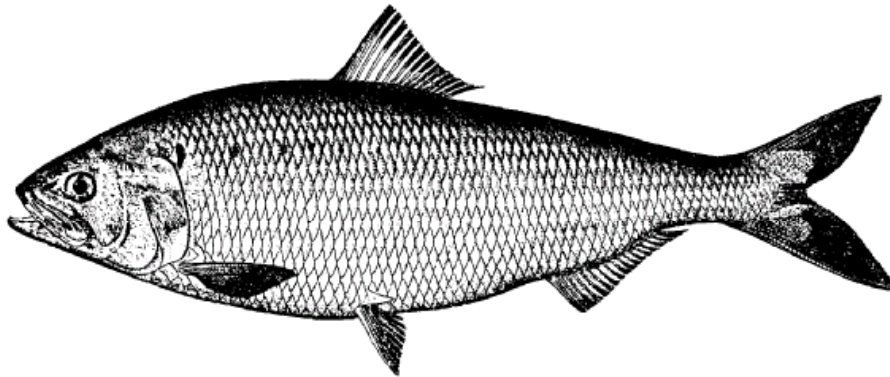


2003 REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR
SHAD AND RIVER HERRING (*Alosa spp.*)



October 16, 2003

Prepared by

The Shad and River Herring Plan Review Team

Lydia Munger, Atlantic States Marine Fisheries Commission (Chair)
Dick St. Pierre, U.S. Fish and Wildlife Service
Sara Winslow, North Carolina Division of Marine Fisheries

2003 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 I (April 1999)
<u>Addenda:</u>	Technical Addendum #1 (February 9, 2000)
<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
<u>Active Boards/Committees:</u>	Shad & River Herring Management Board, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, Plan Review Team

In 1994, the Plan Review Team and the Management Board determined that the original 1985 Fishery Management Plan (FMP) was no longer adequate for protecting or restoring the remaining shad and river herring stocks. As a result, Amendment I was adopted in October 1998 (completed April 1999).¹ Amendment I focuses on American shad regulations and monitoring programs, but also requires States to initiate fishery-dependent monitoring programs for river herring and hickory shad in addition to current fishery-independent programs. Such monitoring programs will seek to improve data collection and stock assessment capabilities. Furthermore, Amendment I contains specific measures to control exploitation of American shad populations while maintaining the status quo in the other Alosine fisheries. The amended goal of the FMP is to protect, enhance, and restore East Coast migratory spawning stocks of American Shad, hickory shad, and river herrings in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass. The Plan further specifies four (4) management objectives as follows:

- 1) Prevent overfishing of American shad stocks by constraining fishing mortality below F_{30} ,
- 2) Develop definitions of stock restoration, determine appropriate target mortality rates and specify rebuilding schedules for American shad populations within the management unit,
- 3) Maintain existing or more conservative regulations for hickory shad and river herring fisheries until new stock assessments suggest changes are necessary, and
- 4) Promote improvements in degraded or historic alosine habitat throughout the species' range.

¹ ASMFC, 1999. Amendment I to the Interstate Fishery Management Plan for Shad & River Herring. April, 1999. Washington, D.C. 76 pp.

In the fall of 1999, the Technical Committee reviewed both state annual reports and fishing recovery plans. In doing so, the Technical Committee compiled a report, which identified a number of technical errors that required correction and/or clarification to Tables 2 and 3 of Amendment I. Upon review by the Shad and River Herring Management Board, the Board concurred with the Technical Committee's report and suggested that a technical addendum be developed to address modifications to the states' fishery dependent and independent monitoring program for American shad.

II. Status of the Stocks

While the FMP addresses four species including American shad, Hickory shad, Alewife, and Blueback herring, lack of comprehensive and accurate commercial and recreational fishery data for the latter three species make it difficult to ascertain the status of these stocks. A stock assessment for American shad was completed in 1997 and submitted for peer review in early 1998 based on new information and Management Board recommended terms of reference. The 1998 assessment estimated fishing mortality rates for nine shad stocks and general trends in abundance for 13 shad stocks. The next stock assessment update to be externally peer reviewed is scheduled for 2004.

