Admin #584

DRAFT Merrimack River Shad Plan
Joe_McKeon to: Ericp Nelson 01/19/2010 02:31 PM

From: Joe_McKeon@fws.gov
To: Ericp Nelson/R1/USEPA/US@EPA
History: This message has been replied to.

1 attachment

Mrrmk Shad Plan C latest_1.19.2010.doc

Hello Eric:

While we are still working on our DRAFT American Shad Plan for the Merrimack River, I realize you are most interested in the information. I have attached the DRAFT. I does need additional work, however it will give you a sense regarding how we plan to move ahead in the watershed with shad production, stocking etc. Take a look and give me a call with questions. We'll continue to work on the Plan and hope to have a final document in early Spring.

(See attached file: Mrrmk Shad Plan C latest_1.19.2010.doc)

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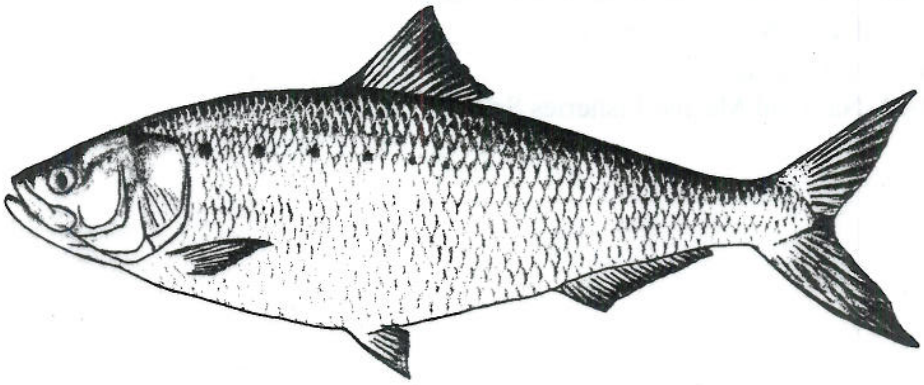
A PLAN FOR THE RESTORATION OF AMERICAN SHAD

MERRIMACK RIVER WATERSHED



Prepared by the

Technical Committee for Anadromous Fishery Management of the Merrimack River Basin

2010

Preface

This Plan was developed by the Technical Committee for Anadromous Fishery Management of the Merrimack River Basin to provide a framework for the restoration of American shad to the Merrimack River watershed. The migratory American shad is an inter-jurisdictional fish species with significant commercial and recreational value, and the Merrimack River is an inter-jurisdictional watershed. Therefore, a successful restoration effort requires the cooperation of numerous entities including government and non-government organizations. The interagency Technical Committee was formed to address the restoration of anadromous fish in the Merrimack River Watershed, and includes representatives from the following government organizations:

New Hampshire Fish and Game Department
Massachusetts Division of Fisheries and Wildlife
Massachusetts Division of Marine Fisheries
U.S. Fish and Wildlife Service
U.S. Forest Service
NOAA-National Marine Fisheries Service

Introduction

The development of the Merrimack River Anadromous Fish Restoration Program Strategic Plan and Status Review of 1997 (MRTC 1997) formalized coordinated strategies and actions for rebuilding American shad stocks within the Merrimack River watershed. This document (Plan) represents an update of the 1997 plan specific to American shad (*Alosa sapidissima*). The Technical Committee intended that this Plan be concise and flexible, whereby objectives, strategies, and related management measures would be adaptive based on new information and enhanced understanding of current information needs.

The anadromous American shad was historically an important fish resource in the Merrimack River. In pre-colonial times, the shad run extended from the mouth of the Merrimack River in Newburyport, MA to Lake Winnipesaukee in central NH (223 rkm). Shad provided an important fish resource initially for Native Americans and subsequently for colonial settlers (Marston and Gordon 1938, and Meader 1869). As late as 1841, records indicate the landing of 365,000 adult shad in the Merrimack River (Stolte 1981). The construction of dams on the Merrimack River in the 1800s combined with pollution and overfishing severely impacted anadromous fish populations in the river and likely extirpated the annual shad run upstream of the Essex Dam, Lawrence, MA. It is possible that a remnant population of American shad survived downstream of the dam.

