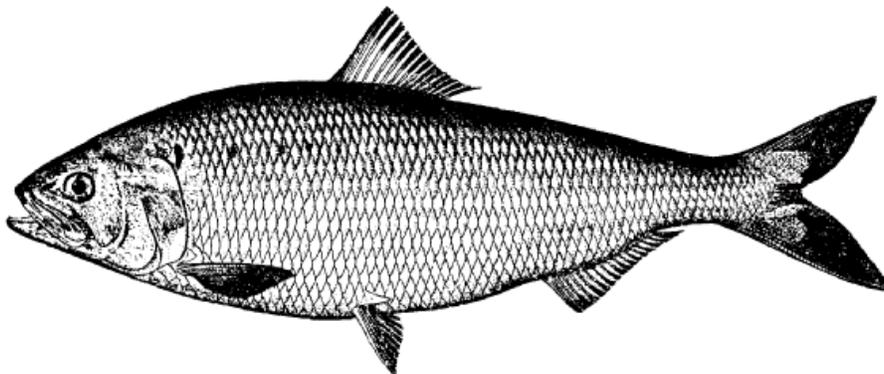


**REVIEW OF THE  
ATLANTIC STATES MARINE FISHERIES COMMISSION  
FISHERY MANAGEMENT PLAN FOR  
SHAD AND RIVER HERRING (*Alosa spp.*)  
2010**



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

## I. Status of the Fishery Management Plan

<u>Date of FMP Approval:</u>	October 1985
<u>Amendments:</u>	Amendment 1 (April 1999) Amendment 2 (August 2009) Amendment 3 (February 2010)
<u>Addenda:</u>	Technical Addendum #1 (February 2000) Addendum I (August 2002)
<u>Management Unit:</u>	Migratory stocks of American shad, hickory shad, alewife, and blueback herring from Maine through Florida
<u>States With Declared Interest:</u>	Maine through Florida, including the Potomac River Fisheries Commission 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. In 1994, the Management Board determined that the original 1985 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. Amendment 1 required specific American shad monitoring programs, and also recommended member states and jurisdictions to initiate fishery-dependent and fisheries-independent monitoring programs for river herring and hickory shad, in order to improve stock assessment capabilities. Furthermore, Amendment 1 contains specific measures to control exploitation of American shad populations while maintaining the status quo in 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
- 4) Promote improvements in degraded or historic alosine habitat throughout the species' range

In the fall of 1999, the Technical Committee reviewed both state annual reports and fishing recovery plans. After doing so, the Technical Committee compiled a report that identified a number of technical errors requiring correction and/or clarification in Tables 2 and 3 of Amendment 1. Upon review by the Shad and River Herring Management Board, the Board

concluded 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. The Board approved Technical Addendum #1 to Amendment 1 of the Interstate Fishery Management Plan for Shad and River Herring.

In February 2002, the Plan Review Team and the Technical Committee recommended several changes to both Amendment 1 and Technical Addendum #1. The Management Board approved the changes and directed the Commission staff to develop an addendum to both Amendment 1 and Technical Addendum #1. Addendum I does the following: changes the conditions for marking hatchery-reared alosines; clarifies the definition and intent of *de minimis* status for the American shad fishery; and modifies and clarifies the fishery-independent and dependent monitoring requirements of Tables 2 and 3 of Technical Addendum #1. These measures went into effect on January 1, 2003.

In August 2009, the Shad and River Herring Management Board approved Amendment 2, which deals only with river herring management. The Amendment prohibits state waters commercial and recreational fisheries beginning January 1, 2012, unless a state or jurisdiction has a sustainable management plan reviewed by the Technical Committee and approved by the Management 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." Submitted plans must clearly demonstrate that the state's or jurisdiction's river herring fisheries meet this new definition of sustainability through the development of sustainability targets which must be achieved and maintained. Amendment 2 required states to implement fisheries-dependent and independent monitoring programs similar to current requirements for American shad, and contains recommendations to member states and jurisdictions to conserve, restore, and protect critical river herring habitat. In 2011, the Shad and River Herring Management Board approved sustainable fishery management plans for Maine, New Hampshire, North Carolina and South Carolina.

