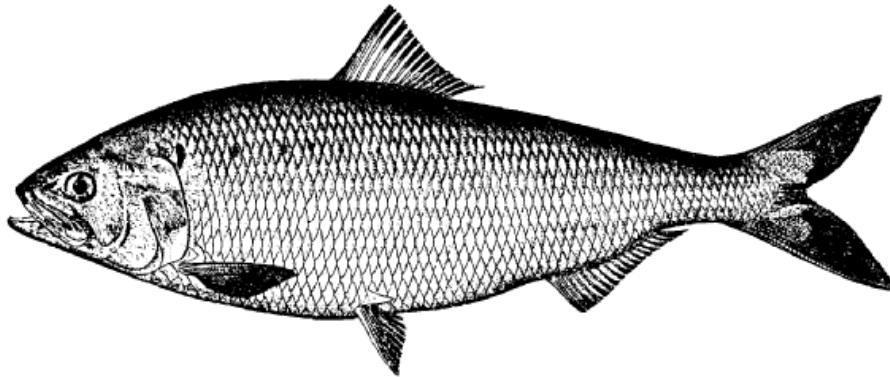


2005 REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR
SHAD AND RIVER HERRING (*Alosa spp.*)



September 19, 2005

Prepared by

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2005 REVIEW OF THE ASMFC FISHERY MANAGEMENT PLAN FOR SHAD AND RIVER HERRING (*Alosa spp.*)

I. Status of the Fishery Management Plan

<u>Date of FMP Approval:</u>	October, 1985
<u>Amendments:</u>	Amendment 1 (April 1999)
<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 1 was adopted in October 1998 (completed April 1999).¹ Amendment 1 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 1 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 herring (collectively alewife and blueback herring) 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 1 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 1. 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 2006.

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 (both freshwater and saltwater), estuaries, tributaries, 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 2004 were 1,384,138 pounds (Table 1). Combined landings from New Jersey, Delaware, North Carolina and South Carolina accounted for 81% of the commercial harvest in 2004. 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 2004 increased slightly from 2003 levels, comprising 378,778 pounds, or about 27% of the coastwide total. Only four states –New Jersey, Delaware, Virginia, and South Carolina - harvested 90% of the ocean catch.

Table 1. Directed commercial landings (lbs.) of American shad reported by ASFMC jurisdictions in 2004².

State	River/Bay	Ocean	Totals
ME	0	0	0
NH	0	0	0
MA	0	0	0
RI	0	14,665	14,665
CT ³	60,000	500	60,500
NY	72,839	15,053	87,892
NJ	97,458	120,267	217,725
DE	90,093	86,937	177,030
PA	0	0	0
PRFC	0	0	0
DC	0	0	0
MD	0	879	879
VA	0	48,263	48,263
NC	262,339	6,724	269,063
SC	336,496	45,941	382,437
GA	37,947	0	37,947
FL	0	0	0
Totals	960,740	338,729	1,299,469
Percent	74%	26%	
2003	1,171,738	330,977	1,502,715
Percent	78%	22%	

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) Rivers. Shad sport fisheries are also pursued on several other rivers in MA, NC, SC, GA, and VA. In 2004, 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 plan in 2000. 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.

MRFSS Data for American Shad are unreliable due to the design of MRFSS that focuses on active fishing sites along coastal and some estuarine areas. For 2004, MRFSS reports recreational harvest of American shad from North Carolina only. The proportional standard error (PSE) in 2004 accompanying the MRFSS estimates of total catch for North Carolina is 99.9.

In 2004, MRFSS reported that Maine caught and released 2,016 American shad. MRFSS also reported the following: Rhode Island released all 793 fish caught, Delaware caught and released

Portions of this report were taken from 2004 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*

6,²426 fish, Maryland caught and released 3,076 fish, Virginia caught and released 3,458 fish, and North Carolina harvested all 227 fish caught.