Essex Dam was constructed in 1848, and is the downstream-most mainstem barrier on the Merrimack River (rkm 48), located approximately 10 km above the head of tide (Figure 1). In 1983, the dam was outfitted with a fish lift in the tailrace of the new Lawrence Hydroelectric Project (Lawrence) [Federal Energy Regulatory Commission (FERC) Project No. 2800] to provide upstream fish passage for returning anadromous fish. Pawtucket Dam, Lowell, MA was constructed in the early 1800s and is the site of the Lowell Hydroelectric Project [(Lowell), FERC No. 2790]; it is located 22 km upstream of Essex Dam at rkm 70. Fish passage facilities at Lowell include (1) a dual vertical-slot fish ladder located at the upper end of a 2 km bypass reach from the tailrace at the dam, and (2) a fish lift in the Boott Hydroelectric Station that moves fish into a canal system leading to the Pawtucket Dam headpond. Both structures became operational in 1986. Boott Station is the main generating station at Lowell and is licensed as a run-of-river hydroelectric facility similar to Lawrence. There is also a pool-and-weir fishway at Amoskeag Dam (Amoskeag) in Manchester, NH (rkm 119), the next dam upstream of Lowell. No fishways currently exist at the next two upstream dams, Hooksett (Hooksett) and Garvins Falls (Garvins) at rkm 50.4 and 54.2, respectively.

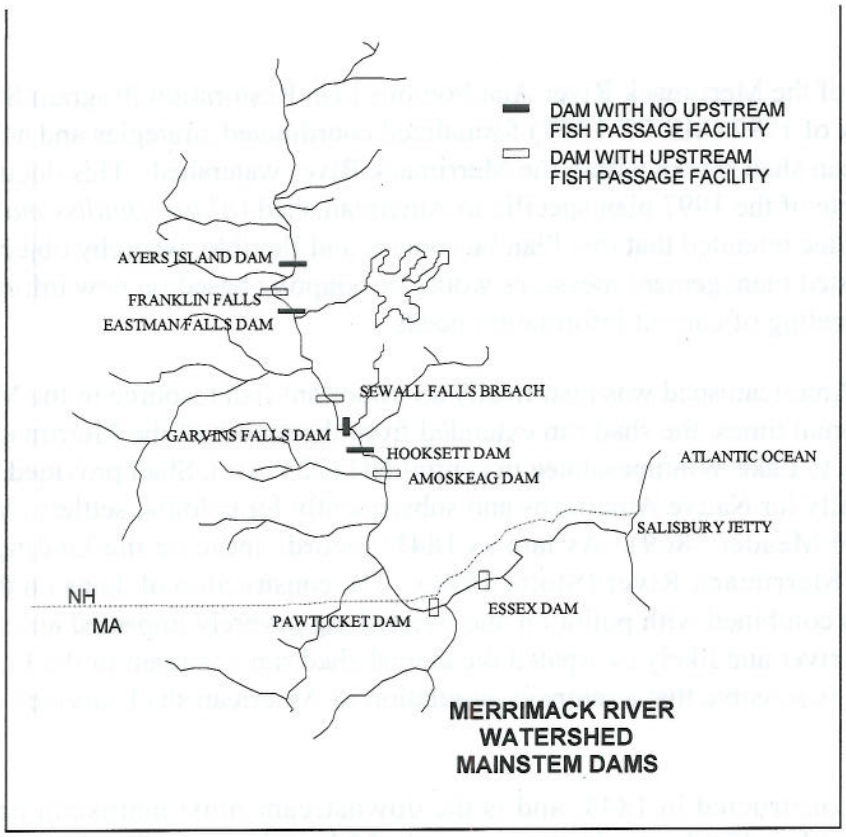


Figure 1. Map of Merrimack River watershed showing main stem dams and major tributaries.

The American shad population is identified for restoration by the interagency Anadromous Fish Restoration Program for the Merrimack River [New Hampshire Fish and Game Department (NHFG), Massachusetts Division of Marine Fisheries (MDMF), Massachusetts Division of Fisheries and Wildlife (MDFW), U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), and (NOAA) National Marine Fisheries Service (NMFS)], which was formed in 1969. Restoration activities include coordinating installation, evaluation, operation, and maintenance of fish passage and capture facilities at targeted hydroelectric dams for returning adults and juvenile out-migrants. Additional activities include the cqapture and transport of adult donor stocks to upriver spawning locations, and the hatchery propagation, marking, and release of fry for several diadromous fish species, including American shad (MRTC 1997).