III. Status of the Fisheries

American shad, hickory shad, and river herring formerly supported important commercial and recreational fisheries throughout their range. Fisheries are executed in rivers, estuaries, and oceans. Although recreational harvest data are scarce, most harvest is believed to come from the commercial industry. Commercial landings for all these species have declined dramatically from historic highs. Following is a summary of fisheries by species:

AMERICAN SHAD:

Total combined river and ocean commercial landings decreased from a high a 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. Total commercial landings in 2002 were 1,801,668 pounds (Table 1). Combined landings from New York, New Jersey, Delaware, Virginia, North Carolina and South Carolina accounted for 87% of the commercial harvest in 2001. No directed shad harvest was reported for Maine, New Hampshire, Massachusetts, Pennsylvania, the District of Columbia, or Florida.

Shad landings from ocean waters (directed and incidental) in 2002 were lower than those in 2001, comprising 711,840 pounds, or about 40% of the coastwide total. Only five states – RI, NJ, DE, VA, and SC - harvested 89% of the ocean landings.

Substantial shad sport fisheries occur at least on the Connecticut (CT and MA), the Hudson (NY), the Delaware (NY, PA and NJ), the Santee and Cooper (SC), Savannah (GA), and the St. Johns (FL) River. Shad sport fisheries are also pursued on several other rivers in MA, NC, SC, GA, and VA. In 2001, recreational creel limits ranged from zero (RI, PA-Susquehanna, DE, MD, VA, DC) to 10 fish per day (NC, SC, FL). The exception to this is the Santee River in SC, which is permitted to have a 20 fish per day creel limit due to the approval of a conservation equivalency in 2000. Tens of thousands of shad are angled from large East Coast rivers each year but detailed creel surveys are generally not available. Actual harvest (catch and keep) 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.

Table 1. Reported Commercial Landings (lbs.) of American Shad in 2002 (includes EEZ and incidental catch)².

State	River/Bay	Ocean	Totals
ME	0	18	18
NH	0	0	0
MA	0	424	424
RI	0	87,200	87,200
CT ³	108,099	0	108,099
NY	130,603	60,922	191,525
NJ	48,417	227,909	270,156
DE	38,710	85,496	124,226
PA	0	0	0
PRFC	2,762	0	2,762
DC	0	0	0
MD	19,300	7,529	26,829
VA ⁴	0	149,544	149,544
NC	266,281	8,377	274,658
SC	450,130	84,421	534,551
GA	25,526	0	25,526
FL	0	0	0
Totals	1,089,828	711,840	1,801,668
Percent	60%	40%	

MRFSS Data for American Shad are unreliable. The proportional standard errors (PSEs) for Maine, Maryland, New Hampshire, Connecticut, New York, Delaware, and North Carolina are 99.9, 58, 100, 100.1, 100, 53.7, and 58.7, respectively.

In 2002, MRFSS reported that Maine caught and released 438 American shad. MRFSS also reported the following: Connecticut harvested zero fish (total caught and released was 219), Delaware harvested zero fish (total catch was 2,195), Maryland harvested zero fish (total caught and released was 2,403), New Hampshire harvested zero fish (total caught and released was 242), New York harvested zero fish (total caught and released was 1,357), and North Carolina harvested 213 fish (total caught was 741).

A creel survey was conducted on the Delaware River, which borders New York, New Jersey, Pennsylvania, and Delaware, in 2002. The number of American shad harvested by sport anglers from the Delaware River in 2002 was estimated at 6,627. The estimated total catch of American shad in the Delaware River in 2002 was 35,281 fish. A creel survey was completed on the Cape Fear River in North Carolina in 2002. North Carolina reports an estimated 26,735 American shad caught during the study period. An estimated 49% (13,125 fish) were harvested in 2002. A creel survey on the St. John's River in Florida reported 3,524 shad caught in the St. John's River

² Unless indicated otherwise, the landings used in this table come from the 2002 Annual State Reports.

