

ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR SHAD AND RIVER HERRING (*Alosa spp.*)

2016 FISHING YEAR



Prepared by the Plan Review Team

Approved by the Shad and River Herring Management
Board October 2017

**REVIEW OF THE INTERSTATE 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 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 very first FMPs developed at 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 August 2009, the Board initiated 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 fisheries in state waters beginning January 1, 2012, unless a state or jurisdiction has a sustainable management plan 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.” Amendment 2 required states to implement fisheries-dependent and independent monitoring programs. Sustainable fishery management plans have been approved by the Management Board for Maine, New Hampshire, Massachusetts, New York, North Carolina and South Carolina (Table 1).

In February 2010, the Board initiated 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 as developed in Amendment 2 (for river herring). Specifically, Amendment 3 prohibits shad commercial and recreational fisheries in state waters beginning January 1, 2013, unless a state or jurisdiction has a sustainable management plan 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.” The Amendment allows any river systems to maintain a catch and release recreational fishery. Sustainable fishing plans have been approved by the Board for Florida, Georgia, South Carolina, North Carolina, the Potomac River Fisheries Commission, and the Delaware River Basin Fish Cooperative (on behalf of New York, Delaware, New Jersey, and Pennsylvania) and Connecticut (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 with approved sustainable fishery management plans (SFMP) for river herring or shad. Includes year of Board approval and year the Board approved the updated¹ SFMP.

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

*Delaware River Basin Fish and Wildlife Management Co-op has a Shad SFP, 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 have to 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/or alewife) and/or two shads (American shad and/or hickory shad)—these are collectively referred to as shad/river herring, or S/RH.

The most recent *American shad stock assessment report* (ASMFC 2007) identified that American shad stocks are highly depressed from historical levels. Of the 24 stocks of American shad for which sufficient information was available, 11 were depleted relative to historic levels, 2 were increasing, and 11 were stable (but still below historic levels). The status of 8 additional stocks could not be determined because the time-series of data was too short or analyses indicated conflicting trends.

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 ones need to be identified and applied. These include fishing rates, dam passage, stocking, and habitat restoration. There are no coastwide reference points for American shad. There is no stock assessment available for hickory shad. A stock assessment update is scheduled for 2018 to analyze American shad stock status.

The most recent benchmark *river herring stock assessment report* (ASMFC 2012) indicated, 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 indicates that river herring remain depleted at near historic lows on a coastwide basis. Total mortality estimates over the final 3 years of the data time series (2013-2015) are generally high and exceed region-specific reference points for some rivers. However, there are some positive signs of improvement for some river systems. Total mortality estimates for 2 rivers have fallen below region-specific reference points during the final 3 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 for which data were available, 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 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, most harvest is believed to come from the commercial industry. Commercial landings for these species have declined dramatically from historic highs. The following summarizes each fishery:

AMERICAN SHAD:

Total combined river and ocean commercial landings decreased from a high of 2,364,263 pounds in 1985 to a low of 1,390,512 pounds in 1999, but increased in 2000 to 1,816,979 pounds. The 2005 closure of the ocean-intercept fishery (phase out started in 2000) has substantially lowered the coastwide total landings of American shad. The total landings reported in compliance reports from individual states and jurisdictions in 2016 was 239,067 pounds, a 50% decrease from landings in 2015 (478,688 pounds) (Table 2).

In 2016, landings from North Carolina and South Carolina accounted for 26% and 32% of the commercial harvest, respectively. The remainder of the harvest came from Maine, Connecticut, New York, New Jersey, Delaware, Maryland¹, PRFC, Virginia, and Georgia. In 2016 New Hampshire, Massachusetts, Rhode Island, Pennsylvania, District of Columbia and Florida reported no directed shad harvest in their state compliance reports.

Substantial shad recreational fisheries occur on the Connecticut (CT and MA), Delaware (NY, PA and NJ), Susquehanna (MD), Santee and Cooper (SC), Savannah (GA), 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. Tens of thousands of shad are caught by hook and line from large east coast rivers each year, but detailed creel surveys are generally not available. Actual harvest (catch and removal) may amount to only about 20-40% of total catch, but hooking mortality could boost this “harvest” value substantially. Several comprehensive angler use and harvest surveys are planned or have been recently completed. In January 2007, the Management Board suspended the requirement to monitor the recreational fishery until the stock assessment had been completed and a template for creel surveys had been developed.

Since 2009, MRFSS/MRIP data are no longer provided for American shad. This is a result of the unreliable design of MRFSS/MRIP that focuses on active fishing sites along coastal and estuarine areas. In previous years the proportional standard error (PSE) has ranged from 0-100.

