REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION FISHERY MANAGEMENT PLAN FOR SHAD AND RIVER HERRING *(Alosa spp.)* FOR THE 2021 FISHING YEAR

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

I. Status of the Fishery Management Plan

Date of FMP Approval:	October 1985
Amendments:	Amendment 1 (April 1999) Amendment 2 (August 2009) Amendment 3 (February 2010)
Addenda:	Technical Addendum #1 (February 2000) Addendum I (August 2002)
Management Unit:	Migratory stocks of American shad, hickory shad, alewife, and blueback herring from Maine through Florida
States With Declared Interest:	Maine through Florida, including the Potomac River Fisheries Commission (PRFC) and the District of Columbia
Active Boards/Committees:	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 updates[1].

State	River Herring SFMP	Shad SFMP
Maine	Approved (2010, 2017, 2020)	Approved (2020)
New Hampshire	Approved (2011, 2015, 2020)	
Massachusetts	Approved (2016, 2022)	Approved (2012, 2019)
Connecticut		Approved (2012, 2017)
Rhode Island		
Pennsylvania		Approved* (2012, 2017, 2020, 2022)
New York	Approved (2011, 2017, 2022)	Approved* (2012, 2017, 2020, 2022)
New Jersey		Approved* (2012, 2017, 2020, 2022)
Delaware		Approved* (2012, 2017, 2020, 2022)
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). The next river herring stock assessment is expected to be completed in 2023.

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 eight million lbs, then declined to just over two million lbs 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 lbs. Since 2015, landings have remained below half a million lbs.

The total commercial landings (directed and bycatch) reported in compliance reports from individual states and jurisdictions in 2021 were 195,642 lbs, representing a 39% decrease from landings in 2020 (323,171 lbs) (Table 2). Bycatch landings accounted for approximately 17% of the total commercial landings of American shad in 2021. Landings from North Carolina, South Carolina, and Georgia accounted for 36.2%, 36.8%, and 9.7% of the directed coastwide

commercial fishery removals in 2021, respectively. The remainder of the directed landings came from Connecticut, New Jersey, 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, South Carolina, and Florida reported American shad recreational harvest estimates for 2021 (Table 3).

HICKORY SHAD:
In 2021, North Carolina, South Carolina, and Georgia reported directed commercial hickory shad landings; New York and Virginia reported bycatch landings. North Carolina accounts for a vast majority of directed landings, contributing 98% of the total. Coastwide commercial and bycatch landings in 2021 totaled 99,419 lbs, representing an 8% increase from 2020 landings (92,023 lbs) (Table 2). North Carolina and Georgia reported recreational harvest of 55,144 lbs and 112 lbs, respectively.

RIVER HERRING (BLUEBACK HERRING/ALEWIFE COMBINED):
Commercial landings of river herring declined 95% from over 13 million lbs in 1985 to about 733 thousand lbs 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 2021, the coastwide directed commercial river herring landings reported in state compliance reports were 2.11 million lbs, a 12% increase from 2020 (1.88 million lbs). Bycatch landings in 2021 totaled 451 lbs, a 99.7% decrease from the 2020 total of 167,445 lbs (Table 2). Confidential data preclude reporting commercial landings by state. North Carolina, South Carolina, and Florida provided an estimate of recreational river herring harvest in 2021; recreational harvest estimates for Maine and Massachusetts are produced by MRIP but highly uncertain (Table 3).

Table 2. Shad and river herring total commercial fishery removals (directed landings and bycatch[1], in lbs) provided by states, jurisdictions and NOAA Fisheries for 2021.