³ Connecticut reports the number of American shad harvested from the Connecticut river in 2002 as 27,806 fish. NMFS reports 108,099 lbs of American shad landed in the state of Connecticut.

⁴ Virginia reports 149,544 lbs of American shad landed in the ocean fishery, whereas NMFS reports 152,309 lbs of American shad landed in Virginia's ocean fishery.

recreational fishery. This is an increase from previous years. The estimated harvest rate on the St. John's River is 23 percent (817 fish) for the 2002-2003 season.

HICKORY SHAD:

Georgia, Maryland, New York, North Carolina, and Virginia all reported hickory shad commercial landings in 2002. North Carolina reported the highest landings with 51,162 pounds including 3,641 pounds from offshore. In 2002, the coastwide commercial landings for hickory shad were 93,219 pounds. This is a decrease from the 2001 total preliminary landings of 198,479 pounds.

MRFSS data for Hickory Shad are unreliable. The proportional standard error (PSE) for Connecticut, New York, Rhode Island, and North Carolina are 40.8, 58.5, 100.1, and 99.9, respectively.

MRFSS indicates that in 2002 the recreational harvest of hickory shad was 87,306 fish, which represents a substantial increase from 2001 (34,904 fish). The MRFSS report indicates that hickory shad were harvested from the state waters of Rhode Island, Connecticut, New York, and North Carolina.

RIVER HERRING (BLUEBACK/ALEWIFE COMBINED):

Commercial landings of river herring declined 90% from over 13 million pounds in 1985 to about 1.33 million pounds in 1998. In 2002, eight states reported total herring commercial landings of 1,984,729 pounds, mostly from Maine, Virginia, and North Carolina.

MRFSS data for River Herring are unreliable. The proportional standard errors (PSEs) for Maine, Rhode Island, New York, Delaware, and Maryland are 60.8, 97.3, 100, 99.8, and 69.6, respectively.

According to MRFSS, 2002 recreational harvest was 51,740 fish, which represents a decrease in number of fish from 2001 (138,636). Harvest from Rhode Island and Maryland accounted for 99.6% of the recreational harvest in 2002. While data on the recreational fishery for river herring is sparse, catch and release recreational fisheries have been reported to take place in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Delaware, Maryland, DC, and Virginia.

IV. Status of Research and Monitoring

Under Amendment I (April 1999), fishery-independent and fishery-dependent monitoring programs are now mandatory for American shad. Juvenile abundance index (JAI) surveys, annual spawning stock surveys, and hatchery evaluations are required for states/jurisdictions specified in the fishery management plan. In addition, Amendment I recommends that JAIs for other alosine species be reported when possible. In February 2000, the Shad Management Board indefinitely deferred the ocean-tagging requirement stipulated by Amendment I, which was to begin in the year 2000 to analyze the mixed stock contribution to ocean landings coastwide.

All States are required to calculate mortality and/or survival estimates, while monitoring and reporting 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 each year. In addition, States were required to submit State recovery/fishing plans by July 1, 1999. All States plans to implement Amendment I were approved by January 1, 2000.

In addition to the mandatory monitoring requirements stipulated under Amendment I, some states/jurisdictions continue important research initiatives for these species. For example, Maine, Pennsylvania, Delaware, New Jersey, Maryland, Virginia, North Carolina and USFWS are actively involved in shad restoration using hatchery-cultured fry and fingerlings. All hatchery fish are marked with multiple oxytetracycline marks on otoliths to allow future distinction from wild fish. During 2002, several jurisdictions from Maine to North Carolina (including USFWS) reared larval and fingerling American shad, stocking a total of 31,439,198 in 19 drainages (Table 2). Also, Maryland DNR reared and stocked 2.8 million hickory shad into four Maryland rivers.