HICKORY SHAD:

In 2016, Virginia, North Carolina, South Carolina, and Georgia reported hickory shad landings. North Carolina accounts for a vast majority of the landings with 96%. The coastwide commercial

¹ Maryland commercial fishermen are permitted a 2 fish per day allowance of dead American shad for personal use; no sale is permitted

landings were 100,079 pounds in 2016, representing a 35% decrease from 2015 landings (153,263 pounds) (Table 2).

RIVER HERRING (BLUEBACK HERRING/ALEWIFE COMBINED):

Commercial landings of river herring declined 95% from over 13 million pounds in 1985 to about 700 thousand pounds in 2005. Recent commercial landings continue to increase, despite North Carolina implementing a no-harvest provision for commercial and recreational fisheries of river herring in coastal waters of the state in 2007. In 2016, river herring landings were reported from Maine, New York, New Jersey, Maryland, and South Carolina. Landings in 2016 totaled 1,970,893 pounds, 2% less than 2015 landings of 2,005,154 pounds (Table 2).

Table 2. Shad and river herring in-river commercial and ocean bycatch landings (in pounds) provided by states, jurisdictions and NOAA Fisheries for 2016.

	American Shad	Hickory Shad	River Herring
Maine	^		*
New Hampshire			
Massachusetts			
Rhode Island			
Connecticut	32,620		
New York	^		*
New Jersey*	18,377		*
Pennsylvania			
Delaware	14,247		
Maryland	^		*
D.C.			
PRFC	1149		
Virginia	310	21	
North Carolina	62,244	96,543	
South Carolina	75,602	294	670,245
Georgia	34,228	3,221	
Florida			
Total	239,067	100,079	1,970,893

*Several state landings for river herring are not shown due to confidential data for Maine and Maryland

^American shad landings for Maine, New York and Maryland are confidential and not shown

IV. Status of Research and Monitoring

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

Table 3. American shad and river herring passage counts at select rivers along the Atlantic coast in 2016. This table includes the fish passage counts required by Amendments 2 and 3, it represents a sub-set the overall fish passage counts.

State/River	Shad	River Herring
Maine		
Androscoggin	1,096	114,874
Saco	16,926	22,644
Kennebec	830	224,990
Sebasticook	18	3,128,753
Penobscot	1,800	1,259,307
St. Croix		33,016
New Hampshire		
Cocheco		99,241
Exeter		6,622
Oyster		863
Lamprey		92,364
Taylor		
Winnicut		0
Massachusetts		
Merrimack	67,528	417,240
Rhode Island		
Gilbert Stuart		74,304
Nonquit		9,664
Buckeye Brook		27,552
Connecticut River		
Holyoke Dam	385,930	137
Pennsylvania/Maryland/Delaware		
Susquehanna (Conowingo)	14,276	34
Susquehanna (Holtwood)	6,718	
Susquehanna (Safe Harbor)	4,242	
Susquehanna (York Haven)	178	
South Carolina		
St. Stephen Dam	41,375	3,285
Total 2016	540,917	5,514,890
Total 2015	611,368	3,825,435
Total 2014	426,073	3,031,753
Total 2013	776,162	2,922,985
Total 2012	205,928	2,493,322

Note: Passage numbers on Susquehanna River are cumulative. For example, any shad counted at the York Haven dam has also passed the previous three dams (Safe Harbor, Holtwood and Conowingo). The dams are listed in ascending order of passage mile.

In addition to the mandatory monitoring requirements stipulated under Amendments 2 and 3, some states and jurisdictions continue important research initiatives for these species. For example, Massachusetts, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, and 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 2016, several jurisdictions reared American shad, stocking a total of **23,535,342 American shad, an increase of 9% from the 21,519,800 shad stocked in 2015** (Table 4).

Table 4. Stocking of Hatchery-Cultured Alosines in State Waters, 2016.

State	American Shad	Alewife
Maine*		
Massachusetts		
Merrimack River	1,523,218	
Nashua River		
Charles River	2,059,799	
Rhode Island		
Pawcatuck River	1,072,252	
Pawtuxet River	1,053,167	
Pennsylvania		
Susquehanna River	1,746,873	
Lehigh River	236,062	
Schuykill River	261,940	
Maryland		
Choptank River	2,467,000	
District of Columbia		
Anacostia River	0**	
Virginia		
James River	1,879,628	
North Carolina		
Roanoke River	3,738,732	
Neuse River	609,720	
South Carolina		
Edisto River	16,494	
Santee River	4,387,007	
Georgia		
Altamaha River	1,720,127	
Ogeechee	763,323	
Total	23,535,342	0

*Maine: Only river herring are of wild origin are stocked as adult pre-spawning individuals on the Androscoggin, Kennebec and Union Rivers

**No American shad were stocked in 2016 so no samples were taken from juvenile American shad for the hatchery evaluation

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 (enclosed).

