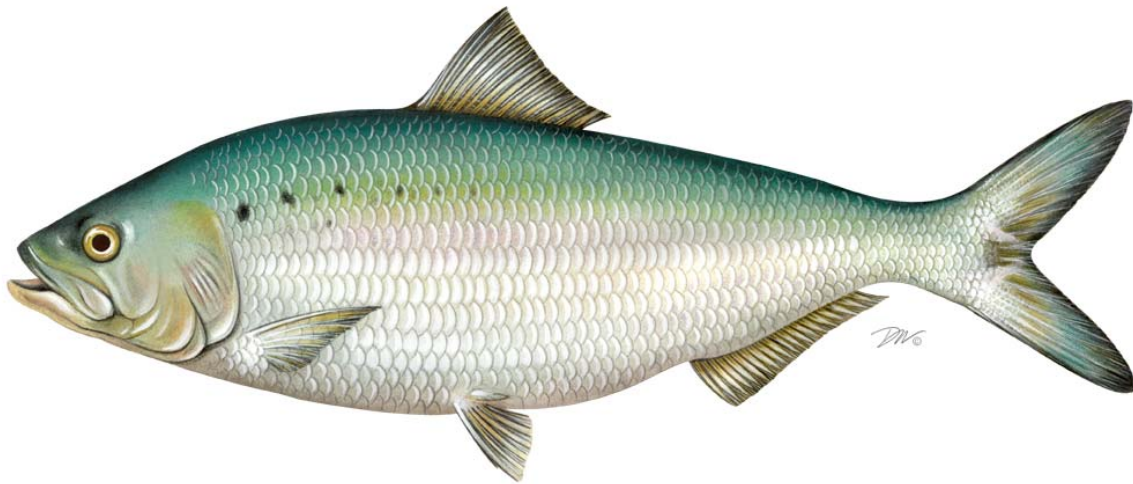


**REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR
SHAD AND RIVER HERRING (*Alosa spp.*)
2012**



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Shad & River Herring Plan Review Team

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DRAFT 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 2 (August 2009) Amendment 3 (February 2010)	Amendment 1 (April 1999)
<u>Addenda:</u> Addendum I (August 2002)	Technical Addendum #1 (February 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, 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 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 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 commercial and recreational river herring 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. 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. Sustainable fishery management plans have been approved by the Management Board for Maine, New Hampshire, New York, North Carolina and South Carolina (Table 1).

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 shad commercial and recreational fisheries in state waters 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. Sustainable fishing plans have been approved by the Management Board for Florida, Georgia, South Carolina, North Carolina, the Potomac River Fisheries Commission, and the Delaware River Basin Fish and Wildlife Management Cooperative (on behalf of New York, Delaware, New Jersey, and Pennsylvania) and Connecticut (Table 1). All states and jurisdictions are also required to identify local significant threats to American shad critical habitat and develop a plan for mitigation and restoration.

Table 1. States with approved sustainable fishery management plans (SFP) for river herring or shad.

State	River Herring SFP	Shad SFP
Maine	Approved	
New Hampshire	Approved	
Massachusetts		
Connecticut		Approved
Rhode Island		
Pennsylvania		Approved
New York	Approved	Approved
New Jersey		Approved
Delaware		Approved
PRFC		Approved
Maryland		
Virginia		
North Carolina	Approved	Approved
South Carolina	Approved	Approved
Georgia		Approved
Florida		Approved

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.

A 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 new river herring stock assessment was initiated by the Management Board in response to concern over population decline and the impact of ocean bycatch. The stock assessment report concluded that, of the 52 stocks of alewife and blueback herring for which data were available, 23 were depleted relative to historic levels, one stock was increasing, and the status of 28 stocks could not be determined because the time-series of available data was too short. Estimates of abundance and fishing mortality could not be developed because of the lack of adequate data. The “depleted” determination was used instead of “overfished” and “overfishing” because of the many factors that have contributed to the declining abundance of river herring, which include not just directed and incidental fishing, but also habitat loss, predation, and climate changes.

