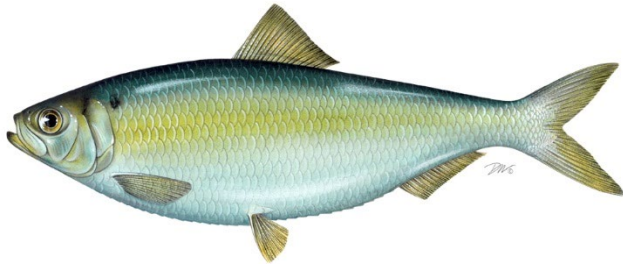
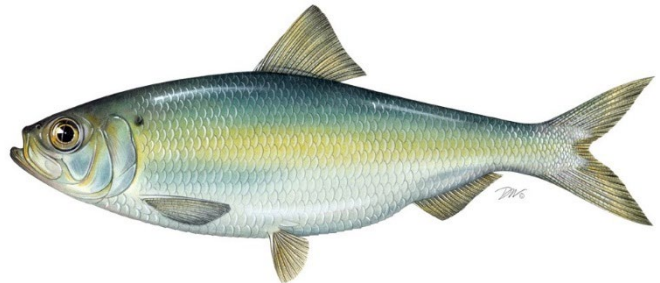
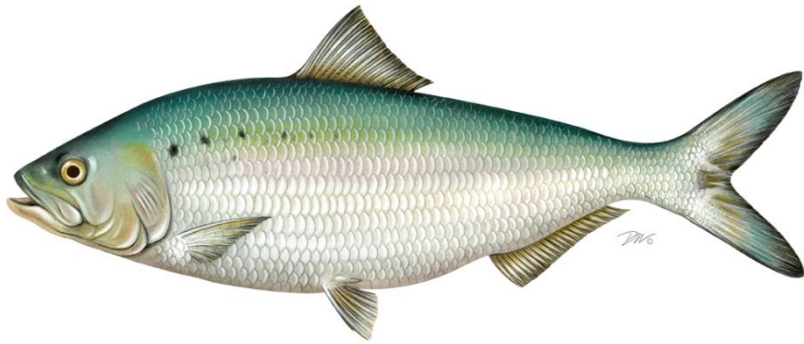


**REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR SHAD AND RIVER HERRING
(*Alosa spp.*) FOR THE 2022 FISHING YEAR**



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October 2023

Approved October 16, 2023

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, 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, 2023) |
| Maryland | | |
| Virginia | | |
| North Carolina | | Approved (2012, 2017, 2020, 2023) |
| 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 exceeded 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 benchmark stock assessment is expected to be completed in 2024.

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 2022 were 110,027 lbs, representing a 44% decrease from landings in 2021 (195,642 lbs) (Table 2). Bycatch landings accounted for approximately 8% of the total commercial landings of American shad in 2022. Landings from Connecticut, North Carolina, and South Carolina accounted for 15.5%, 9.3%, and 68.3% of the directed coastwide commercial fishery removals in 2022, respectively. The remainder of the directed landings came from Georgia, 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 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, Maine, North Carolina, South Carolina, and Florida reported American shad recreational harvest estimates for 2022 (Table 3).

HICKORY SHAD:

In 2022, 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 96% of the total. Coastwide commercial and bycatch landings in 2022 totaled 98,962 lbs, representing a 0.5% decrease from 2021 landings (99,419 lbs) (Table 2). North Carolina and Georgia reported a recreational harvest of 7,244 lbs.