In February 2010, the Shad and River Herring Management Board approved Amendment 3, which revised American shad regulatory and monitoring programs. The Amendment was developed in response to the 2007 American shad stock assessment, which found that most American shad stocks were at all time lows and did not appear to be recovering. The Amendment requires similar management and monitoring as developed in Amendment 2. Specifically, Amendment 3 prohibits state waters commercial and recreational fisheries beginning January 1, 2013, unless a state or jurisdiction has a sustainable management reviewed by the Technical Committee and approved by the Management 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." Submitted plans must clearly demonstrate that the state's or jurisdiction's American shad fisheries meet this new definition of sustainability through the development of sustainability targets which must be achieved and maintained. The Amendment allows any river systems to maintain a catch and release recreational fishery. States and jurisdictions are also required to identify local significant threats to American shad critical habitat and develop a plan for mitigation and restoration.

## **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.

A coastwide American shad stock assessment was completed and accepted in August 2007. The 2007 assessment found that American shad stocks are currently at all-time lows and do not appear to be recovering. Recent declines of American shad were reported for Maine, New Hampshire, Rhode Island, and Georgia stocks, and for the Hudson (NY), Susquehanna (PA), James (VA), and Edisto (SC) rivers. Low and stable stock abundance was indicated for Massachusetts, Connecticut, Delaware, the Chesapeake Bay, the Rappahannock River (VA), and some South Carolina and Florida stocks. Stocks in the Potomac and York Rivers (VA) have shown some signs of recovery in recent years. Data limitations and conflicting data precluded the report from indicating much about the current status or trend of many of the stocks from North or South Carolina.

The 2007 report identified primary causes for stock decline as a combination of overfishing, pollution, and habitat loss due to dam construction. In recent years, coastwide harvests have been on the order of 500-900 metric tons, nearly two orders of magnitude lower than in the late 19th century. Given these findings, the peer review panel recommended that current restoration actions need to be reviewed and new ones need to be identified and applied. The peer review panel suggested considering a reduction of fishing mortality, enhancement of dam passage and mitigation of dam-related fish mortality, stocking, and habitat restoration.

The last river herring stock assessment was completed in 1990 and looked at 15 river specific stocks. It concluded that five of the stocks were overfished and recruitment failure was apparent, and another four stocks were not overfished but had declined in recent years. In 2008, a river herring stock assessment was initiated by the Management Board in response to concern over population decline and the impact of ocean bycatch. Preliminary results from the current stock assessment indicate that commercial landings are at historic lows and that recent trends in stock size were inconsistent. However, stocks in some river systems appear to have suffered declines. On a coastwide basis, decreases in the mean length and age of river herring were observed. The stock assessment is scheduled to be completed in 2012.

### **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. The closure of the ocean-intercept fishery has lowered the coastwide total landings of American shad. The 2010 total landings (in-river plus ocean bycatch) reported in Compliance Reports from individual states and jurisdictions in 2010 was 563,209 pounds.

In 2010 in-river landings totaled 554,663, a 12% increase from 2009 (490,108 pounds) (Table 1). Combined landings from North Carolina and South Carolina accounted for 71% of the commercial harvest in 2010. The remainder of the in-river commercial harvest came from New Jersey, Delaware, PRFC, Virginia and Georgia. In 2010 Maine, New Hampshire, Massachusetts, Rhode Island, New York, Pennsylvania, Maryland, DC and Florida reported no directed shad harvest in their state Compliance Reports. The National Marine Fisheries Service reported landings totaling 565,944 in 2010.

Amendment 1 requires that each state annually document that the American shad ocean bycatch did not exceed 5% of the total landings (in pounds) per trip. Shad bycatch landings from ocean waters in 2010 continued to decrease, comprising 8,546 pounds, or about 1.53% of the coastwide total. Three states – Maine, New Jersey and North Carolina – reported landings of ocean bycatch. 83% of the ocean bycatch came from Maine. It is not known if any of the trips exceeded the %5 bycatch limit. Two trips in NJ resulted in reported levels of American shad harvest over the five percent trip limit (for a total of 40 pounds); for all trips where American shad were harvested the percentage of bycatch was 1.20.