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 2012 total landings reported in ASMFC Compliance Reports from individual states and jurisdictions in 2011 was 635,960 pounds, which is a 1% decrease from landings in 2011 (642,535 pounds).

Landings from North Carolina and South Carolina accounted for 37% and 47% of the commercial harvest, respectively, in 2012. The remainder of the harvest came from Connecticut, New York, New Jersey, PRFC, and Virginia. In 2012 New Hampshire, Massachusetts, Rhode Island, Pennsylvania, Delaware, Maryland, District of Columbia and Florida reported no directed shad harvest in their state Compliance Reports.

Table 2. American shad and river herring in-river commercial and ocean bycatch landings (in pounds) provided by states, jurisdictions and the NOAA Fisheries for 2012.

	American Shad	River Herring	Hickory Shad
Maine⁴		1,606,535	
New Hampshire		2,681	
Massachusetts			
Rhode Island			
Connecticut	61,623		
New York¹	1,485	16,965	
New Jersey²	28,120	84	924
Pennsylvania			
Delaware			
Maryland		290	
D.C.			
PRFC	4,742		446
Virginia	4,601		999
North Carolina	235,861	678	65,645
South Carolina³	299,528	163,076	
Georgia⁴			
Florida			
Total	635,960	1,790,309	68,014

¹New York American shad landings are from ocean bycatch

²Includes in-river and coastal harvest

³American shad landings include hickory shad

⁴Georgia & Maine (shad) landings are confidential

Substantial shad recreation fisheries occur on the Connecticut (CT and MA), Hudson (NY), Delaware (NY, PA and NJ), Susquehanna (MD), Santee and Cooper (SC), Savannah (GA), and St. Johns (FL) Rivers. Shad recreational fisheries are also pursued on several other rivers in Massachusetts, Virginia, North Carolina, South Carolina, and Georgia. In 2011, 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.

HICKORY SHAD:

In 2012, New Jersey, PRFC, Virginia and North Carolina reported hickory shad landings. North Carolina accounts for a vast majority of the landings with 97%. The coastwide commercial landings were 68,041 pounds in 2012, a 27% decrease from 2011 landings (93,334 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.

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 2012, river herring landings were reported from Maine, New Hampshire, New York, New Jersey, Delaware, Maryland, the Potomac River Fisheries Commission, Virginia, North Carolina, and South Carolina, totaling 1,790,309 pounds.

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.

IV. Status of Research and Monitoring

Under Amendment 2 (2009) and Amendment 3 (2010), 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. 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 2012.

State/River	Shad	River Herring
Maine		
Androscoggin	11	170,191
Saco	6404	27,858
Kennebec	5	179,357
Sebeccook	163	1,703,520
St. Croix		36,168
New Hampshire		
Cochecho		27,608
Oyster		2,573
Lamprey		86,862
Exeter		378
Taylor		92
Winnicut		5
Massachusetts		
Merrimack	21,396	
Rhode Island		
Gilbert Stuart		107,901
Nonquit		60,132
Buckeye Brook		90,625
Pennsylvania/Maryland/Delaware		
Susquehanna (Conowingo)	23,629	52
Susquehanna (Holtwood)	4,238	
South Carolina		
St. Stephen Dam	150,082	
Total 2012	205,928	
Total 2011	307,793	

In addition to the mandatory monitoring requirements stipulated under Amendments 2 and 3, some states and jurisdictions continue important research initiatives for these species. For example, 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 2012, several jurisdictions from reared American shad, hickory shad, and alewife, stocking a total of 15,727,734 American shad and 380,663 alewife (Table 4).

Table 4. Stocking of Alosines in State Waters, 2012.