	River Herring	American Shad	Hickory Shad
Maine^	1,825,855	C	C
New Hampshire	0	0	0
Massachusetts	0	0	0
Rhode Island	0	0	^
Connecticut	0	27,233	0
New York^	2,458	1,129	C
New Jersey	0	C	0
Pennsylvania	0	0	0
Delaware	0	C	0
Maryland^	0	0	0
D.C.	0	0	0
PRFC	0	11,331	0
Virginia	0	4,246	1,955
North Carolina	0	58,885	95,372
South Carolina	278,801	59,964	C
Georgia	0	15,764	C
Florida	0	0	0
Total Directed	2,106,663	162,822	97,435
Total Bycatch	451	32,820	1,984
Total	**2,107,114**	**195,642**	**99,419**

*All values for river herring by state are not shown due to confidential data. Confidential values for American shad and hickory shad are indicated by "C." Some values are listed as confidential to protect the confidentiality of other states.
^Data not yet available.

Table 3. Recreational harvest information for river herring and American shad in 2021 from MRIP and state compliance reports.

State	River Herring Harvest	American Shad Harvest	Source of Estimates
Maine	0	0	MRIP*
New Hampshire	0		Due to failure to meet fishery-independent target in NH's SFP, the recreational river herring fishery was closed in 2021.
Massachusetts	0		MRIP*; No catch recorded
North Carolina		14,589 fish (36,546 lbs)	Recreational creel surveys on the Roanoke, Tar, Neuse, and Cape Fear rivers
South Carolina	12,385 fish (5,239 lbs)	15,200 fish (72,048 lbs)	Creel surveys and mandatory reporting for recreational gill netters.
Florida		47 fish (56kg)	Access point creel survey on St. Johns River

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

*MRIP estimate considered highly uncertain. 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 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 2021, several jurisdictions reared American shad, stocking a total of 16,239,677 American shad, an increase of 11% from the 14,688,667 shad stocked in 2020 (Table 5). In addition, 1,268,795 river herring (both alewife and blueback) larvae were stocked in the James river system in 2021.

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 2021.

State/River	Shad	River Herring
Maine		
Androscoggin	550	54,906
Saco	2,739	135,198
Kennebec	92	66,008
Sebasticook	7	C
Penobscot	11,581	2,852,037
St. Croix	40	550,123
New Hampshire		
Cocheco		2,117
Exeter		167,729
Oyster		9,976
Lamprey		80,567
Winnicut		0
Massachusetts		
Merrimack	47,678	203,399
Rhode Island		
Pawcatuck	65	100,110
Gilbert Stuart		32,760
Nonquit		44,341
Buckeye Brook		122,190
Connecticut River		
Holyoke Dam	237,306	
Pennsylvania		
Schuylkill (Fairmont Dam)	0	*
Pennsylvania/Maryland/Delaware		
Susquehanna (Conowingo)	6,413	27
Susquehanna (Holtwood)	^	^
Susquehanna (Safe Harbor)	^	^
Susquehanna (York Haven)	80	0
South Carolina		
St. Stephen Dam	70,921^^	17,377
Total 2021	377,472	4,438,865
Total 2020	713,520	6,252,726
Total 2019	437,853	6,543,632
Total 2018	642,688	9,404,020
Total 2017	761,386	5,876,375

*Count not completed due to impacts from COVID-19 pandemic.

**Did not collect data in 2021 due to low stock abundance

^No lift operations; ^^2021 season closed early due to mechanical failure of Gate 1

Table 5. Stocking of Hatchery-Cultured Alosine Larvae (Fry) in State Waters, 2021.

State	American Shad	River Herring
Maine		
Androscoggin River	0	0
New Hampshire		
Lamprey River	0	*
Massachusetts*		
Merrimack River	0	0
Nashua River	0	0
Rhode Island		
Pawcatuck River	1,899,929	0
Pawtuxet River	0	0
Pennsylvania		
Susquehanna River	0	0
Lehigh River	0	0
Schuykill River	0	0
Delaware		
Nanticoke River	603,000	0
Maryland		
Choptank River	1,140,000	0
Patapsco River	200,000	0
Maryland/District of Columbia/PRFC**		
Potomac River	264,100	0
Virginia		
James River	0	1,268,795
North Carolina		
Neuse River	0	0
Roanoke River	0	0
South Carolina		
Santee	12,111,381	0
Edisto River	21,267	0
Wateree River	0	0
Georgia		
Altamaha River	0	0
Oconee River	0	0
Total	**16,239,677**	**1,268,795**