Shad and river herring are currently managed under Amendments 2 and 3. In 2009 the Board approved Amendment 2, which was initiated in response to concerns over river herring stock. The amendment prohibits commercial and recreational fisheries in state waters beginning January 1, 2012, unless a state or jurisdiction submits a sustainable fishery management plan and receives approval from the Board. Sustainable fishery management plans (SFMPs) have been approved by the Management Board for Maine, New Hampshire, Massachusetts, New York, North Carolina and South Carolina (Table 1).

In 2010, the Board approved Amendment 3, which was initiated in response to concerns over shad stocks. The Amendment requires similar management and monitoring as developed in Amendment 2, specifically the development of a SFMP for any jurisdiction that will maintain a commercial or recreational fishery after January 1, 2013 (with the exception of catch and release recreational fisheries). SFMPs have been approved by the Management Board for Florida, Georgia, South Carolina, North Carolina, the Potomac River Fisheries Commission (PRFC), Connecticut and the Delaware River Basin Cooperative (on behalf of New York, Delaware, New Jersey, and Pennsylvania) (Table 1).

States are required to update their SFMP every five years. In 2017, states reviewed their current SFMPs and, made changes based on fishery performance or observations (e.g., revise the sustainability targets) where necessary. At minimum, states updated the data for their commercial and/or recreational fisheries and recommended the current sustainability measures be carried forward in the next plan. The Technical Committee will review all SFMPs and make recommends to the Board. States have presented SFMPs to the Board according to the following timeline:

2017 SFMP Timeline

February Board Meeting

- Maine (RH)
- Delaware River Basin Cooperative (Shad)
- New York (RH)

August Board Meeting

- South Carolina (RH)
- Florida (shad)

October Board Meeting

- South Carolina (shad)
- PRFC (shad)
- Georgia (shad)

- North Carolina (shad)
- Connecticut (shad)

V. Prioritized Research Needs

Fishery-Dependent Priorities

High

- Expand observer and port sampling coverage to quantify additional sources of mortality for alosine species, including bait fisheries, as well as rates of bycatch in other fisheries to reduce uncertainty.²

Moderate

- Identify directed harvest and bycatch losses of American shad in ocean and bay waters of Atlantic Maritime Canada.

Low

- Identify additional sources of historical catch data of the US small pelagic fisheries to better represent earlier harvest of river herring and improve model formulation.

Fishery-Independent Priorities

Moderate

- Develop demersal and pelagic trawl CPUE indices of offshore river herring biomass.

Modeling / Quantitative Priorities

High

- Conduct population assessments on river herring, particularly in the south.³
- Analyze the consequences of interactions between the offshore bycatch fisheries and population trends in the rivers.
- Quantify fishing mortality for major river stocks after ocean closure of directed fisheries (river, ocean bycatch, bait fisheries).
- Improve methods to develop biological benchmarks used in assessment modeling (fecundity-at-age, sex specific mean weight-at-age, partial recruitment vector/maturity schedules) for river herring and American shad of both semelparous and iteroparous stocks.
- Improve methods for calculating M.

Moderate

- Consider standardization of indices with a GLM to improve trend estimates and uncertainty characterization.
- Explore peer-reviewed stock assessment models for use in additional river systems as more data become available.

² A prior statistical study of observer allocation and coverage should be conducted (see Hanke et al. 2012).

³ A peer reviewed river herring stock assessment was completed in 2012 by the ASMFC.

Low

- Develop models to predict the potential impacts of climate change on river herring distribution and stock persistence.

Life History, Biological, and Habitat Priorities

High

- Conduct studies to quantify and improve fish passage efficiency and support the implementation of standard practices.
- Assess the efficiency of using hydroacoustics to repel alosines or pheromones to attract alosines to fish passage structures. Test commercially available acoustic equipment at existing fish passage facilities. Develop methods to isolate/manufacture pheromones or other alosine attractants.
- Investigate the relationship between juvenile river herring/American shad 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.
- Develop an integrated coastal remote telemetry system or network that would allow tagged fish to be tracked throughout their coastal migration and into the estuarine and riverine environments. UPDATE: currently available for American shad but not in use due to tagging mortality
- Continue studies to determine river herring population stock structure along the coast and enable determination of river origin of catch in mixed stock fisheries and incidental catch in non-targeted ocean fisheries. Spatially delineate mixed stock and Delaware stock areas within the Delaware system. Methods to be considered could include otolith microchemistry, oxytetracycline otolith marking, genetic analysis, and/or tagging.⁴
- Validate the different values of M for river herring and American shad stocks through shad ageing techniques and repeat spawning information.
- Continue to assess current ageing techniques for river herring and American shad, using known-age fish, scales, otoliths, and spawning marks. Conduct biannual ageing workshops to maintain consistency and accuracy of ageing fish sampled in state programs.⁵
- Summarize existing information on predation by striped bass and other species. Quantify consumption through modeling (e.g., MSVPA), diet, and bioenergetics studies.
- Refine techniques for tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock.