Table 2. Stocking of Cultured American and Hickory Shad in 2002.

Jurisdiction	Rivers	No. American Shad Stocked	Notes
Maine	Kennebec	2,079,819	
	Androscoggin	295,725	
	Sebasticook	505,902	
	Medomak	10,957	
	Total	2,892,403	
Pennsylvania	Susquehanna	2,640,148	
	Schuylkill	2,000	
	Lehigh	85,025	
	Total	2,727,173	
New York	Susquehanna	158,790	(from Pennsylvania)
	Chemung	200,351	(from Pennsylvania)
	Total	359,141	
Delaware	Nanticoke	22,347	(from Maryland DNR)
Maryland	Potomac	1,530,886	(from USFWS)
	Broad	101,000	(DNR -- + 975,000 hickory)
	Choptank	1,143,118	(DNR -- + 1,075,000 hickory)
	Patuxent	617,468	(DNR -- + 390,000 hickory)
	Nanticoke	148,074	(DNR -- + 354,300 hickory)
	Total	3,540,546	2,794,300 hickory shad
Virginia	James	8,767,072	(from VA & USFWS)
	Pamunkey	6,310,516	(from VA, USFWS, Pamunkey Tribal)
	Mattaponi	6,000,000	(Mattaponi Tribal)
	Total	21,077,588	
North Carolina	Roanoke	820,000	(NC – Watha)
TOTALS		35,259,954	2,794,200 hickory shad

TABLE 3. American Shad Fish Passage Counts at Select Dams – 2002.

Portions of this report were taken from 2002 State annual reports, the ASMFC FMP for Shad and River Herring, the ASMFC report *American shad and Atlantic Sturgeon Stock Assessment Peer Review: Terms of Reference and Advisory Report*

State	River	Site	Number of American Shad	Trend
Maine	Androscoggin	Brunswick	11	Decrease
	Saco	Head-of-tide	1,014	Decrease
New Hampshire	Exeter		41	Decrease
	Lamprey		6	Stable
Massachusetts	Merrimack	Essex Dam	54,586	Decrease
	Connecticut	Holyoke	374,548	Increase
Rhode Island	Pawcatuck	Potter Hill	768	Decrease
Pennsylvania	Lehigh	Easton	3,314	Decrease
		Chain	1,479	Decrease
Maryland/PA	Susquehanna	Conowingo	117,348	Decrease
South Carolina	Santee	St. Stephens	165,875	Decrease

V. Status of Management Measures

All state programs must implement commercial and recreational management measures or an alternative program as approved by the Management Board. The current status of each state's compliance with these measures is provided in Section VII of this report (See Table 4).

As noted in Section I, the Management Board determined that the original Plan and its lack of mandatory measures were insufficient for protecting and restoring Alosine stocks along the East Coast. Accordingly, the 1985 fishery management plan was amended in 1999. The Plan Development Team developed Amendment I to expedite recovery of American shad populations and maintain current regulations in the hickory shad and river herring fisheries.

After careful consideration of stock assessment results, peer reviewers' comments, and public opinion, the Management Board voted to address "inriver" or estuarine American shad fisheries differently than oceanic intercept fisheries. Specifically, the Board decided to require states to submit in-river shad restoration plans for stocks under their jurisdiction. For those 7 river systems evaluated in the 1998 stock assessment (Connecticut R., Hudson R., Delaware R., Upper Chesapeake Bay MD, Edisto R., Santee R., and Altamaha R.), states could continue current regulations since overfishing was not detected for those respective stocks. States/jurisdictions must maintain a fishing mortality level at or below F_{30} . Also, reporting of catch and effort data for all Alosine fisheries is now mandatory under Amendment I.