*In Maine and Massachusetts river herring of wild origin are stocked as adult pre-spawning individuals through trap and transfer programs. Similarly, New Hampshire stocked river herring are adults of wild origin. 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 2021 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 2021:

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

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. Several states did not report on all monitoring requirements listed under Amendments 2 and 3 (see Table 6). Along with the COVID-19 pandemic, persistent funding and staffing issues prevented states from conducting the required surveys.
    a. The Delaware COOP has not conducted recreational monitoring for American shad since 2002.
    b. Massachusetts does not conduct a JAI for American shad in the Merrimack River
    c. Rhode Island takes river herring samples for mortality/survival estimates but mortality rates have not been updated since 2015.
2. Edisto River was below American shad CPUE sustainability benchmark for three consecutive years (2019-2021), but management action was not triggered.
    a. Note: 2020 monitoring was suspended after March 19th; Management measures are currently being deliberated and will be reviewed by the TC.
3. Maine, DC, and South Carolina did not provide a copy or link to their current fishery regulations.
4. Connecticut did not include a section for hickory shad reporting.

VIII. PRT Recommendations

After a thorough review of the state reports, **the PRT recommends approval of the state compliance reports for the 2021 fishing year and *de minimis* requests**. In order to further streamline the compliance review process, the PRT also recommends moving section VIII B, which provides the results of hickory shad monitoring, to the appendices. This change would allow states that conduct hickory shad monitoring a place to share the results, while removing

optional data from the main body of the compliance report. Additionally, the PRT noted that bycatch losses are inconsistently reported by jurisdictions. Given the importance of this data and the emphasis placed on bycatch by the shad stock assessment and peer review, the PRT will add a section for all states to include their sources of bycatch information to the compliance report template.

Table 6. Summary of PRT Review of 2021 State Compliance Reports.

STATE	2021 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
MAINE		Did not provide a copy of state regulations for American shad.
NEW HAMPSHIRE	No known passage of American shad at state monitored fishways in 2021. River herring return to monitored rivers for 2021 was 260,065 fish. Therefore, the NH fishery-independent target was exceeded in 2021	Did not include a section for habitat recommendation implementation.
MASSACHUSETTS		No JAI program; requirement for American shad to develop one in the Merrimack River.
RHODE ISLAND		Samples were taken for mortality/survival estimates for river herring but mortality rates have not been updated since 2015.
CONNECTICUT		Shad: Due to a lack of funding and staff, the spawning stock survey, calculation of mortality/survival estimates, and recreational FD monitoring were not completed. Fishery independent work completed but still processing and analyzing data. River Herring: Unable to collect spawning stock data due to funding and staffing issues. Did not include a section for hickory shad.
NEW YORK		Did not include a section for implementation of habitat recommendations. American shad: Annual spawning stock survey not completed due to COVID-19 restrictions. River herring: Spawning stock assessment, monitoring of recreational landings, and mortality estimates were not completed in 2021 due to funding and COVID-19 constraints.
NEW JERSEY	Did not complete Ocean Trawl in 2021 for shad or river herring.	

Table 6. Summary of PRT Review of 2021 State Compliance Reports.