Moderate

- Determine the effects of passage barriers on all life history stages of American shad and river herring. Conduct studies on turbine mortality, migration delay, downstream passage, and sub-lethal effects. UPDATE: Recent studies have been conducted by T. Castro-Santos of UMass.
- Evaluate and ultimately validate large-scale hydroacoustic methods to quantify river herring and American shad escapement in major river systems.
- Conduct studies of egg and larval survival and development.

⁴ Genetic research currently underway in combination with otolith chemistry.

⁵ River herring ageing workshop occurred in 2013.

- Conduct studies on energetics of feeding and spawning migrations of American shad on the Atlantic coast.
- Resource management agencies in each state shall evaluate their respective state water quality standards and criteria and identify hard limits to ensure that those standards, criteria, and limits account for the special needs of alosines. Primary emphasis should be on locations where sensitive egg and larval stages are found.
- Encourage university research on hickory shad.
- Develop better fish culture techniques, marking techniques, and supplemental stocking strategies for river herring.

Low

- Characterize tributary habitat quality and quantity for Alosine reintroductions and fish passage development.
- States should identify and quantify potential shad and river herring spawning and nursery habitat not presently utilized, including a list of areas that would support such habitat if water quality and access were improved or created, and analyze the cost of recovery within those areas. States may wish to identify areas targeted for restoration as essential habitat.¹¹
- Investigate contribution of landlocked versus anadromous produced river herring.

VII. PRT Recommendations

State Compliance

All states with a declared interest in the management of shad and river herring have submitted reports and have regulations in place that meet the requirements of the Interstate Fisheries Management Plan for Shad and River Herring.

The PRT notes, however, that some states were not able to complete the required fishery independent monitoring due to budgetary restrictions.

1. Several of the states did not report all of the monitoring requirements listed under Amendments 2 and 3 (see PRT Report). The states should take note of the required monitoring programs that were not reported and make concerted effort to report all monitoring programs in forthcoming annual reports (most common omissions were: characterization of other losses, variance, characterization of recreational harvest, length and age frequency, and degree of repeat spawning).
2. The PRT requests that those states and jurisdictions that share monitoring should report who was responsible for the required monitoring in lieu of not including the information. In addition, one report could be sent for each state or jurisdiction.

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 2016:

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

The PRT would like clarification on recreational fishery monitoring requirements for shad and river herring. In January 2007, the Management Board suspended the requirement to monitor the recreational fishery until the stock assessment had been completed and a template for creel surveys had been developed. The stock assessment was completed, but a creel survey template was not finalized, so the requirement was not reinstated. In 2009 and 2010 Amendments 2 and 3, respectively, were approved by the Management Board, which outline recreational monitoring requirements coastwide, but still do not provide a template for creel surveys. Many states are not currently monitoring recreational fisheries as MRFSS/MRIP data are no longer provided for these species, many states do not have the funding and staff to complete these surveys, and surveys in the past have revealed that recreational harvest is relatively low compared to the coastwide commercial harvest. The PRT would like clarification if it is the intent of Amendments 2 and 3 to re-instate recreational fishery monitoring coastwide and if so should a creel survey template be developed by the Technical Committee.

PRT REVIEW OF SHAD AND RIVER HERRING ANNUAL COMPLIANCE REPORTS

INTRODUCTION

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 reviewed all state reports for compliance with the mandatory measures in Amendments 2 (River Herring) and 3 (American shad). The following report provides an evaluation of each state program.

MAINE

De minimis

- The state of Maine requests *de minimis* for the commercial fishing year 2016 in the American shad fishery.

Comments or trends highlighted in state report:

- American shad recreational catch estimates = 8,870 fish caught (A+B1+B2) and 1,740 harvested (A+B1) (MRIP).
- Comparing the juvenile CPUE to past years, American shad CPUE was below average in all river segments except the Cathancee and Eastern Rivers.
- Comparing the JAI CPUE to past years, 2016 had the highest alewife CPUE on record for the lower Kennebec River. The Eastern River CPUE was the 2nd highest in 35 years. Juvenile alewife CPUE was below average for 4 of 7 river segments. Blueback CPUE were 2nd highest in upper river.
- There was a strong alewife run in the Kennebec River drainage in 2016.
- Spawning Stock Survey: In 2016, fisheries personnel counted and passed upstream 830 American shad in the trap at the Lockwood Dam on the Kennebec River, and 18 at the Benton Falls fish lift on the Sebasticook River. At the Brunswick Fishway on the

Androscoggin River, 1,096 American shad were captured in the fish lift. On the Saco River, Brookfield Energy biologists counted a total of 16,462 American shad (13,889 passing the East Channel Dam, and 2,573 passing the West Channel Dam). Additionally, 442 shad mortalities were noted, representing a total fishway mortality of 3.2%, which is higher compared to 2015.