State	American Shad	Alewife
Maine		
Androscoggin		138,941
Kennebec		88,092
Union River		153,630
Massachusetts		
Merrimack	2,100,000	
Charles River	3,300,000	
Pennsylvania		
Susquehanna	3,438,500	
Lehigh	301,112	
Schuykill	200,429	
North Carolina		
Roanoke River	4,800,118	
South Carolina		
Edisto River	2,465	
Santee River	1,585,110	
Total	15,727,734	380,663

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 Shad and River Plan Review Team Report.

As noted in Section I, the Management Board determined that the original FMP and its lack of mandatory measures were insufficient for protecting and restoring alosine stocks along the East Coast. Accordingly, the 1985 FMP was amended in 1999. The Plan Development Team (PDT) developed Amendment 1 to expedite recovery of American shad populations and maintain current regulations in the hickory shad and river herring fisheries. In addition, the Management Board voted to phase out all ocean intercept fisheries for American shad within five years of Amendment 1 implementation. 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 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 2009 the Board approved Amendment 2, which was initiated in response to concerns over river herring stock. 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 and requires states to implement fisheries-dependent and independent monitoring programs. The monitoring requirements in Amendment 2 go into effect January 1, 2010. Sustainable fishery management

plans have been approved by the Management Board for Maine, New Hampshire, New York, North Carolina and South Carolina.

In 2010, the Board approved Amendment 3, which revised American shad regulatory and monitoring programs under Amendment 1. 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 the development of a Sustainable Fishing Management Plan (SFP) for any jurisdiction that will maintain a commercial or recreational fishery after January 1, 2013 (with the exception of catch and release recreational fisheries). The monitoring requirements under Amendment 3 go into effect January 1, 2011. SFPs have been approved by the Management Board for Florida, Georgia, South Carolina, North Carolina, the Potomac River Fisheries Commission, Connecticut and the Delaware River Basin Fish and Wildlife Management Cooperative (on behalf of New York, Delaware, New Jersey, and Pennsylvania).

V. Prioritized Research Needs

Fishery-Dependent Priorities

High

- Expand observer and port sampling coverage to quantify additional sources of mortality for alosine species, including bait fisheries, as well as rates of bycatch in other fisheries to reduce uncertainty.¹

Moderate

- Identify directed harvest and bycatch losses of American shad in ocean and bay waters of Atlantic Maritime Canada.

Low

- Identify additional sources of historical catch data of the US small pelagic fisheries to better represent earlier harvest of river herring and improve model formulation.

Fishery-Independent Priorities

Moderate

- Develop demersal and pelagic trawl CPUE indices of offshore river herring biomass.

Modeling / Quantitative Priorities

High

- Conduct population assessments on river herring, particularly in the south.²
- Analyze the consequences of interactions between the offshore bycatch fisheries and population trends in the rivers.
- Quantify fishing mortality for major river stocks after ocean closure of directed fisheries (river, ocean bycatch, bait fisheries).
- Improve methods to develop biological benchmarks used in assessment modeling (fecundity-at-age, sex specific mean weight-at-age, partial recruitment vector/maturity schedules) for river herring and American shad of both semelparous and iteroparous stocks.
- Improve methods for calculating M.

¹ A prior statistical study of observer allocation and coverage should be conducted (see Hanke et al. 2012).

² A peer reviewed river herring stock assessment was completed in 2012 by the ASMFC.

Moderate

- Consider standardization of indices with a GLM to improve trend estimates and uncertainty characterization.
- Explore peer-reviewed stock assessment models for use in additional river systems as more data become available.

Low

- Develop models to predict the potential impacts of climate change on river herring distribution and stock persistence.