STATE	2021 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
PENNSYLVANIA	Fish passage operations for adult American shad and river herring at Conowingo, Holtwood, and Safe Harbor dams were suspended during 2021 to preclude the upriver range expansion of several invasive fish species.	
DELAWARE BASIN COOP	Seine GLM Index (1988-2015) and Gillnetting CPUE Index (1990-2015) exceeded benchmark but did not trigger management action. Removal of dams 4 and 6 is planned with the permit applications currently under review. Permits submissions for dam 2 and 4 removal on White Clay Creek in Delaware are currently under review as well. Removal of additional dams on the Paulinskill and Musconetcong River in New Jersey are also being evaluated.	No recreational monitoring for American shad since 2002. Shad and river herring: NJ Tidal Beach Seine and Delaware River Beach Seine not conducted due to COVID-19; No mortality rates provided. Did not include section on implementing habitat recommendations.
DELAWARE		Did not include section on implementing habitat recommendations.
MARYLAND	Nanticoke River spawning stock survey resumed in 2021, but was conducted once per week. Shad: Due to a lack of boat access at the Conowingo Dam, the Susquehanna River/upper Chesapeake Bay spawning stock survey was conducted almost exclusively from shore in 2021, precluding fishery independent CPUE estimates; survey was conducted as normal in 2022. However, annual population estimate was calculated from the number of tagged fish recaptured in fish lifts.	
D.C.		River herring: COVID-19 work restriction prevented the completion of required fishery independent monitoring in 2020. Only an abbreviated JAI seine survey was conducted. No spawning stock survey, adult biological data, or mortality/survival estimates are available for 2020. Did not provide a copy of fishery regulations. Did not include a section for habitat recommendation implementation.
PRFC	No hatchery evaluation was conducted because COVID-19 prevented any broodstock collections.	No recreational effort for American shad. Did not include a section for habitat recommendation implementation.
VIRGINIA	Virginia is stocking prespawn river herring in the headwaters of Herring Brook to increase returns.	Did not include a section for habitat recommendation implementation.

Table 6. Summary of PRT Review of 2021 State Compliance Reports.

STATE	2021 FISHERY AND MONITORING HIGHLIGHTS	UNREPORTED INFORMATION AND COMPLIANCE ISSUES
NORTH CAROLINA		
SOUTH CAROLINA	The commercial fishery in the Black River was closed in 2021. No management actions were triggered in 2021, though the commercial CPUEs for the Pee Dee River Run, Edisto River, and Savannah River, as well as the fishery independent CPUE for The Santee-Cooper Rivers Complex, were all below sustainability benchmark values in 2021. The Pee Dee River Run was also below its sustainability benchmark in 2018 and 2019, and the Edisto River was below its sustainability benchmark in 2019.	Edisto River was below American shad CPUE sustainability benchmark for three consecutive years (2019-2021), but management action was not triggered. Did not provide a copy or link to current fishery regulations.
GEORGIA	Creel surveys on the Altamaha River were not conducted in 2021 due to internal restructuring but resumed in 2022. Effective in 2022, this creel survey is hereafter scheduled to occur every 3 years. All systems currently managed under Georgia's SFMP were above their sustainability targets in 2021. In 2021, no river herring were recorded in the state's juvenile American shad seine surveys.	
FLORIDA	For the 5th year in a row, the St. Johns River E-fish index fell below sustainability threshold, triggering a management review (triggers after 3-consective years). The state determined that the minimal harvest in recreational fishery doesn't warrant closure. The state has also not completed ageing, though otoliths were collected. Could not calculate age frequency or mortality estimates for adult blueback in the St. Johns River due to a low sample size.	

Table 7. Reported protected species interactions (sturgeon species) in shad or river herring fisheries in 2021. 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			C	0			C	0
NJ	**	**	**	**	**	**	**	**
PRFC	4	0					4	0
VA	1	0					1	0
NC	3	1			2	0	5	1
SC	4	0					4	0
GA	20	0	5	0			25	0
Total by Species	32	1	5	0	2	0	**39**	**1**

*Rhode Island reports NOAA NEFOP and ASM data, which is available after the compliance report submission deadline. Therefore, their data lags by one year. Rhode Island reported 4 sturgeon caught in their waters in 2020.

**In 2021 gill netters in New Jersey coastal waters reported discarding 1,666 lbs of sturgeon.