Unreported information / Compliance Issues:

- Shad Fishery independent monitoring: no variance was mentioned for juvenile indices.
- River herring scale samples collected from commercial harvesters are being processed.

Sturgeon bycatch report:

- There was no known bycatch of Atlantic or shortnose sturgeon within the recreational fishery.

NEW HAMPSHIRE

De minimis:

- The state of New Hampshire requests *de minimis* status for the commercial and recreational fishing year 2016 for the American shad and river herring fisheries.

Comments or trends highlighted in state report:

- No American shad were harvested from New Hampshire waters in 2016.
- Since 2006, a total of 11 American shad have been observed in the Exeter River.
- River herring SFMP target met for 2016 – exploitation rate <20% (4.4%) and returns >72,293 fish (199,090 fish).
- In 2016, 4,354 lbs of river herring were reported harvested from New Hampshire waters through mandatory coastal harvest reports. It is noted that this harvest is for personal use and is no longer included with NMFS harvest.
- Recreational harvest estimates for river herring were 840 alewives and 0 blueback herring in NH through the Access-Point Angler Intercept Survey (APAIS).
- There is a general increase in alewife herring runs in New Hampshire waters for the last 7 years.
- Geometric mean for juvenile alewives was lower in 2016 than 2015, but still higher than the means encountered between 2009 and 2012.

Unreported information / Compliance Issues:

- None identified.

Sturgeon bycatch report:

- No protected species were reported taken as bycatch from New Hampshire's coastal harvest program.

MASSACHUSETTS

De minimis:

- The Commonwealth of Massachusetts requests *de minimis* for the commercial fishing year 2016 for the American shad fishery.

Comments or trends highlighted in state report:

- 0 pounds of American shad were reported landed from Massachusetts by NMFS Statistic and Economic Division.
- Merrimack River American shad counts have shown a general increase since 2010; a total of 67,528 American shad passed Essex Dam in 2016.
- Connecticut River Holyoke Dam American shad counts have seen a general increase since 2004, and appear to be relatively stable since 2012 recording greater than 300,000 American shad annually.
- An exploratory study was initiated by the Massachusetts Division of Marine Fisheries to monitor the presence and abundance of American shad in the South and Indianhead rivers.
- Since 2006, analyses indicate an increasing trend in river herring run sizes in most monitored rivers with a time series high observed in the Merrimack River in 2016.

Unreported information / Compliance Issues:

- Catch composition data was not available for the American shad recreational fishery in the Merrimack River.
- A juvenile abundance index was not reported for the Merrimack River American shad.
- A description of Amendment 2 and 3 requirements for river herring and shad should be included in the compliance report; it is unclear what the recreational fishery monitoring requirements are.
- Degree of repeat spawning was not evaluated in the river herring spawning stock surveys.
- Age and length composition from bycatch sampling was not reported.

Sturgeon bycatch report:

- No sturgeon interactions were reported in 2016.

RHODE ISLAND**Comments or trends highlighted in state report:**

- No significant changes in monitoring, regulations, or harvest in 2016.
- A total of 169 American Shad passed through the fishway in 2016.
- In 2016, 1,072,252 American shad fry were stocked in the Pawcatuck River and 1,053,167 into the Pawtuxet River.
- River herring run counts in 2016 were; Gilbert Stuart (74,304), Nonquit (9,664), and Buckeye Brook (27,552). Gilbert Stuart and Buckeye were higher than 2015, but Nonquit had lowest return in 15+ years.

Unreported information / Compliance Issues:

- None

Sturgeon bycatch report:

- One Atlantic sturgeon was observed by the NOAA Fisheries Observer Program in 2015.

CONNECTICUT**Comments or trends highlighted in state report:**

- The preliminary 2015 landings are 51,004 pounds (14,637 fish) of American shad from drift gillnets through harvester catch reporting.
- Shad spawning population relies on a few age classes and low rates of repeat spawners.
- Passage of 412,656 shad at Holyoke was third highest since 1992.

Unreported information / Compliance Issues:

- Estimate of other commercial losses is reported by weight instead of length and age.
- Directed recreational harvest of shad is not characterized due to limited budget and staff.
- No sources of river herring loss are listed.
- No age frequency, degree of repeat spawning, or annual mortality rate calculation is provided for river herring.

Sturgeon bycatch report:

- A total of 37 sturgeons (species unclassified) were reported as caught and released by shad fishermen in 2015.