**Table 1. American shad in-river commercial and ocean bycatch landings (in pounds) provided by states, jurisdictions and the National Marine Fisheries Service for 2010.**

State	State Compliance Report Landings			NMFS
	Ocean Bycatch	In-river	Total	Landings
Maine	7,140		3,034	
New Hampshire				
Massachusetts	NR		31	
Rhode Island	NR			492
Connecticut			36,232	18,327
New York			17,142	2,683
New Jersey	1,140	14,363	16,351	1,273
Pennsylvania				
Delaware	NR	5,017	3,445	5,147
Maryland	NR			3,700
PRFC		3,922	3,922	
DC				
Virginia	NR	1,070	951	4,627
North Carolina	266	233,267	167,692	233,274
South Carolina	NR	297,024	223,644	296,421
Georgia	NR	confidential		
Florida	NR			
<b>2010 Total</b>	<b>8,546</b>	<b>554,663</b>	<b>563,209</b>	<b>565,944</b>
<b>2010 Percent</b>	<b>1.52%</b>	<b>98.48%</b>		
<b>2009 Total</b>	<b>14,111</b>	<b>490,108</b>	<b>504,219</b>	<b>472,273</b>

Substantial shad sport fisheries occur on the Connecticut (CT and MA), the Hudson (NY), the Delaware (NY, PA and NJ), the Susquehanna (MD), the Santee and Cooper (SC), the Savannah (GA), and the St. Johns (FL) Rivers. Shad sport fisheries are also pursued on several other rivers in Massachusetts, Virginia, North Carolina, South Carolina, and Georgia. In 2009, recreational creel limits ranged from zero to 10 fish per day. The exception to this is the Santee River (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. In October 2006, the Management Board suspended the requirement to monitor the recreational fishery.

As of 2009, MRFSS data are no longer provided for American shad. This is a result of the unreliable design of MRFSS that focuses on active fishing sites along coastal and estuarine areas. In previous years the proportional standard error (PSE) has ranged from 0-100.1

#### **HICKORY SHAD:**

Coastwide hickory shad landings have averaged 129,346 pounds from 2000-2009. During that time period North Carolina has accounted for, on average, 76% of total coastwide landings. In 2010, Rhode Island, Connecticut, New York, Delaware, Maryland, Virginia, and North Carolina reported hickory shad commercial landings. The coastwide commercial landings increased 17% in 2010, with states landing 128,098 pounds (landings in 2009 were 109,426 pounds). North Carolina reported 84% of the total landings (108,033 pounds) (Table 2).

As of 2009, MRFSS data are no longer provided for hickory shad. This is a result of the unreliable design of MRFSS that focuses on active fishing sites along coastal and estuarine areas. In previous years the proportional standard error (PSE) has ranged from 0-100.1

#### **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. In 2010, river herring landings were reported from Maine, New Hampshire, New York, New Jersey, Delaware, Maryland, the Potomac River Fisheries Commission, North Carolina, and South Carolina, totaling 2,052,601, a 9% increase from 2008 (landings from 2009 compliance reports totaled 1,885,984 pounds) and a continued increase since 2007. The majority of the landings (64%) were reported by the state of Maine, followed by South Carolina (24%) and Virginia (9%) (Table 2).

As of 2009, MRFSS data are no longer provided for river herring (alewife or blueback herring). This is a result of the unreliable design of MRFSS that focuses on active fishing sites along coastal and estuarine areas. In previous years the proportional standard error (PSE) has ranged from 0-100.1

**Table 2. River herring (alewife and blueback herring, combined) and hickory shad commercial landings (in pounds) for 2010.**

State	River Herring		Hickory Shad
	State Compliance Report Landings	NMFS Landings	NMFS Landings
Maine	1,327,375	1,342,286	
New Hampshire	7,466	7,469	
Massachusetts			
Rhode Island			4406
Connecticut			353
New York	11,375		2
New Jersey	1,322		
Pennsylvania			
Delaware	429	665	590
Maryland	38,511	421,606	35
PRFC	898		
DC			
Virginia	172,476	151,095	14,679
North Carolina	1,765	1,765	108,033
South Carolina	490,984		
Georgia			
Florida			
<b>2010 Total</b>	<b>2,052,601</b>	<b>1,924,886</b>	<b>128,098</b>
<b>2009 Total</b>	<b>1,885,984</b>	<b>1,647,512</b>	<b>109,426</b>

#### **IV. Status of Research and Monitoring**

Under Amendment 1 (April 1999) and Amendment 2 (2009), fishery-independent and fishery-dependent monitoring programs are now mandatory for American shad and river herring. Juvenile abundance index (JAI) surveys, annual spawning stock surveys (Table 3), and hatchery evaluations are required for states and jurisdictions specified in the fishery management plan. All 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 2010.**