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 2022, the coastwide directed commercial river herring landings reported in state compliance reports were 2.82 million lbs, a 34% increase from 2021 (2.11 million lbs). Non-confidential bycatch landings in 2022 totaled 2,599 lbs, an 476% increase from the 2021 total of 451 lbs (Table 2). However, the PRT notes that low estimates of bycatch in 2021 were strongly influenced by Massachusetts ending their portside sampling program and instead reporting mixed stock bycatch figures from NOAA's Northeast Fisheries Observer Program (NEFOP). In 2022, Massachusetts reported an additional 27,558 pounds of shad and river herring bycatch from NEFOP data. South Carolina provided an estimate of recreational river herring harvest in 2022; 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 bycatch¹, in lbs) provided by states, jurisdictions and NOAA Fisheries for 2022.

| | River Herring | American Shad | Hickory Shad |
|-----------------------|------------------|----------------|---------------|
| Maine | 2,690,983 | C | C |
| New Hampshire | 0 | 0 | 0 |
| Massachusetts | 0 | 0 | 0 |
| Rhode Island | 0 | 0 | 2,147 |
| Connecticut | 0 | 15,826 | 0 |
| New York | 3,876 | C | C |
| New Jersey | 0 | 1,320 | 0 |
| Pennsylvania | 0 | 0 | 0 |
| Delaware | 0 | C | 0 |
| Maryland | C | C | 0 |
| D.C. | 0 | 0 | 0 |
| PRFC | 625 | 7,126 | 0 |
| Virginia | 0 | 832 | 597 |
| North Carolina | 0 | 9,443 | 92,198 |
| South Carolina | 129,238 | 69,510 | C |
| Georgia | 0 | 5,598 | 3,675 |
| Florida | 0 | 0 | 0 |
| Total Directed | 2,822,123 | 101,798 | 96,185 |
| Total Bycatch | 2,599 | 8,229 | 2,777 |
| Total | 2,824,722 | 110,027 | 98,962 |

*Confidential values are indicated by "C." Some values are listed as confidential to protect the confidentiality of other states.

Table 3. Recreational harvest information for river herring and American shad in 2022 from MRIP and state compliance reports.

| State | River Herring Harvest | American Shad Harvest | Source of Estimates |
|----------------|-----------------------|-----------------------|---|
| Maine | 42,188 | 3,346 | 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 | 3,183 | 350 | MRIP*; PSE>100 for both estimates |
| North Carolina | | 7,437 lbs | Recreational creel surveys on the Roanoke, Tar, Neuse, and Cape Fear rivers |
| South Carolina | 2,028 lbs | 28,753 lbs | Creel surveys and mandatory reporting for recreational gill netters. |
| Florida | | 441 lbs | Access point creel survey on St. Johns River |

*MRIP estimate considered highly uncertain. Spatial coverage of MRIP sampling may not align with recreational harvest areas for shad.

IV. Status of Research and Monitoring

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

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 2022, several jurisdictions reared American shad, stocking a total of 14,643,171 American shad, a 10% decrease from the 16,239,677 shad stocked in 2021 (Table 5). In addition, 850,000 river herring (both alewife and blueback) larvae were stocked in the James River system in 2022.

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.

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 2022.

| State/River | Shad | River Herring |
|--|----------------|------------------|
| Maine | | |
| Androscoggin | 228 | 139,326 |
| Saco | 1,109 | 179,366 |
| Kennebec | 5 | 83,978 |
| Sebasticook | 9 | C |
| Penobscot | 7,582 | 2,852,037 |
| St. Croix | 17 | 712,878 |
| New Hampshire | | |
| Coheco | | 4,452 |
| Exeter | | 273,228 |
| Oyster | | 11,272 |
| Lamprey | | 77,285 |
| Winnicut | | |
| Massachusetts | | |
| Merrimack | 36,371 | 50,535 |
| Rhode Island | | |
| Pawcatuck | | |
| Gilbert Stuart | | 22,592 |
| Nonquit | | 23,753 |
| Buckeye Brook | | 106,981 |
| Connecticut River | | |
| Holyoke Dam | 190,352 | |
| Pennsylvania^ | | |
| Schuylkill (Fairmont Dam) | | |
| Pennsylvania^/Maryland/Delaware | | |
| Susquehanna (Conowingo) | 4,001 | 848 |
| Susquehanna (Holtwood) | | |
| Susquehanna (Safe Harbor) | | |
| Susquehanna (York Haven) | | |
| South Carolina | | |
| St. Stephen Dam | 243,913 | 9,265 |
| Total 2022 | 483,587 | 4,547,796 |
| 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 |

^Pennsylvania did not submit an annual compliance report.