NEW YORK

Comments and trends highlighted in state report:

- In 2016 no changes to in-river fishery, recreational or commercial regulations, or fishery independent sampling.
- Commercial and recreational shad fishery closed in 2010.
- In 2016 the fisheries unit refocused efforts on aging shad scales, age-length key was used between 2003-2015.
- Mandatory reporting of river herring harvest = 6,791 pounds landed in Hudson River.
- Shad landings were reported through ACCSP, however due to confidentiality agreements, this data cannot be disclosed.
- 2016 American shad spawning stock survey sex ratio was 66:34 (male:female)
- 2016 river herring spawning stock survey sex ratio: 70:30 (male:female) alewife and 26:74 (male:female) blueback herring.
- The 2016 index for YOY American Shad was 1.54. 2016 marks the second consecutive year below the recruitment failure limit. The 2016 index of YOY blueback herring continues a slightly declining trend while the Hudson Alewife index continues to generally increase.

Unreported Information / Compliance Issues:

- No data for commercial or recreational “other loss” of river herring is available.
- A river herring recreational creel survey was not conducted in 2016.

Sturgeon bycatch report:

- Sturgeon bycatch was not mentioned in 2016 report, though shad fishery remains closed.

NEW JERSEY

Comments and trends highlighted in state report:

- Coastal commercial shad fishery closed in 2016.
- Directed ocean shad fishery closed in 2005.

- NMFS landings of shad unavailable for 2016, but was 0 in 2015.
- The NJ Ocean Trawl Survey had a geometric mean CPUE of shad in 2016 of 1.72, ranking first in the 28 year time series.
- During 2016 NJ commercial fishers reported harvest of 4 lbs. of river herring.
- Ocean Trawl Survey for both alewives and blueback herring had sharp decline in geometric mean beginning in 2010, but now starting to increase.

Unreported Information / Compliance Issues:

- No fishery independent monitoring in 2016 for shad or river herring.
- No recreational fishery data for river herring.
- No state regulations listed.
- No sex or age data for shad or river herring. Length data from Ocean Trawl Survey only.

Sturgeon bycatch report:

- No sturgeon was reported as bycatch in 2016 coastal fishery due to the required closure in coastal waters.

PENNSYLVANIA

Comments or trends highlighted in state report:

- No commercial or recreational harvest of American Shad is permitted within the Susquehanna River basin. Commercial harvest of hickory shad, alewife and blueback herring is prohibited in any state water.
- Recreational harvest of river herring was prohibited in 2016.
- In general, the 2016 American shad spawning stock showed a 1:0.5 (M:F) sex ratio, a decrease in mean total length and mean total weight, a slight decrease in mean age, and an increase in the frequency of repeat spawning.
- 89% of recovered juvenile American Shad in 2016 were found to be of hatchery origin.
- No juvenile Hickory Shad, Blueback Herring or Alewife were collected in haul seine efforts from 2002 to 2016.

Unreported Information / Compliance Issues:

- None.

Sturgeon bycatch report:

- No sturgeon have been reported using the fish passage structures on the Susquehanna River.

DELAWARE – NANTICOKE RIVER

Comments or trends highlighted in state report:

- Thirty-three juvenile American Shad were collected in the Nanticoke River which was slightly lower than the 2015 JAI.
- The 2016 electrofishing American Shad CPUE increased noticeably from 2015 and ranked seventh lowest in the time series.
- Most shad restoration efforts throughout the Northeast United States rely on stocking programs to supplement natural reproduction and accelerate the recovery process. An

estimated 437,000 American Shad fry were stocked in Nanticoke River tributaries during the spring of 2016.

- The Blueback Herring JAI decreased from 2015 to the sixth lowest value in the time series. Alewife abundance decreased from its 2015 value to the ninth lowest value in the time series.

Unreported information / Compliance Issues:

- None.

Sturgeon bycatch report:

- There have been no voluntary or anecdotal reports of Atlantic Sturgeon or other protected species caught in the Nanticoke River commercial gill net fishery.

DELAWARE BASIN F&W COOPERATIVE

Comments or trends highlighted in state report:

- Commercial landings of American Shad in the Delaware Estuary and Bay as reported to New Jersey in their directed fishery (18,377 pounds) were slightly below the time series average of ~25,000 pounds.
- Landings of American Shad reported to Delaware declined in 2016 (14,247 pounds) compared to 2015 (21,733 pounds).
- The Smithfield Beach CPUE was suggestive of a below average spawning run of American shad in the Delaware River in 2016
- Review of the identified four indices and their respective benchmarks in the American Shad Sustainable Fishing Plan indicate two of the four indices were well within acceptable levels.
- Juvenile abundance indices from New Jersey's upper tidal beach seine survey shows a serious decline in the overall health of the Blueback Herring stock within the river. Alewife recruitment for 2016 was also below the time series average.
- Adult river herring catch rates increased from 2015, but are highly variable between years.