Several creel surveys were completed in 2004 including the Susquehanna River below the Conowingo Dam (MD), the Cooper River (SC), and the St. John's River (FL). In Maryland, recreational harvest of American shad is not permitted, however the 2004 creel survey indicates that 32% of the 65 anglers interviewed would harvest American shad if the fishery were opened and the mean number harvested would be two shad per angler per day. The number of American shad harvested by sport anglers from the Cooper River in 2004 was estimated at 7,696, 84% of the estimated total catch of 9,162 fish. The creel survey on the St. John's River in Florida for the 2004-2005 season reported 1,270 shad caught with an estimated harvest rate of 21% (269 fish).

HICKORY SHAD:

New Jersey, Virginia, and North Carolina reported hickory shad commercial landings in 2004. North Carolina reported the highest landings with 187,464 pounds including 5,927 pounds from offshore. In 2004, the coastwide commercial landings for hickory shad were 195,754 pounds. This is an increase from the 2003 total preliminary landings of 69,255 pounds.

MRFSS data for Hickory Shad are unreliable. The proportional standard errors (PSEs) in 2004 for Rhode Island, Connecticut, New York, and Delaware are 100, 47.1, 44.4, and 65.5, respectively.

MRFSS indicates that in 2004 the recreational harvest of hickory shad was 54,967 fish, which represents a decrease from 2003 (92,320 fish). The MRFSS report indicates that hickory shad were harvested from the state waters of Rhode Island, Connecticut, New York, and Delaware.

RIVER HERRING (BLUEBACK HERRING/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 2004, ten states reported total river herring commercial landings of 2,120,881 pounds, mostly from Maine, Maryland, Virginia, North Carolina, and South Carolina.

MRFSS data for river herring are unreliable. The proportional standard errors (PSEs) in 2004 for Maine, Massachusetts, Rhode Island, and Maryland are 66.7, 35.7, 31.7 (alewife)/77.2 (blueback herring), and 99.7, respectively.

According to MRFSS, 2004 recreational harvest was 378,540 fish, which represents a slight increase in numbers of fish from 2003 (360,350). 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.

² Unless indicated otherwise, the landings used in this table come from the 2004 Annual State Reports.

³ Connecticut reports the number of American shad harvested from the Connecticut River in 2004 as 15,892 fish.

IV. Status of Research and Monitoring

Under Amendment 1 (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 1 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 1 due to the pending ocean fishery closures, 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 1 were approved by January 1, 2000.

In addition to the mandatory monitoring requirements stipulated under Amendment 1, some states/jurisdictions continue important research initiatives for these species. For example, Maine, Pennsylvania, Delaware, Maryland, Virginia, North 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 2004, several jurisdictions from Maine to North Carolina (including USFWS) reared American shad, stocking a total of 35,613,000 fish in 20 drainages (Table 2). Also, Maryland DNR and PA Fish and Boat Commission reared and stocked 17.2 million hickory shad into seven rivers.

Table 2. Stocking of Cultured American and Hickory Shad in 2004.

Jurisdiction	Rivers	No. American Shad Stocked	Notes
Maine	Kennebec	4,930,000	
	Androscoggin	539,000	
	Sebasticook	511,000	
	Medomak	1,000	(fingerlings)
	subtotal	5,981,000	
New Hampshire	Exeter	234,000	(Merrimack stock from Maine)
Pennsylvania	Susquehanna	4,730,000	(plus 3.37 million hickory)
	Schuylkill	422,000	
	Lehigh	366,000	
	Delaware + tribs	----	(plus 2.75 million hickory)
	subtotal	5,518,000	(plus 6.12 million hickory)
New York	Susquehanna	485,000	(Hudson stock from PA)
	Chemung	343,000	(Hudson stock from PA)
	subtotal	828,000	
New Jersey	Raritan	119,000	(Hudson stock from PA)
Delaware	Nanticoke	187,000	(+ 1.1 million hickory from MD)
Maryland	Choptank	829,000	

Portions of this report were taken from 2004 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*

	Patuxent	667,000	[plus 9.99 million hickory shad stocked in several rivers]
	Nanticoke	458,000	
	Total	1,954,000	
Virginia	James	6,580,000	(VA & USFWS)
	Pamunkey	4,400,000	(VA, Pamunkey tribal)
	Mattaponi	3,840,000	(Mattaponi Tribal)
	Rappahannock	3,221,000	(Potomac source from VA/FWS)
	Potomac	421,000	(VA and USFWS)
	subtotal	18,462,000	
North Carolina	Roanoke	1,198,000	(NC and USFWS)
	Staunton	1,132,000	(NC and USFWS)
	subtotal	2,330,000	
TOTALS		35,613,000	+17,210,000 hickory shad

TABLE 3. American Shad Fish Passage Counts at Select Dams – 2004.