<b>State/River</b>	<b>Shad</b>	<b>River Herring</b>
<b>Maine</b>		
Androscoggin	22	39,689
Saco	3474	2,012
St. Croix		58,776
<b>New Hampshire</b>		
Cocheco		32,654
Oyster		19,003
Lamprey		33,327
Exeter		69
Taylor		675
Winnicut		576
<b>Massachusetts</b>		
Essex/Lawrence	13,284	
<b>Rhode Island</b>		
Gilbert Stuart		110,287
Nonquit		38,516
Buckeye Brook		8,299
<b>Pennsylvania/Maryland</b>		
Conowingo	43,362	
Holtwood	16,472	
Lehigh Dams	1910	
<b>South Carolina</b>		
St. Stephen Dam	346,879	
<b>Total 2010</b>	<b>425,403</b>	<b>343,883</b>

Atlantic sturgeon have been documented as bycatch in coastal gillnet fisheries for American shad, and Amendment I to the 1990 Interstate Fishery Management Plan for Atlantic Sturgeon (ASMFC, 1998) stipulates that jurisdictions within this Amendment's management unit shall report any estimates of Atlantic sturgeon bycatch in their shad or river herring fisheries to the Sturgeon Board, regardless of the fishery location. If the ASMFC Sturgeon Board determines that unacceptable levels of sturgeon bycatch occur in these fisheries, it will stipulate corrective measures for the jurisdictions involved (e.g. area/season closures, gear modification, etc.). If the named jurisdictions do not comply with the conservation measures recommended by the Sturgeon Board, the Sturgeon Board may intervene to close the given shad or river herring fishery under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) until the bycatch reduction measures are implemented. In 2010 there were 58 sturgeon interactions reported in shad fishing related activities and fisheries independent surveys (Table 4).

**Table 4. Atlantic sturgeon bycatch reported in shad related fishing commercial fishing activities and fisheries independent surveys in 2010.**

State	Atlantic Sturgeon Bycatch		Fishery/Survey
	Released Alive	Released Dead	
Maine			
New Hampshire			
Massachusetts			
Rhode Island	5		trawl and gillnet survey
Connecticut			
New York			
New Jersey	2*		shad gillnet fishery
Pennsylvania			
Delaware	172*		shad gillnet fishery
Maryland			
PRFC	10		pound net fishery
DC			
Virginia	10		staked gillnet survey
North Carolina	17		gillnet survey
South Carolina	15		shad gillnet fishery
Georgia	1		grift gillnet survey
Florida			
<b>2010 Total</b>	<b>58</b>		

\*extrapolated numbers

In addition to the mandatory monitoring requirements stipulated under Amendment 1, some states and 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 2010, several jurisdictions from Maine to North Carolina (including USFWS) reared American shad, hickory shad, and alewife, stocking a total of 21,891,828 American shad and 695,760 alewife (Table 5).

## V. Status of Management Measures

All state programs must implement commercial and recreational management measures or an alternative program approved by the Management Board. The current status of each state's compliance with these measures is provided in the PRT Report.

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 the 1998 stock assessment results, peer reviewers' comments, and public opinion, the Management Board voted to address in-river 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 seven 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 F30. 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 five years of Amendment 1 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. As required, each state submitted a proposal for a 40% reduction in effort by December 31, 2002. All states have closed their ocean-intercept fisheries as of January 1, 2005.

**Table 5. Stocking of Cultured Alosines in State Waters, 2010.**

State	American Shad	Alewife
<b>Maine</b>		
Graham Lake		125,000
Leonard Lake		570,760
<b>Massachusetts</b>		
Charles River	1,987,711	
<b>Pennsylvania</b>		
Susquehanna River	4,745,860	
Lehigh	347,522	
<b>Delaware</b>		
Nanticoke Tributaries	566,588	
<b>Maryland</b>		
Choptank River	4,289,272	
<b>District of Columbia</b>		
Anacostia River	2,072,411	
<b>North Carolina</b>		
Roanoke River	7,882,464	
<b>Total</b>	<b>21,891,828</b>	<b>695,760</b>

For recreational fisheries, the states voted to implement a 10 fish combined daily creel limit for American and hickory shad. In October of 2000, the Board approved a 10 fish per 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.