Unreported information / Compliance Issues:

- Age and repeat spawning composition data from the commercial fishery were not reported for 2016. The Co-op members have been working on developing standardized ageing protocols specific to the Delaware River Basin. Once finalized, age and repeat spawning frequencies will be determined from commercial landing samples.
- No recreational angler use or harvest information is available for 2016.

Sturgeon bycatch report:

- According to commercial reports collected from New Jersey commercial shad fishers there were six Atlantic Sturgeon caught as bycatch during 2016 in Delaware Bay.
- In the Delaware River above the head of tide and the Lehigh and Schuylkill rivers, no sturgeon (Atlantic Sturgeon or Shortnose Sturgeon) have been reported caught.
- No sturgeon (Atlantic and Shortnose) have been observed using the fish passage structures on the Lehigh and Schuylkill rivers.

MARYLAND

Comments or trends highlighted in state report:

- American shad and river herring commercial fishery is closed; catch and release only.
- Relative abundance of American shad in Nanticoke and Potomac rivers has significantly increased over time series.
- No significant changes in American shad management in 2016.
- Total recreational release mortality is estimated to be 144 American shad per year (estimate based on two studies, one from 1997 and one from 2010).
- American shad JAI Decreased bay wide in 2016.
- Total loss of American shad from turbine mortality is somewhere between 3,241-8,589 for 2016.
- American Shad Stocking continues in Choptank River.
- In 2016, the Conowingo Dam tailrace American shad population was estimated at 153,171.
- Shad JAI for Upper Chesapeake Bay and Potomac River have increased linearly since 1980 while Nanticoke River has shown no trend.
- River herring relative abundance in Nanticoke River has declined over time series. River herring abundance declined in North East River in 2016.
- In 2016, The JAI CPUE for alewife and blueback herring both decreased in both the Upper Bay and the Nanticoke River.

Unreported / Compliance Issues:

- Spawning stock assessment for river herring began with 2013 gillnet survey for adult river herring in the North East River. Longer time series needed for this assessment.
- No characterization of other losses in commercial fishery due to lack of bycatch monitoring, funding, and staffing constraints.

Sturgeon bycatch report:

- The Atlantic sturgeon bycatch for Maryland's American shad ocean intercept fishery has been zero since this fishery was closed in 2005.

DISTRICT OF COLUMBIA

Comments or trends highlighted in state report:

- Commercial and recreational fisheries for river herring and shad remained closed.
- American shad fry stocking did not occur in 2016.
- In 2016, the American shad CPUE (fish per 6,000 square foot of net) increased to 2.78 compared to 2.04 in 2015.

Unreported information / Compliance Issues:

- DOEE has no direct estimate of any other losses occurring in any of the shad and river herring fisheries in the District of Columbia.
- No ageing has been done for American shad or river herring, thus age frequency, degree of repeat spawning and mortality estimates have not been reported.

Sturgeon bycatch report:

- No sturgeon captures were reported in the District of Columbia during 2016.

POTOMAC RIVER FISHERIES COMMISSION

Comments or trends highlighted in state report:

- Since 2012, all fisheries are closed to the taking and/or possession of river herring.
- The Potomac River is closed to the directed harvest, commercial and recreational, of American and hickory shad.
- Bycatch landings in 2016 included 1,149 pounds of American shad and no hickory shad.
- In 2016, the American shad restoration target (31.1) was exceeded for the sixth year in a row with a value of (43.3)
- The 2016 JAI index for American shad (3.84) greatly decreased from the time series high in 2015 (19.81), and the alewife and blueback herring indices (0 and 0.17, respectively) both decreased.

Unreported information / Compliance Issues:

- Variances for juvenile indices are missing.

Sturgeon bycatch report:

- In 2016, two Atlantic sturgeon captures were reported in the Potomac River. Both were released alive.

VIRGINIA

Comments or trends highlighted in state report:

- 93 American shad (310lbs) were taken under the 10 American shad per vessel per day bycatch allowance, which is less than the total adult American shad taken for research and monitoring.
- The number of trips taken by bycatch permit holders has declined the last two years.
- Juvenile abundance for American shad was lower in 2016 for all rivers compared to 2015 values, but remained relatively high in the Rappahannock River.
- The 2016 American shad spawning stock catch index was the lowest on record for the James and York Rivers.
- The overall assessment of the James River American shad population is that the stock remains at historically low levels and is dependent on hatchery inputs.
- In 2016, river herring fishery remained closed to both commercial and recreational harvest and possession.
- As of 2016, annual spawning stock surveys and representative sampling of river herring are occurring in all required Virginia systems.

Unreported information / Compliance Issues:

- Age and length composition was not reported for river herring bycatch monitoring from pound nets in the upper western Chesapeake Bay scientific permit collections.
- Degree of repeat spawning was not evaluated in the river herring spawning stock surveys.