Life History, Biological, and Habitat Priorities

High

- Conduct studies to quantify and improve fish passage efficiency and support the implementation of standard practices.
- Assess the efficiency of using hydroacoustics to repel alosines or pheromones to attract alosines to fish passage structures. Test commercially available acoustic equipment at existing fish passage facilities. Develop methods to isolate/manufacture pheromones or other alosine attractants.
- Investigate the relationship between juvenile river herring/American shad and subsequent year class strength, with emphasis on the validity of juvenile abundance indices, rates and sources of immature mortality, migratory behavior of juveniles, and life history requirements.
- Develop an integrated coastal remote telemetry system or network that would allow tagged fish to be tracked throughout their coastal migration and into the estuarine and riverine environments.
- Verify tag-based estimates of American shad.
- Continue studies to determine river herring population stock structure along the coast and enable determination of river origin of catch in mixed stock fisheries and incidental catch in non-targeted ocean fisheries. Spatially delineate mixed stock and Delaware stock areas within the Delaware system. Methods to be considered could include otolith microchemistry, oxytetracycline otolith marking, genetic analysis, and/or tagging.³
- Validate the different values of M for river herring and American shad stocks through shad ageing techniques and repeat spawning information.
- Continue to assess current ageing techniques for river herring and American shad, using known-age fish, scales, otoliths, and spawning marks. Conduct biannual ageing workshops to maintain consistency and accuracy of ageing fish sampled in state programs.⁴
- Summarize existing information on predation by striped bass and other species. Quantify consumption through modeling (e.g., MSVPA), diet, and bioenergetics studies.
- Refine techniques for tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock.

Moderate

- Determine the effects of passage barriers on all life history stages of American shad and river herring. Conduct studies on turbine mortality, migration delay, downstream passage, and sub-lethal effects.

³ Genetic research currently underway in combination with otolith chemistry.

⁴ River herring ageing workshop to occur in 2013.

- Evaluate and ultimately validate large-scale hydroacoustic methods to quantify river herring and American shad escapement in major river systems.
- Conduct studies of egg and larval survival and development.
- Conduct studies on energetics of feeding and spawning migrations of American shad on the Atlantic coast.
- Resource management agencies in each state shall evaluate their respective state water quality standards and criteria and identify hard limits to ensure that those standards, criteria, and limits account for the special needs of alosines. Primary emphasis should be on locations where sensitive egg and larval stages are found.
- Encourage university research on hickory shad.
- Develop better fish culture techniques, marking techniques, and supplemental stocking strategies for river herring.

Low

- Characterize tributary habitat quality and quantity for Alosine reintroductions and fish passage development.
- States should identify and quantify potential shad and river herring spawning and nursery habitat not presently utilized, including a list of areas that would support such habitat if water quality and access were improved or created, and analyze the cost of recovery within those areas. States may wish to identify areas targeted for restoration as essential habitat.¹¹
- Investigate contribution of landlocked versus anadromous produced river herring.

VII. PRT Recommendations

State Compliance

All states with a declared interest in the management of shad and river herring have submitted reports and have regulations in place that meet the requirements of the Interstate Fisheries Management Plan for Shad and River Herring. The PRT notes, however, that some states were not able to complete the required fishery independent monitoring due to budgetary restrictions.

1. Several of the states did not report all of the monitoring requirements listed under Amendments 2 and 3 (see PRT Report). 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 (most common omissions were: variance, length frequency, age frequency and degree of repeat spawning).
2. 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.
3. The PRT requests the Board task the TC with the following tasks:
 - a. Review of recreational compliance and the ability of states to provide recreational data. A majority of states rely on MRIP for catch estimates and do not have survey data of their own.
 - b. Review methods to ensure states submit data that were previously unavailable (if a state is still completing sampling when the compliance report is turned in, a follow-up version should be sent when the sampling is completed).

De Minimis Status

Maine, New Hampshire and Massachusetts have requested *de minimis* status for the 2013 American shad fisheries. New Hampshire and Massachusetts also requested *de minimis* status for the 2013 river herring fisheries. These states continue to meet the standards for commercial *de minimis* as defined in Amendment 2 and Amendment 3. 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, New York, Pennsylvania, Delaware, Maryland, PRFC, D.C., Virginia, and Florida. All of the above states except Maine and New York also had landings that were reported to be less than 1% of the coast-wide commercial landings for river herring. Connecticut, New Jersey and North Carolina also qualify for *de minimis* status for river herring.