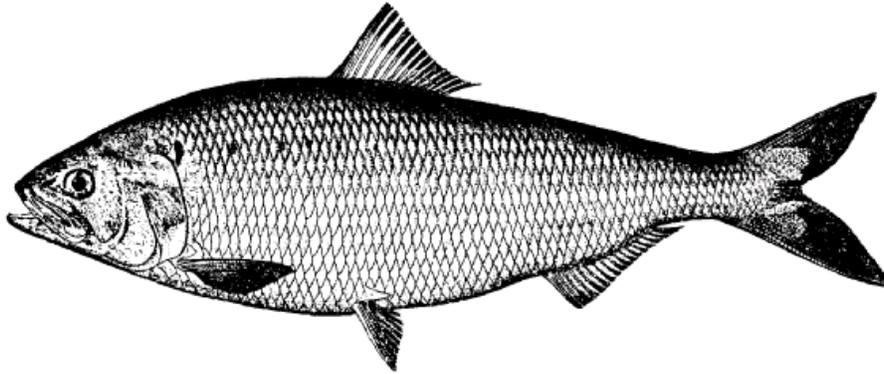


2004 REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR
SHAD AND RIVER HERRING (*Alosa spp.*)



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Prepared by

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2004 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 2005.

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 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. Total commercial landings in 2003 were 1,502,715 pounds (Table 1). Combined landings from Connecticut, New York, New Jersey, Delaware, North Carolina and South Carolina accounted for 90% of the commercial harvest in 2003. 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 2003 were less than half that reported in 2002, comprising 330,977 pounds, or about 22% of the coastwide total. Only five states – RI, NJ, DE, VA, and SC - harvested 88% 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 lower Susquehanna (MD), 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 or have been recently completed.

Table 1. Reported Commercial Landings (lbs.) of American Shad in 2003 (includes EEZ and incidental catch)².

State	River/Bay	Ocean	Totals
ME	0	54	54
NH	0	2	2
MA	0	1,109	1,109
RI	0	31,424	31,424
CT ³	105,680	0	105,680
NY	110,224	24,471	134,695
NJ	90,520	145,449	235,969
DE	62,422	30,586	93,008
PA	0	0	0
PRFC	8,141	0	8,141
DC	0	0	0
MD	23,800	2,485	26,285
VA	0	45,795	45,795
NC	382,739	12,515	395,251
SC	354,389	37,087	391,476
GA	33,823	0	33,823
FL	0	0	0
Totals	1,171,738	330,977	1,502,715
Percent	78%	22%	

MRFSS Data for American Shad are unreliable. The proportional standard errors (PSEs) in 2003 accompanying the MRFSS estimates of total catch for Maine, Rhode Island, Delaware, and Maryland are 100, 73.1, 70.2, and 43.1, respectively.

In 2003, MRFSS reported that Maine caught and released 1,367 American shad. MRFSS also reported the following: Rhode Island harvested all 479 fish caught, Delaware harvested 3,577 fish (total catch was 11,447), and Maryland harvested zero fish (total caught and released was 10,829).

Several creel surveys were completed in 2002 including the Delaware River (DE, PA, NJ, NY), the Cape Fear River (NC), and the St. John’s River (FL). The number of American shad harvested by sport anglers from the Delaware River in 2002 was estimated at 6,627, 19% of the estimated total catch of 35,281 fish. North Carolina reports an estimated 26,735 American shad caught during the study period, of which about 49% (13,125 fish) were harvested in 2002. The creel survey on the St. John’s River in Florida for the 2002-2003 season reported 3,524 shad caught with an estimated harvest rate of 23 percent (817 fish).

² Unless indicated otherwise, the landings used in this table come from the 2003 Annual State Reports.

³ Connecticut reports the number of American shad harvested from the Connecticut river in 2003 as 26,420 fish.

HICKORY SHAD:

New Jersey and North Carolina reported hickory shad commercial landings in 2003. North Carolina reported the highest landings with 66,063 pounds including 2,865 pounds from offshore. In 2003, the coastwide commercial landings for hickory shad were 69,255 pounds. This is a decrease from the 2002 total preliminary landings of 93,219 pounds.

MRFSS data for Hickory Shad are unreliable. The proportional standard errors (PSEs) in 2003 for Connecticut, New York, New Jersey, Delaware, and North Carolina are 28.6, 62.7, 99.8, 83.5, and 76.1, respectively.

MRFSS indicates that in 2003 the recreational harvest of hickory shad was 92,320 fish, which represents a slight increase from 2002 (87,306 fish). The MRFSS report indicates that hickory shad were harvested from the state waters of Connecticut, New York, New Jersey, Delaware, 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 2003, five states reported total river herring commercial landings of 2,145,305 pounds, mostly from Maine, North Carolina, and South Carolina.

MRFSS data for River Herring are unreliable. The proportional standard errors (PSEs) in 2003 for Maine, New Hampshire, Massachusetts, Rhode Island, New Jersey, and Maryland are 64.6, 100.1, 70.3, 70.9 (alewife)/35.9 (Blueback herring), 100, and 98.4 (alewife)/100 (Blueback herring), respectively.