The 1986 *Merrimack River Basin Fish Passage Action Plan for Anadromous Fish* (FPAP) stipulated that for Hooksett and Garvins, fish passage facilities were to be operational within five years following the passage of 15,000 American shad at the next downstream dam (i.e. fish target

number passage at Amoskeag would warrant fishway construction at Hooksett and so forth). However, as part of the recent relicensing of the Merrimack River Hydroelectric Project (FERC No. 1863 - which includes Amoskeag, Hooksett, and Garvins Falls dams), a Section 18 Fishway Prescription was stipulated by the USFWS (USFWS 2006).

The Prescription is based on shad habitat availability and estimated shad production in each mainstem reaches and various tributaries. Based on these estimates, the Prescription requires fishway construction at Hooksett after the passage of 9,500 shad at Amoskeag, and fishway construction at Garvins after the passage of 9,800 shad at Hooksett [1]. At both dams, upstream fishways should be installed and operational within three years after reaching the respective target numbers.

The FPAP further describes time-lines and/or fish passage target numbers at dams in the watershed that would require the construction of fish passage facilities. Generally, identified fish passage requirements and measures in the FPAP have not changed since the plan was developed. Exceptions include hydroelectric projects where FERC relicensing agreements have superceded or modified requirements, and/or where fish passage measures have been implemented (i.e. fishway construction, dam removal, decommissioned project) since 1986 (MRTC 1997). The FPAP deferred the need for fish passage at Eastman Falls Dam (Eastman, rkm 72) on the Pemigewasett River until year 2010, and, as such, that need is re-evaluated here.

Our Plan identifies nine mainstem river reaches (Reaches I – IX; Table XX, Kuzmeskus et al 1982) and nine major tributaries where shad spawning and nursery habitat is known to exist. Mainstem river reaches are designated as follows: Reach I: Tip of Salisbury, MA jetty, rkm 0 to Essex Dam (Lawrence), rkm 48; Reach II: Lawrence to Pawtucket Dam (Lowell), rkm 70; Reach III: Lowell to Amoskeag Dam (Amoskeag), rkm 119; Reach IV: Amoskeag to Hooksett Dam (Hooksett), rkm 50.4; Reach V: Hooksett to Garvis Falls Dam (Garvins), rkm 54.2; Reach VI: Garvins to Sewell Falls Dam (Sewell, breached), rkm 60.7; Reach VII: Sewell to Eastman Falls Dam (Eastman), rkm 72; Reach VIII: Eastman to Franklin Falls Dam (Franklin), rkm 73; and Reach IX: Franklin to Ayers Island Dam (Ayers), rkm 80.4.

Our Plan identifies the prevalence of shad spawning and nursery habitat in the river reaches (Reaches VIII – IX) from Eastman to Ayers Island Dam [(Ayers, rkm 80.4; Table XX; Kuzmeskus et al 1982]. However, we accept the continued deferred status for upstream fish passage measures at Eastman in this Plan with expectation that if future improved shad stock rebuilding in the Eastman to Franklin/Ayers reaches occurs, then it would promote consideration of measures necessary at Eastman.

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1. The Prescription provides an alternative trigger for construction of upstream fishways at Garvins if nature-like or rock-ramp type fishways are constructed at Hooksett, as these types of fishways would not allow for enumeration of shad passing Hooksett. Under this scenario, the trigger for fishway construction at Garvins would be the passage of 19,300 shad at Amoskeag.

Table XX. Estimates of American shad nursery habitat units (one unit = 100 yd^2) and in surveyed rivers and river reaches in the Merrimack River Watershed.

River Reach	River	No. of Units	No. of Square Yards	Acres	Adult Shad (60/acre)	Adult Shad (98/acre)	Percent of Total
I	Merrimack	98,146	9,814,600	2,027.82	121,669	198,726	21.42
II	Merrimack	40,620	4,062,000	839.26	50,356	82,247	8.86
	Concord	4,348	434,800	89.84	5,390	8,804	0.95
II	Merrimack	98,042	9,804,200	2,025.67	121,540	198,516	21.39
	Nashua	8,695	869,500	179.65	10,779	17,606	1.90
	Souhegan	7,986	798,600	165.00	9,900	16,170	1.74
	Piscataquog	12,835	1,283,500	265.19	15,911	25,988	2.80
IV	Merrimack	23,232	2,323,200	480.00	28,800	47,040	5.07
V	Merrimack	15,197	1,519,700	313.99	18,839	30,771	3.32
	Suncook	5,617	561,700	116.05	6,963	11,373	1.22
	Soucook	3,098	309,800	64.01	3,841	6,273	0.68
VI	Merrimack	44,866	4,486,600	926.99	55,619	90,845	9.79
VII	Merrimack	28,314	2,831,400	585.00	35,100	57,330	6.18
	Contoocook	45,879	4,587,900	947.92	56,875	92,896	10.01
VIII	Pemigewasset	5,280	528,000	109.09	6,545	10,691	1.15
IX	Pemigewasset	16,126	1,612,600	333.18	19,991	32,652	3.52
X	Pemigewasset	0	0	0.00	0	0	
TOTAL		**458,281**	**45,828,100**	**9,468.65**	**568,119**	**927,928**	**100.00**

Goal

Restore a self-sustaining annual migration of American shad (*Alosa sapidissima*) to the Merrimack River watershed, with unrestricted access to all spawning and juvenile rearing habitat throughout the main stem river and its major tributaries.

Objectives

1. Optimize adult and juvenile American shad migrations to and from Eastman Falls Dam (Eastman) in Franklin, NH to achieve a spawning stock of (one million??) American shad in the Merrimack River watershed. We use the word optimize as it is described in Webster's Dictionary: to make as perfect, effective, or functional as possible.

2. Pass 9,500 American shad at Amoskeag, and trigger the requirement to provide fish passage at Hooksett.

3. Pass 9,800 American shad at Hooksett, and trigger the requirement to provide fish passage at Garvins.

4. Implement, where appropriate, optimal fish passage (upstream and downstream) measures at dams, water development projects, and impediments to migration in the main stem and major tributaries (Shawsheen, Concord, Nashua, Souhegan, Piscataquog, Suncook, Soucook, Contoocook, Pemigewassset rivers) of the Merrimack River watershed.

Rationale for Objectives

Our Plan is consistent with the objectives of the ASMFC, Fisheries Management Plan (FMP) for American shad and river herring. Early attempts at managing this interjurisdictional species on a state-by-state basis were hindered by lack of coordination among the many government organizations and publics involved. The ASMFC was formed by the 15 Atlantic coast states in 1942 in recognition that fish do not adhere to political boundaries. ASMFC serves to coordinate the conservation and management of fishery resources among the states on a coast-wide basis. The coast-wide FMP was developed by the ASMFC to coordinate management and enhancement (including restoration) activities for American shad on the Atlantic seaboard (ASMFC 1985, 1988). This document set the stage for cooperative restoration efforts. Specifically, Recommendation 7.4 in the ASMFC FMP encourages all state and federal agencies to cooperate in order to further restoration efforts. Recently, (2005 Need Citation) the ASMFC implemented a coast-wide moratorium on the directed ocean fishery for American shad. This action in conjunction with ASMFC FMP identified management objectives, should aid in the restoration of the Merrimack River shad population.

The ASMFC FMP specifies four Management Objectives:

1. Control exploitation to ensure survival and enhancement of depressed stocks and continued well-being of stocks exhibiting no perceived decline.

2. Improve habitat accessibility and quality consistent with management actions for non-anadromous fisheries.

3. Initiate programs to reintroduce alosid stocks to historical spawning areas, expand existing restoration programs, and initiate enhancement programs for depressed stocks.

4. Recommend and support research programs that will produce data to enhance management capabilities.

The intent of ASMFC objectives has been adopted in our Plan with our Objectives and within the framework of our Restoration Strategies. The states do have the ability to change creel limits for the recreational shad fishery based on the status of the shad population, however, the main focus of our Plan relates to ASMFC Objectives 2 and 3 above and on reaching target fish passage numbers at dams and in river reaches upstream of Lowell. These target numbers are identified in the USFWS, Fishway Prescription for the Merrimack Hydroelectric Project (DOI 2000), and represent the threshold above which volitional upstream fish passage will be instituted at each successive dam. Attainment of these target numbers will provide a sequential increase in available shad habitat and facilitate sequential increases in shad production. Attainment of these sequential passage targets will help achieve the overall Goal of the restoration program.