Sturgeon bycatch report:

- In 2016, a total of two Atlantic sturgeon were caught as bycatch and released alive (James River, n=2; York River, n=0; Rappahannock River, n=0).

NORTH CAROLINA

Comments and trends highlighted in state report:

- In 2016, American shad landings totaled 62,244 pounds and were approximately 35% lower than 2015 due to various factors including weather and fish availability during the shortened season and represented the lowest harvest since the implementation of the SFP in 2013.
- The 2016 JAI for blueback herring (0.00) was below 2015 and the only year in the time series where no blueback herring were caught. The alewife JAI (0.38) was below 2015 (7.13) and also the time series average (~2.50).
- A total of 588 (184 aged) blueback herring and 997 (210 aged) alewife samples were obtained from four contracted Chowan River pound net fishermen.
- A total of 96,543 pounds of hickory shad were harvested in 2016 worth \$29,418 which was a 35% decrease in the pounds landed as compared to 2015.

Unreported information / Compliance Issues:

- Age analysis for 2015 Blueback Herring and Alewife from the contracted Chowan River pound net survey was not included in the 2015 compliance report due to staff turnover and vacancy in the biologist position. Therefore, age analysis for 2015 is included in the 2016 report. Age analysis is not complete for 2016, and will be included as an appendix to this compliance report at a later date.

Sturgeon bycatch report:

- In 2016, 26 Atlantic sturgeon were observed or reported from the Albemarle Sound; – four via the DMF observer data (all released alive), and 22 via the DMF IGNS (1 fatality).
- Four Atlantic sturgeon were reported captured via onboard observers within the Pamlico Sound, Pamlico, Neuse and Cape Fear River Areas. One shortnose sturgeon was recorded during this reporting period in the Cape Fear River.
- In the Cape Fear River, DMF observer data recorded four Atlantic sturgeon interactions (three released alive, one dead. The DMF IGNS captured one Atlantic sturgeon which was released alive.
- Observer trips completed in the Pamlico and Neuse rivers recorded no sturgeon interactions.
- The DMF IGNS in the Pamlico Sound, Pamlico, Pungo, and Neuse Rivers captured five Atlantic sturgeon, all released alive.

SOUTH CAROLINA

Comments and trends highlighted in state report:

- In 2016, total estimated commercial landings of American shad, as reported through NMFS, was 75,801 pounds (100% in-river).
- In 2016, observed sex ratios for American shad were not available for the Santee and Waccamaw River because only females were available. The high occurrence of females in these samples is most likely due to the marketability of females vs. males.
- In 2016, three year running average for blueback herring on the Santee Cooper was $u = 0.036$, which was below the sustainability benchmark of 0.050.
- In 2016, the three year running average for blueback herring on the Pee Dee River did not exceed the benchmark of 1,000 kg.

Unreported information / Compliance Issues:

- None.

Sturgeon bycatch report:

- Atlantic – 15 total from Carolina DPS.
- Shortnose – 8 total from the Santee River.

GEORGIA**Comments and trends highlighted in state report:**

- In 2016, commercial American shad landings was 32,071 pounds on the Altamaha and 2,157 pounds on the Savannah River.
- A recreational fishery at 8 shad per day (combination of American and/or Hickory) exists only on Savannah and Ogeechee River.
- The population of American shad in the Altamaha River in 2016 was estimated at 221,775 shad, an 8% decrease from 2015.
- In the 2016 American shad electrofishing surveys, catch rates increase for both the Savannah and Ogeechee Rivers.
- American shad fry were stocked into Altamaha tributaries and the Ogeechee River.

Unreported information / Compliance Issues:

- Shad recreational harvest data was not reported for 2016.

Sturgeon bycatch report:

- Atlantic and shortnose sturgeon are caught in gill nets. In drift nets, essentially 100% of the sturgeon can be released unharmed. During 30 direct observations of monitoring adult shad in 2016, no sturgeon were captured in drift gill nets from the Altamaha River. Shad fishermen reported capturing 23 Atlantic and 16 shortnose sturgeon from the Altamaha River. Commercial fishermen reported no incidental catches of sturgeon on the Savannah River during the 2016 commercial shad season.

FLORIDA**Comments and trends highlighted in state report:**

- No commercial fishery exists for shad or river herring.
- There is no recreational harvest of river herring.
- An access point creel total estimated shad catch was 492 fish in Mullet Creel area and 2,287 in Puzzle Lake Creel area.
- In 2016, 499 American shad and 85 blueback herring were caught during eighty electrofishing transects on the St. Johns River.

Unreported information / Compliance Issues:

- Include more detail on blueback herring (currently no CPUE, length or age data).

Sturgeon bycatch report:

- No netting is allowed for shad, so no sturgeon bycatch is expected.