In addition, the Management Board voted to phase out all ocean intercept fisheries for American shad within 5 years of Amendment I implementation. States were to comply with a 40% reduction in effort within the ocean intercept fishery by December 31, 2002. States with non-directed harvest of American shad in ocean fisheries can permit the landing of shad bycatch, provided that American shad do not constitute more than 5% of the total landings (in pounds) per trip.

For recreational fisheries, the states voted to implement a 10 fish combined daily creel limit for American and hickory shad. In 2000, South Carolina was found to be out of compliance due to a lack of creel limits on shad. In October of 2000, the Board approved a 10 fish/day creel limit (combined American and hickory shad) for all waters of South Carolina except the Santee River which will have a 20 fish combined daily limit. Existing or more conservative recreational/personal use regulations for river herring will be maintained under Amendment I.

In addition, the states are required to submit annual reports on harvest and certain required fishery-independent/dependent monitoring programs. Implementation of these programs and reporting schedules is intended to improve future assessments of Alosine populations and permit adaptive management of fisheries as stock recovery is documented.

On February 19th, 2002, the Shad and River Herring Plan Review Team and Technical Committee recommended several changes to both Amendment I and Technical Addendum #1. The Shad and River Herring Management Board approved the changes and directed Commission staff to develop an addendum to both Amendment I and Technical Addendum #1. The proposed changes in Addendum I supersedes the requirements described in Technical Addendum #1. Addendum I changes the conditions for marking hatchery-reared alosines. The addendum clarifies the definition and intent of *de minimis* status for the American shad fishery. It also further modifies and clarifies the fishery-independent and fishery-dependent monitoring requirements in Table 2 and 3 of Technical Addendum #1. These measures became effective upon approval by the Shad and River Herring Management Board in August of 2002.

Rhode Island, New Jersey, Delaware, Maryland, Virginia, North Carolina, and South Carolina all have an ocean-intercept commercial fishery for American shad. As required, each state submitted a proposal for a 40% reduction in effort by December 31, 2002. The states of New Jersey, Delaware, Maryland, Virginia, North Carolina, and South Carolina have submitted reports detailing the effectiveness of their implementation plans in achieving the 40% reduction in effort.

VI. Prioritized Research Needs

1. Continue to assess current aging techniques for American shad and river herring, using known age fish, scales, otoliths, and spawning marks. Conduct bi-annual aging workshops to maintain consistency and accuracy of aging fish sampled in state programs.
2. Determine and update biological benchmarks used in assessment modeling (fecundity at age, mean weight at age for both sexes, partial recruitment vector/maturity schedules) for American shad and river herring stocks in a variety of coastal river systems, including both semelparous and iteroparous stocks.
3. Validate the different values of M for shad stocks through verification of shad aging techniques and repeat spawning information and develop methods for calculating M.
4. Determine which stocks are impacted by mixed stock fisheries (including bycatch fisheries). Methods to be considered could include otolith microchemistry, oxy-tetracycline otolith marking and/or tagging.
5. Investigate the relation between juvenile production and subsequent year class strength in American shad with emphasis on the validity of juvenile abundance indices, rates and sources of immature mortality, migratory behavior of juveniles, natural history and ecology of juveniles, and essential nursery habitat in the first few years of life.
6. Identify ways to improve fish passage efficiency using hydroacoustics to repel alosines or pheromones or other chemical substances to attract them. Test commercially available acoustic equipment at existing fish passage facility to determine effectiveness. Develop methods to isolate/manufacture pheromones or other alosine attractants.
7. Develop effective culture and marking techniques for river herring.