Table 5. Stocking of Hatchery-Cultured Alosine Larvae (Fry) in State Waters, 2022.

| State | American Shad | River Herring |
|---|-------------------|----------------|
| Maine | | |
| Androscoggin River | 0 | * |
| New Hampshire | | |
| Lamprey River | 0 | * |
| Massachusetts* | | |
| Merrimack River | 0 | 0 |
| Nashua River | 0 | 0 |
| Rhode Island | | |
| Pawcatuck River | 1,608,907 | 0 |
| Pawtuxet River | 0 | 0 |
| Pennsylvania^ | | |
| Susquehanna River | 0 | 0 |
| Lehigh River | 0 | 0 |
| Schuylkill River | 0 | 0 |
| Delaware | | |
| Nanticoke River | 321,000 | 0 |
| Maryland | | |
| Choptank River | 2,100,000 | 0 |
| Patapsco River | 250,000 | 0 |
| Maryland/District of Columbia/PRFC** | | |
| Potomac River | 255,200 | 0 |
| Virginia | | |
| James River | 0 | 850,000 |
| North Carolina | | |
| Neuse River | 0 | 0 |
| Roanoke River | 0 | 0 |
| South Carolina | | |
| Santee | 9,264,100 | 0 |
| Edisto River | 843,964 | 0 |
| Wateree River | 0 | 0 |
| Georgia | | |
| Altamaha River | 0 | 0 |
| Oconee River | 0 | 0 |
| Total | 14,643,171 | 850,000 |

*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.

^Pennsylvania did not submit an annual compliance report.

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 submitted state reports for compliance with the mandatory measures in Amendments 2 (River Herring) and 3 (American shad). Pennsylvania did not submit a compliance report for the 2022 fishing year. Table 6 provides important information on each state's fisheries, monitoring programs, and compliance issues pertaining to the 2022 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 2022:

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

State Compliance

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). 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.
 - d. New York has not completed a creel survey for river herring since 2003.
2. Pennsylvania did not provide an annual compliance report.
3. Maine, DC, and South Carolina did not provide a copy or link to their current fishery regulations.
4. Connecticut and New Hampshire did not include a section for hickory shad reporting.

VIII. PRT Recommendations

While considering the issues listed above, **the PRT recommends approval of the state compliance reports for the 2022 fishing year and *de minimis* requests.** The PRT requests that states with no new information to report still include the hickory shad, law enforcement reporting, and implementation of habitat recommendations sections in their reports. Additionally, the PRT reviewed the additional bycatch information provided by the states in the new report template. Reported bycatch information varies widely by state: Vessel trip reports, creel survey data, on-board observer data, NMFS landings in federal waters, and no information available are all listed as state sources of bycatch data. Given the importance of bycatch losses identified in the 2020 American Shad Benchmark Stock Assessment, the PRT recommends the

Board consider the inconsistency of bycatch/discard reporting sources coastwide and its impact on evaluating bycatch annually.

Table 6. Summary of PRT Review of 2022 State Compliance Reports.

| STATE | 2022 FISHERY AND MONITORING HIGHLIGHTS | UNREPORTED INFORMATION AND COMPLIANCE ISSUES |
|---------------|--|---|
| MAINE | Due to the low numbers of fish that ascend these fishways during any given year biological samples data (length, weight, sex, and scale sample) are not collected from American shad. Mortality estimates cannot be developed as a result. | Did not provide a copy of state regulations for American shad. |
| NEW HAMPSHIRE | Due to failure to meet fishery-independent target in New Hampshire's river herring SFMP the river herring commercial and recreational fisheries remained closed in 2022. Biological assessment and annual mortality rates for American shad could not be completed due to no American shad returning to the fishways in 2022. | No hickory shad section or data was included in the report. |
| MASSACHUSETTS | Although the SFMPs for both the Nemasket River and Herring River were approved, the towns decided to not open the runs for harvest. | 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. River herring: Monitoring of recreational landings was not completed. Creel surveys have not been completed since 2003. |
| NEW JERSEY | Did not complete the January Ocean Trawl in 2022 for shad or river herring. | |
| PENNSYLVANIA | | Compliance report not submitted |