In addition, the states are required to submit annual reports on harvest and certain required fishery-independent and 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 response to concerns over the decline of many river herring stocks, the Management Board initiated the development of Amendment 2 to the FMP. The Amendment was approved by the Board in August 2009 and prohibits commercial and recreational 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 Management Board. These management plans must be submitted to the Technical Committee for review by January 1, 2010. Amendment 2 requires states to implement fisheries-dependent and independent monitoring programs similar to current requirements for American shad and contains recommendations to member states and jurisdictions to conserve, restore, and protect critical river herring habitat. The monitoring requirements in Amendment 2 go into effect January 1, 2010.

In February 2010, the Shad and River Herring Management Board approved Amendment 3, which revises American shad regulatory and monitoring programs. The Amendment was developed in response to the 2007 American shad stock assessment, which found that most American shad stocks were at all time lows and did not appear to be recovering. The Amendment prohibits state waters commercial and recreational fisheries beginning January 1, 2013, unless a state or jurisdiction has a sustainable management plan reviewed by the Technical Committee and approved by the Management Board. These management plans must be submitted to the TC for review by August 1, 2011. The Amendment defines a sustainable fishery as “a commercial and/or recreational fishery that will not diminish the potential future stock reproduction and recruitment.” Submitted plans must clearly demonstrate that the state’s or jurisdiction’s American shad fisheries meet this new definition of sustainability through the development of sustainability targets which must be achieved and maintained. The Amendment allows any river systems to maintain a catch and release recreational fishery. States and jurisdictions are also required to identify local significant threats to American shad critical habitat and develop a plan for mitigation and restoration. The monitoring requirements under Amendment 3 go into effect January 1, 2011.

## **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 biannual 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.
- Evaluate predation by striped bass as a factor of mortality for alosines.
- Evaluate fish passage efficiency at all fishways.
- Conduct studies to improve fish passage design criteria.
- Quantify fishing mortality (in-river, ocean bycatch, bait fisheries) for major river stocks after ocean closure of directed fisheries.

### **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 tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock.
- 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.
- Suggest hard limits and range levels for water quality deemed appropriate and defensible for all alosines.

### **Low Priority**

- Review studies dealing with the effects of acid deposition on anadromous alosines.
- 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.
- Conduct and evaluate historical characterization of socio-economic development (potential pollutant sources and habitat modification) of selected shad rivers along the east coast.
- 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**

Upon review of the state annual reports, the PRT has determined that all states have fully implemented the required provisions of Amendment 1 to the Shad and River Herring Fishery Management Plan. The PRT notes, however, that some states did not document that landings were less than 5% in pounds per trip and some states did not include the Harvest and Loss table as required in Table 10.1 D in Amendment 1.

Maine, New Hampshire and Massachusetts have requested *de minimis* status for the 2010 American shad fisheries. These states continue to meet the standards for commercial *de minimis* as defined in Amendment 1 and clarified in Addendum I. Qualification for *de minimis* status was calculated by using the highest reported landings for 2009 based upon data from the 2010 State Compliance Reports and the National Marine Fisheries Service. The following states had landings that were reported to be less than 1% of the coast-wide commercial landings for American shad: Maine, New Hampshire, Massachusetts, Rhode Island, Pennsylvania, Maryland, Delaware, PRFC, D.C., Virginia, and Florida.

## **VIII. Recommendations of Plan Review Team**

1. Several of the states did not report all of the monitoring requirements listed under Amendment 2. 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. The most common omissions were: variance, length frequency, age frequency and degree of repeat spawning.
2. The PRT requests that all states check with law enforcement agencies and their freshwater counterparts when reporting poaching, bycatch or other losses.
3. The PRT requests that for those states and jurisdictions that share monitoring should report who was responsible for the required monitoring in lieu of not including the information.
4. The PRT requests the Board task the TC with review of the following:
  - a. Provide a spreadsheet on how to accurately determine that variance.
  - b. A study on the CT sampling methods in order to determine if the sampling of the fishway does in fact yield equivalent results to sampling of the commercial fishery and also to propose a timeframe for future review of this method.
  - c. A study on the minimum sample size recommended in a survey design.
  - d. A consistent definition of a repeat spawner mark