The ASMFC American Shad restoration target of 31.1 for the Potomac River was exceeded for the 9th year in a row with a value of 49.0 in 2019. The YOY geometric mean index for American shad increased significantly from 7.36 in 2018 to 10.86 in 2019.</p>	NA
VA	<p>In 2019, ten weekly cruises (June to August) were conducted at night when juvenile Alosa spp. are most susceptible to surface trawling. On the Chickahominy River, a total of 184 alewives and 85 blueback herring were captured. On the Rappahannock River, a total of 220 alewives and 550 blueback herring were captured. Catches of pre-spawned alewife peaked between March 18 and April 8, with catch rates typically exceeding 0.04 fish/m/day or 0.01 kg/m/day. The American shad seine survey data on the James River showed above average recruitment in 2019. The geometric mean catch (followed by standard deviation and number of seine hauls in parentheses) of juvenile American shad captured in daylight seine hauls in 2019 was: James River, 0.13 (0.33, 65); Chickahominy River, 0.07 (0.22,</p>	<p>Did not include in report Protected Species interactions, summary of regulations, or monitoring efforts to be performed next year.</p>

Table 6. Summary of PRT Review of 2019 State Compliance Reports.

STATE	2019 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
	10); Rappahannock River, 11.65 (1.75, 35); York River, 1.28 (1.09, 95); Mattaponi River, 2.65 (1.13, 50); and Pamunkey River, 0.40 (0.80, 40).	
NC	During 2019 sampling of the 11 core seine sites, 1,783 Blueback Herring and 4 Alewives were collected. The 2019 juvenile index of abundance was 33.02 for Blueback Herring. In 2019, a total of 3,590 (211 aged) Blueback Herring were caught in the IGNS throughout the Albemarle Sound. Landings of American Shad in 2019 were the lowest on record, since 1972 and the implementation of the reduced season. During 2019 sampling of the 14 seine sites, 1,163 American Shad were captured. The 2019 American Shad arithmetic juvenile index of abundance was 7.36 fish per seine.	Due to budgetary constraints, Recreational Commercial Gear License harvest data for shad has not been collected since 2008. Did not include summary of regulatory changes for the following year.
SC	No management actions were triggered due to any sustainability benchmark exceedances for river herring during the 2019 fishing year. For American shad, the commercial CPUE for the Pee Dee Run was 1.98; therefore, this run fell below the sustainability benchmark (3.26 fish/hr). It is believed hurricanes and resulting flooding in the area are cause for this decline. If this index stays below the sustainability benchmark one more consecutive year, management action will be taken. In 2019, the commercial CPUE for the Santee River was 1.75 kg/hr; therefore, this river fell below the sustainability benchmark (1.87 kg/hr). In 2019, the CPUE for the Edisto River was 0.13; therefore, this river fell below the benchmark. If CPUE remains below the sustainability benchmark for two more years consecutively, management action will be taken. In 2019, the CPUE for the Combahee River fell below the benchmark target; if the CPUE remains below the benchmark one more year, management action will be taken.	Did not provide estimation of repeat spawning for river herring due to low catch. Did not include summary of regulatory or monitoring changes for the following year. Did not report on progress in implementing habitat recommendations.
GA	For 2019, no commercial CPUE for shad could be derived due to zero drift-net landings for Georgia in the Savannah River. GADNR gill netting efforts on the Altamaha River in 2019 resulted in a catch rate of 2.74 American Shad/100 Net ft-hrs, which is above the sustainability benchmark. American Shad CPUE for the Ogeechee River has been trending up for the past 5-year period. 2019 sample value increased 67% from 2018 sample results and is well above the benchmark.	No regulation of river herring recreational harvest in 2019, though an alternative management plan was approved in 2020.
FL	No commercial fishery exists for shad or river herring. The JAI Survey indicated that blueback herring abundance is increasing over the time series that data were collected. American shad are at the southern extent of their range in Florida. Anglers targeting American shad saw catch rates of more than one fish per hour fishing.	For river herring, state regulations allow recreational harvest though there is no approved SFMP. For shad, state regulations allow recreational harvest statewide, though not all systems are included in the SFMP.

Table 7. Reported protected species interactions (sturgeon species) in shad or river herring fisheries in 2019. Only the states listed below reported interactions.

Jurisdiction	Atlantic sturgeon		Shortnose sturgeon		Unclassified		Total by State	
	Catch	Mortalities	Catch	Mortalities	Catch	Mortalities	Catch	Mortalities
RI							Unavailable*	Unavailable*
CT					1	0	1	0
NJ	3,893 lbs**						0	0
PRFC	2	0					2	0
VA	9	0					9	0
NC	14	0					14	0
SC	19	0					19	0
GA	37	0	57	0			94	0
Total by Species	81	0	57	0	1	0	139	0

*Rhode Island reported 87 sturgeon caught in 2018. Data for 2019 from NEFOP is unavailable.

**In 2019 gill netters in New Jersey coastal waters reported discarding 3,893 pounds of sturgeon. Number of fish and mortality is unknown.