8. Develop and implement techniques to determine shad and herring population targets for tributaries undergoing restoration (dam removals, fishways, supplemental stocking, etc.).
9. Evaluate and ultimately validate large-scale hydroacoustic methods to quantify American shad escapement (spawning run numbers) in major river systems. Identify how shad respond (attract/repelled) by various hydroacoustic signals.
10. Refine techniques for hormone induced tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock.
11. Characterize tributary habitat quality and quantity for Alosine reintroductions and fish passage development.
12. Identify and quantify potential American shad spawning and rearing habitat not presently utilized and conduct an analysis of the cost of recovery.
13. Develop comprehensive angler use and harvest survey techniques for use by Atlantic states to assess recreational fisheries for American shad.
14. Determine the effects of passage impediments on all life history stages of shad and river herring, conduct turbine mortality studies and downstream passage studies.
15. Evaluate additional sources of mortality for shad, including bait and reduction fisheries.
16. Conduct studies on energetics of feeding and spawning migrations of shad on the Atlantic coast.
17. Encourage university research on hickory shad.
18. Conduct studies of egg and larval survival and development.
19. Conduct and evaluate historical characterization of socio-economic development (potential pollutant sources and habitat modification) of selected shad rivers along the east coast.
20. Review studies dealing with the effects of acid deposition on anadromous alosines.
21. Conduct population assessments on river herrings - particularly needed in the south.
22. Quantify fishing mortality (in-river, ocean bycatch, bait fisheries) for major river stocks after ocean closure of directed fisheries.
23. Suggest hard limits and range levels for water quality deemed appropriate and defensible for all alosines.
24. Development of appropriate Habitat Suitability Index Models for alosine species in the fishery management plan. Possibly consider expansion of species of importance or go with the most protective criteria for the most susceptible species.

VII. Current State-by-State Implementation of Compliance Requirements

In 2002, all states were in compliance with Amendment I and Technical Addendum #1 to the Shad and River Herring Fishery Management Plan (See Attached Table 4). New Hampshire, Maine and Massachusetts continue to meet the standards for commercial *de minimis* status as defined in Amendment I. Their landings for 2002 were less than 1% of coastwide commercial or recreational landings.

VIII. Recommendations of Plan Review Team

1. Upon review of the state annual reports, the PRT determined that all of the states have implemented the requirements in Amendment 1 and Technical Addendum #1 to the Interstate

Fishery Management Plan for Shad & River Herring. New Hampshire, Maine and Massachusetts continue to meet the standards for commercial *de minimis* status as defined in Amendment I. For these states, the commercial landings for 2002 were less than 1% of coastwide commercial landings.

2. The PRT and Technical Committee determined that the spawning stock survey for the Potomac River as reported by the District of Columbia is not adequate. The Technical Committee recognizes that the solution to this problem is likely to require an interjurisdictional effort involving Maryland, Virginia, the District of Columbia and the Potomac River Fisheries Commission. The PRT and Technical Committee recommend an Addendum to Amendment 1 to remove the monitoring requirement from the District of Columbia and re-assign it to the appropriate entity or group of entities.
3. Several of the states did not report all of the monitoring requirements listed under Amendment I and Technical Addendum #1. 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.
4. The PRT is concerned about the level of detail in several of the state reports for American shad ocean bycatch. As the ocean fishery is phased out over the next few years, ocean bycatch will become a greater source of mortality along the eastern coast. States need to monitor and report on the American shad ocean bycatch in the manner described in Amendment I to the Shad & River Herring Fishery Management Plan. The amendment requires that “states permitting the landing of American shad bycatch must annually document that the 5% trip limit is not exceeded, report the extent and nature of the non-directed fisheries, and total landings of American shad bycatch” (p.50). There were several states that did not document that the American shad bycatch did not exceed 5% of the total landings (in pounds) per trip. Also, states with an ocean bycatch must subsample the bycatch for size, age, and sex distribution, unless the state qualifies for *de minimis* status. Three of the states with ocean bycatch have *de minimis* status for the commercial fishery and are exempted from subsampling the bycatch.
5. Amendment I requires each state report to include a harvest and losses table. Many of the state reports omitted this table from their report. Please refer to Amendment I, Table 10 “Format Required for Annual State Report”.

D. Table 1. Harvest and Loss – including all above estimates in numbers and weight (pounds) of fish and mean weight per fish for each gear type”.