State	River	Site	Number of American Shad	Trend
Maine	Androscoggin	Brunswick	12	Low stable
			Head-of-tide	1,627
New Hampshire	Exeter		22	Low stable
Massachusetts	Merrimack	Essex Dam	45,115	Stable
			Connecticut	Holyoke
Rhode Island	Pawcatuck	Potter Hill	301	Low stable
Pennsylvania	Lehigh	Easton	754	Low Stable
Maryland/PA	Susquehanna	Conowingo	109,360	Stable
Pennsylvania	Susquehanna	Holtwood	3,428	Decrease
South Carolina	Santee	St. Stephens	145,201	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 1 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 1.

In addition, the Management Board voted to phase out all ocean intercept fisheries for American shad within 5 years of Amendment 1 implementation. States were to comply with a 40% reduction in effort within the ocean intercept fishery by December 31, 2002. All states must close their ocean-intercept fisheries as of January 1, 2005. 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. 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.

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 1.

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.

In February 2002, the Shad and River Herring Plan Review Team and Technical Committee recommended several changes to both Amendment 1 and Technical Addendum #1. The Shad and River Herring Management Board approved the changes and directed Atlantic States Marine Fisheries Commission (ASMFC) staff to develop an addendum to both Amendment 1 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.

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.
- 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.

Medium Priority

- 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 has determined that New York has not fully implemented the required provisions of Technical Addendum #1 and Amendment 1 to the Shad and River herring Fishery Management Plan. Specifically, New York reports that landings of shad from the ocean fishery exceed 5% in pounds per trip for a number of trips in 2004. In addition, New York did not sub-sample the ocean bycatch for biological information (length frequency, sex ratio, and age frequency) in 2004 as required by Amendment 1 to the FMP. It should be noted that the resolution of bycatch data reported in other states' compliance reports did not allow similar review of the magnitude of American shad ocean bycatch in other states.

The PRT determined that all of the remaining states have implemented the requirements in Amendment 1 and Technical Addendum #1 to the Interstate Fishery Management Plan for Shad & River Herring. Maine, New Hampshire, and Massachusetts continue to meet the standards for commercial *de minimis* status as defined in Amendment 1. For these states, the commercial landings for 2003 (the most recent year for which commercial landings data are available) were less than 1% of coastwide commercial landings.

VIII. Recommendations of Plan Review Team

1. Recreational Creel Surveys are to be completed once every five years. The PRT requests that states include the year of the most recent creel survey and any plans for future surveys in the annual report.
2. The PRT and Technical Committee determined that the spawning stock survey for the District of Columbia portion of the Potomac River as reported by the District of Columbia is not adequate. Because Potomac shad stocks are interjurisdictional, the Technical Committee and the PRT recommend that Maryland, Virginia, the District of Columbia and the Potomac River Fisheries Commission work together to describe this stock. 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 1 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. Now that the ocean fishery has been phased out, ocean bycatch may become an important 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 1 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, and one state documented that while some of the trips where shad was reported as bycatch fell within this definition, many trips did not. 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. The PRT recommends that the Technical Committee and Management Board consider an Addendum to Amendment 1 to modify the bycatch definition and related sub-sampling requirement.
5. Amendment 1 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 1, 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”.

6. Amendment 1, though focused on American shad monitoring programs, also requires states to report available fishery-dependent and independent information and recommends that states initiate fishery-dependent and independent monitoring programs for river herring and hickory shad in various river systems according to tables 4, 5, and 6 in Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring.