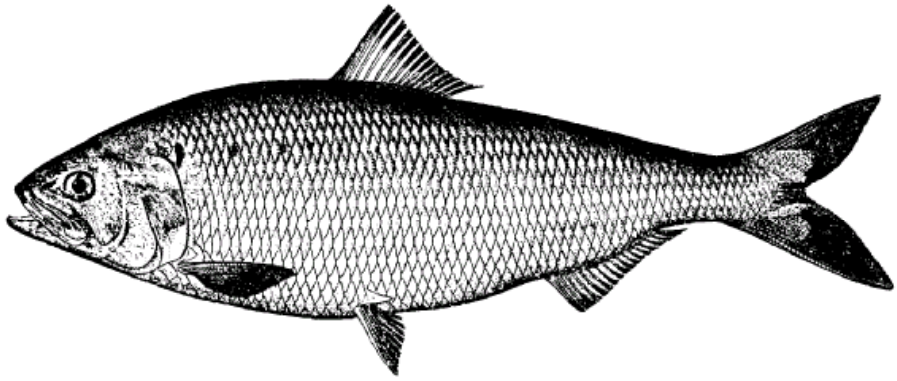
REVIEW OF THE
INTERSTATE FISHERY MANAGEMENT PLAN FOR
SHAD AND RIVER HERRING *(Alosa spp.)*
2005 FISHING YEAR



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Prepared by

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

I. Status of the Fishery Management Plan

Date of FMP Approval:	October 1985
Amendments:	Amendment 1 (April 1999)
Addenda:	Technical Addendum #1 (February 9, 2000) Addendum I (August 28, 2002)
Management Unit:	Migratory stocks of American shad, hickory shad, alewife, and blueback herring from Maine through Florida
States With Declared Interest:	Maine through Florida, including the Potomac River Fisheries Commission and the District of Columbia
Active Boards/Committees:	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 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

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

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 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. 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 alsosines; 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.

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 2007.

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. Based upon landings data provided in Compliance Reports from individual states and jurisdictions, an all-time low has been reached in 2005 with landings of 680,061 pounds (Table 1). This new low is likely a direct result of the closure of all ocean-intercept fisheries. Combined landings from New Jersey, Delaware, North Carolina and South Carolina accounted for 84.3% of the commercial harvest in 2005. No directed shad harvest was reported in state Compliance Reports

from Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, Pennsylvania, Maryland, the District of Columbia, and Florida. The National Marine Fisheries Service reported no harvest from Massachusetts, Pennsylvania, the District of Columbia, South Carolina, Georgia, and Florida .

Shad bycatch landings from ocean waters in 2005 decreased greatly from 2004 levels, comprising 7,411 pounds, or about 1% of the coastwide total. Only five states—Maine, New Hampshire, New York, New Jersey, and North Carolina—reported landings of ocean bycatch.

Table 1. Commercial landings (lbs.) of American shad reported by ASFMC jurisdictions in 2005.

State	State Compliance Report Landings			NMFS Landings
	Ocean Bycatch	Inriver	Total	
Maine	194	-	194	281
New Hampshire	25	-	25	25
Massachusetts	-	-	-	
Rhode Island	-	-	-	670
Connecticut			-	5,325
New York	4,299	52,485	56,784	4,299
New Jersey	2,670	87,984	90,654	90,932
Pennsylvania	-	-	-	
Delaware	-	123,610	123,610	149,599
Maryland	-	-	-	2,983
PRFC	-	6,019	6,019	
DC	-	-	-	
Virginia (all tribal landings)	-	3,959	3,959	3,877
North Carolina	223	191,240	191,463	32,239
South Carolina	-	167,513	167,513	
Georgia	-	39,840	39,840	
Florida	-	-	-	
Total	**7,411**	**672,650**	**680,061**	**290,230**
Percent	**1%**	**99%**		
2004 Total	338,792	960,740	1,299,469	
2004 Percent	26%	74%		

Note: NMFS Landings data has not yet been published.

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 2005, 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.

MRFSS Data for American Shad are unreliable due to the design of MRFSS that focuses on active fishing sites along coastal and estuarine areas. For 2005, MRFSS does not report the harvest or catch of any American shad.

Several creel surveys were completed in 2005 including the Hudson River (NY), the Connecticut River (CT), the Susquehanna River below the Conowingo Dam (MD), the Tar-Pamlico River (NC), the Trailrace Canal of the Cooper River (SC), the Ogeechee River (GA), and the St. John's River (FL). Of the 6,582 shad caught on the Hudson, anglers harvested only 508, a retention rate of 8%. Catch per unit effort ranged from 0.123 fish/hour in early spring to 0.585 fish/hour in late spring. Anglers in Connecticut that targeted shad were successful 32% of the time when fishing from shore and boats were successful 41.2% of the time. Total effort in Connecticut has declined 75% since the last creel survey conducted in 2000, while total catch shows a similar decline of 73.2%. In Maryland, the catch and release fishery for American shad reported a catch rate of 0.49 American shad per hour. Anglers on the Tar-Pamlico River had a total catch of 7,575 shad (combined American and hickory) with an estimated harvest of 1,212 fish (American shad = 1,192 fish), and a success rate of 1.6 fish caught per angling hour. The estimated harvest for the Cooper River recreational fishery was 14,629 fish, 65% of which were males. Fishermen surveys report that catch per hour as 1.60 shad and that 22% of fish caught were released on the Cooper River. The harvest on the Ogeechee River from January 30 through April 2, 2005, was 442 fish (379.9 pounds) with effort estimated to be 1754 hours. 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:

The Potomac River Fisheries Commission, North Carolina, South Carolina, and Georgia reported hickory shad commercial landings in 2005. North Carolina reported the highest landings with 173,779 pounds. In 2005, the coast-wide commercial landings for hickory shad were 179,919 pounds (from 2006 State Compliance Reports). This is a decrease from the 2004 total preliminary landings of 187,464 pounds.