Table 6. Summary of PRT Review of 2022 State Compliance Reports.

| STATE | 2022 FISHERY AND MONITORING HIGHLIGHTS | UNREPORTED INFORMATION AND COMPLIANCE ISSUES |
|----------------------------|--|--|
| DELAWARE BASIN COOP | Delaware River – Smithfield Beach Female GM CPUE Index (1996-2019) Benchmark exceeded, but management action not taken due to non-representative sampling conditions in 2019 | No recreational monitoring for American shad since 2002. No mortality rates provided and possibly no ages from commercial data. Did not include section on implementing habitat recommendations. |
| DELAWARE | | Did not include section on implementing habitat recommendations. |
| MARYLAND | Nanticoke River stock survey not conducted due to lack of fishing. It's unlikely for them to fish again, so MD is exploring options for the future. | |
| D.C. | | Did not include a section for habitat recommendation implementation. |
| PRFC | | Did not include a section for habitat recommendation implementation. |
| VIRGINIA | Virginia Commonwealth University (VCU) and United States Fish and Wildlife Service (USFWS) personnel collected Alewife Brood Stock in an effort to stock these species in Harrison Lake. The lake is in the headwaters of Herring Creek. | Did not include a section for habitat recommendation implementation. |
| NORTH CAROLINA | Seasonal reductions in the American Shad commercial fishing season in Albemarle Sound continued in 2022 because of triggers being met in the Sustainable Fisheries Management plan One violation was written for violation of FFRH01: Take/possess river herring during closed season/days on the Chown River | Did not include a section for habitat recommendation implementation. |
| SOUTH CAROLINA | Hatchery and stocking efforts continue on the Edisto and Santee Rivers in cooperation with the Bears Bluff National Fish Hatchery | Did not provide a copy or link to current fishery regulations, include a law enforcement section, or include section on habitat recommendation implementation. |

Table 6. Summary of PRT Review of 2022 State Compliance Reports.

| STATE | 2022 FISHERY AND MONITORING HIGHLIGHTS | UNREPORTED INFORMATION AND COMPLIANCE ISSUES |
|----------------|---|---|
| GEORGIA | <p>A river herring creel survey was done on the Altamaha River in 2022 to collect data on any potential river herring fishery in the river. Zero (0) river herring were observed in this creel study, and no anglers reported targeting river herring.</p> | <p>Completes creel survey every 5 years.</p> |
| FLORIDA | <p>For the 6th year in a row, the St. Johns River E-fish index fell below sustainability threshold, triggering a management review (triggers after 3-consecutive years). The state determined that the minimal harvest in recreational fishery doesn't warrant closure. TC will review an update. The state has also not completed aging, though otoliths were collected.</p> <p>Could not calculate age frequency or mortality estimates for adult blueback in the St. Johns River due to a low sample size.</p> | |

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 | | | | | | | 0 | 0 |
| NJ | ** | ** | ** | ** | ** | ** | ** | ** |
| PRFC | 5 | | | | | | 5 | 0 |
| VA | 3 | | | | | | 3 | 0 |
| NC | 10 | 1 | | | 2 | | 10 | 3 |
| SC | 5 | | | | | | 5 | 0 |
| GA | 10 | | 5 | | | | 23 | 0 |
| Total by Species | 33 | 3 | 13 | 0 | 2 | 0 | 46 | 3 |

*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 23 sturgeon caught, but none in hauls that started or ended in Rhode Island waters in 2021.

**In 2022 gill netters in New Jersey coastal waters reported discarding 653 lbs of sturgeon.