According to MRFSS, 2003 recreational harvest was 360,350 fish, which represents an almost seven-fold increase in numbers of fish from 2002 (51,740). Harvest from Rhode Island and Maryland accounted for 81% of the recreational harvest in 2003. While data on the recreational fishery for river herring is sparse, catch and release recreational fisheries have been reported to take place in many states.

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 2003, several jurisdictions from Maine to North Carolina (including USFWS) reared American shad, stocking a total of 47,556,703 fish in 19 drainages (Table 2). Also, Maryland DNR and PA Fish and Boat Commission reared and stocked 5.2 million hickory shad into six rivers.

Table 2. Stocking of Cultured American and Hickory Shad in 2003.

Jurisdiction	Rivers	No. American Shad Stocked	Notes
Maine	Kennebec	5,678,934	
	Androscoggin	2,076,369	
	Sebecook	1,857,184	
	Medomak	20,000	(fingerlings)
	Total	9,633,087	
Pennsylvania	Susquehanna	9,778,543	(plus 1.00 million hickory)
	Schuylkill	1,020,169	(plus 1.95 million hickory)
	Lehigh	783,013	
	Total	11,581,725	
New York	Susquehanna	491,998	(from Pennsylvania)
	Chemung	414,721	(from Pennsylvania)
	Total	906,719	
New Jersey	Raritan	254,543	(from Pennsylvania)
Delaware	Nanticoke	330,000	(+ 540,000 hickory from MD DNR)
Maryland	Choptank	1,480,000	
	Patuxent	830,000	[plus 1.71 million hickory shad stocked in several rivers]
	Nanticoke	310,000	
	Total	2,620,000	
Virginia	James	8,720,000	(from VA & USFWS)
	Pamunkey	5,890,000	(from VA, USFWS, Pamunkey Tribal)
	Mattaponi	4,500,000	(Mattaponi Tribal)
	Rappahannock	1,380,000	(VA)
	Total	20,490,000	
North Carolina	Roanoke	592,340	
	Staunton	1,081,289	
	Tar	67,000	
	Total	1,740,629	
TOTALS		47,556,703	+5,200,000 hickory shad

TABLE 3. American Shad Fish Passage Counts at Select Dams – 2003.

State	River	Site	Number of American	Trend
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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*

			Shad	
Maine	Androscoggin Saco	Brunswick Head-of-tide	7 1,227	Decrease Decrease
New Hampshire	Exeter		33	Decrease
Massachusetts	Merrimack Connecticut	Essex Dam Holyoke	52,929 286,528	Stable Stable
Rhode Island	Pawcatuck	Potter Hill	243	Decrease
Pennsylvania	Lehigh	Easton Chain	375 37	Decrease Decrease
Maryland/PA	Susquehanna	Conowingo	125,135	Stable
Pennsylvania	Susquehanna	Holtwood	25,254	Stable
South Carolina	Santee	St. Stephens	298,903	Increase

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 supersede 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 complete closure of this ocean intercept fishery is required to take place on December 31, 2004, at which point these states will no longer allow a directed fishery for American shad in ocean waters.

V. Prioritized Research Needs

High Priority

- 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.
- 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.
- 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.
- 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.
- Evaluate additional sources of mortality for shad, including bait and reduction fisheries.
- Conduct population assessments on river herrings - particularly needed in the south.

Medium Priority

- 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.
- 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.
- Develop effective culture and marking techniques for river herring.
- Develop and implement techniques to determine shad and herring population targets for tributaries undergoing restoration (dam removals, fishways, supplemental stocking, etc.).
- 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.
- Refine techniques for hormone induced tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock.
- Characterize tributary habitat quality and quantity for Alosine reintroductions and fish passage development.
- Identify and quantify potential American shad spawning and rearing habitat not presently utilized and conduct an analysis of the cost of recovery.
- Develop comprehensive angler use and harvest survey techniques for use by Atlantic states to assess recreational fisheries for American shad.
- Determine the effects of passage impediments on all life history stages of shad and river herring, conduct turbine mortality studies and downstream passage studies.
- Conduct studies on energetics of feeding and spawning migrations of shad on the Atlantic coast.
- Encourage university research on hickory shad.
- Conduct studies of egg and larval survival and development.
- Conduct and evaluate historical characterization of socio-economic development (potential pollutant sources and habitat modification) of selected shad rivers along the east coast.
- Quantify fishing mortality (in-river, ocean bycatch, bait fisheries) for major river stocks after ocean closure of directed fisheries.
- Suggest hard limits and range levels for water quality deemed appropriate and defensible for all alosines.
- 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.

Low Priority

- Review studies dealing with the effects of acid deposition on anadromous alosines.

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

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.

VIII. Recommendations of Plan Review Team

1. The PRT realizes that the Recreational Creel Survey is only to be completed once every five years. The PRT requests that states include the year of the most recent creel survey in the annual report
1. 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 the interjurisdictional nature of Potomac River shad stocks and suggests a joint assessment 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.
2. 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.
3. 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.
4. 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”.