MRFSS Data for hickory shad are unreliable due to the design of MRFSS that focuses on active fishing sites along coastal and estuarine areas. For 2005, MRFSS does not report the harvest or catch of any hickory shad.

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 2005, river herring landings were reported from Maine, New Hampshire, Massachusetts, New York, New Jersey, Delaware, PRFC, and North Carolina, totaling 692,827 pounds, down from 2004's total of 2,120,881 (from 2006 State Compliance Reports).

MRFSS Data for river herring are unreliable due to the design of MRFSS that focuses on active fishing sites along coastal and estuarine areas. For 2005, MRFSS does not report the harvest or catch of any river herring.

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, 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. 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 2005, several jurisdictions from Maine to North Carolina (including USFWS) reared American shad, hickory shad, alewife, and blueback herring, stocking a total of 43,175,148 fish in (Table 3).

Table 2. Shad and River Herring Fish Passage Counts at Select Dams – 2005.

State	Shad	River Herring
Maine		
Androscoggin	0	25,846
Saco	744	388
St. Croix	0	22
Massachusetts		
Essex/Lawrence	6,456	98
Holyoke	116,523	534
Rhode Island		
Potter Hill	151	
Pennsylvania/Maryland		
Conowingo	72,822	4
Holtwood	34,198	
Safe Harbor	25,425	
York Haven	1,772	
Easton Dam	675	22
Chain Dam	324	
South Carolina		
St. Stephen Dam	215,428	

Total	474,518	26,914

Table 3. Stocking of Cultured Shad and Alewife in 2005.

State	American Shad	Hickory Shad	Alewife	Blueback
Maine				
Graham Lake			90,240	
Androscoggin R.	96,551			
Kennebec R.	1,106,343			
New Hampshire R.	11,850			
Pennsylvania				
Susquehanna River	3,570,675			
Lehigh River	668,792			
Conowingo Reservoir		5,355,381		
Ridley Creek		600,000		
Pennypack Creek		8,049,377		
Delaware River		3,200,000		
Delaware				
Nanticoke Tributaries	287,000			
Maryland				
Choptank River	193,000 (larvae)	2,430,000 (larvae)		
	170,000 (juvenile)	140,000 (juvenile)		
Patuxent River	707,500 (larvae)	1,160,000 (larvae)		
	93,000 (juvenile)	135,000 (juvenile)		
Nanticoke River	530,000 (larvae)	450,000 (larvae)		
	100,000 (juvenile)	40,000 (juvenile)		
Marshyhope River		370,000 (larvae)		
		66,000 (juvenile)		
Tuckahoe River		37,000 (juvenile)		
Virginia				
Appomattox River	1,119,159			
James River	4,313,947			
Rappahannock River	2,074,370			
Hazel River	1,297,506			
Occoquon River	229,007			
Potomac River	719,694			
Slate River	559,510			
Rivanna River	410,261			
Herring Creek			3,162	9,400
Kimages Creek				208,589
North Carolina				
Roanoke River	2,572,834			
Total	**20,830,999**	**22,032,758**	**93,402**	**217,989**

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 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 inriver 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 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 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.

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 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. 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 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 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 Tables 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 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.

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 (inriver, 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 Hampshire has not fully implemented the required provisions of Amendment 1 to the Shad and River herring Fishery Management Plan. Specifically, New Hampshire reports that landings of shad from the ocean fishery exceed 5% in pounds per trip for one of trips in 2005. The PRT notes, however, that other states did not document that landings were less than 5% in pounds per trip. Thus, other states may have not fully implemented the required provisions of Amendment 1 to the Shad and River herring Fishery Management Plan as well.

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 have been granted *de minimis* status in the past and they request the same status for this year. 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 2005 based upon data from the 2006 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, Connecticut, Pennsylvania, Maryland, PRFC, D.C., and Florida.

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. Several of the states did not report all of the monitoring requirements listed under Amendment 1, Technical Addendum #1, and Addendum I. 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 recommends that the Technical Committee and Management Board consider an addendum to Amendment 1 to modify the ocean bycatch sub-sampling requirement. The PRT believes that low levels of bycatch, such as were landed in 2005, make sampling a difficult task for states to undertake. The PRT questions the value of collecting this data because the minimal landings and the inability to determine stock composition of the landed fish. States should still be required to "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" as is stated in Amendment 1 Section 4.1.A.

4. 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.

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 or provided an incomplete table. According to Amendment 1, Table 10 "Format Required for Annual State Report," the Harvest and Losses Table should have the following information:

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".

An example of the format for the table would be:

Harvest and Losses	Number	Weight (pounds)	Mean weight per fish (pounds)
Commercial			
Gear			
Set Gill Nets			
Drift Gill Nets			
Recreational			
Gear			
Hook and Line			
Fish Passage Mortality			
Discarded Males			
Brood Stock Capture			
Research Losses			

6. The PRT recommends that states report all stocking information. The value of the Hatchery Evaluation requirement is limited without the data on stocking of shad and river herring. The

PRT would recommend that all states that stock shad and river herring be required to put stocking data in their compliance reports.

7. In light of the closure of all ocean intercept fisheries for American shad along the Atlantic coast, the PRT recommends that Table 3 in Addendum I be modified. Currently, the table has fishery-dependent monitoring requirements that pertain to directed harvest of American shad from the Atlantic Ocean. The requirement to participate in an ocean landings stock composition study should be eliminated.