Current Fish Passage Issues

1. Although American shad use the Lawrence fish lift under low and moderate river flows and associated Lawrence operation conditions, high river discharge and spillage at the dam adversely affect (a) the start of fish lift operations in spring, (b) the continuous operation of passage facilities throughout the migratory period, and (c) the efficiency of the fish lift. Efforts to improve passage operations are underway. An inflatable flashboard system has now been installed to replace the wooden breakaway flashboards on the dam crest. It is anticipated that this new flashboard system will significantly improve spill management and lead to improved fish passage. In addition, cooperating agencies are working with the project owner to investigate other measures to improve passage success.

2. Shad passage at the Lowell fish lift is considered less effective than at Lawrence based on the substantial decrease in the number of shad that pass Lawrence and subsequently pass Lowell (Figure 2). From 1989 to 2009, the mean number of shad passing Lawrence was 29,183 while the mean number passing Lowell was only 5,006 (16.5% of that passing Lawrence). A study using radio-tagged American shad, found that 66% of fish tagged at Lawrence reached the pool downstream of the Lowell tailrace, 55% of the total entered the tailrace, but only 4% of the total passed the Lowell fish lift (Sprankle 2005). Studies and measures to determine the reasons for poor passage effectiveness continue to be implemented and conducted.

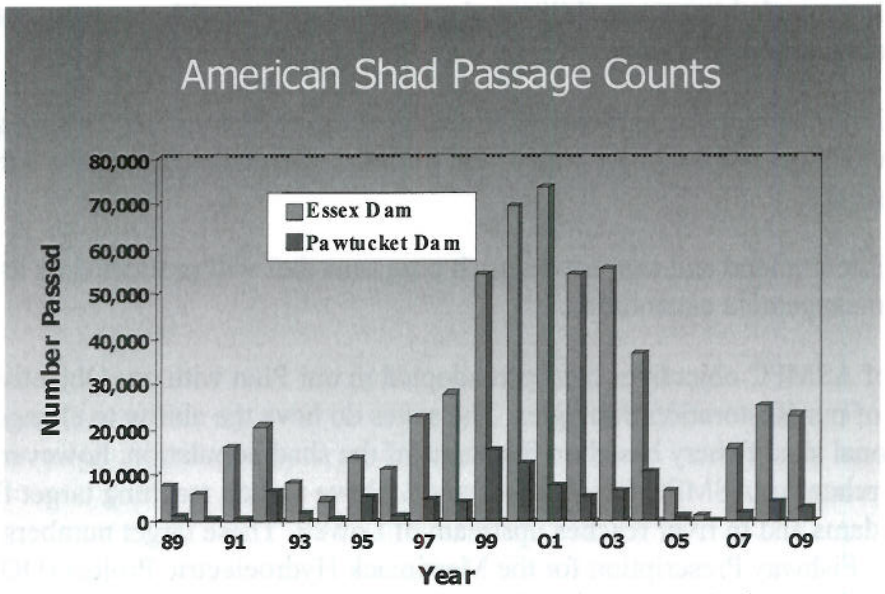

Figure 2. Number of American shad enumerated at Essex (Lawrence) and Pawtucket (Lowell) dams on the Merrimack River for the period 1989-2009.

3. Fish passage effectiveness of the Amoskeag fishway is not known. Although this fishway has effectively passed alewife in earlier years, few shad have ever passed the facility. Efficiency studies will be needed when greater numbers of shad reaching Amoskeag make such an assessment feasible.

4. Recent declines in shad passage at Lawrence from higher abundance levels observed from 1999-2003 (Figure 2) can be attributed in part to fish passage design issues. However, coast-wide declines in shad stocks likely also affected the number of shad returning to the Merrimack River. Given suppressed stock abundance (ASMFC 2007) it may take some time before spawning adults would utilize a fishway at Garvins and voluntarily colonize habitat upstream.

5. Downstream passage efficiency for both adult and juvenile shad needs to be assessed at all dams downstream of habitat used by spawning adults or habitat stocked with shad fry.

Restoration Strategies

Shad Production

We will strive to release approximately five million marked American shad fry annually into the Merrimack River watershed to speed stock colonization in accordance with our Objectives 1-3. Fry for this effort would originate from adult American shad collected in the Merrimack River watershed. If shad from the watershed are not available, then genetically appropriate stocks from other New England rivers would be used. Shad fry would also be stocked into select Merrimack River tributaries.

Whereas USFWS hatcheries will lead the production, marking, and release of fry, other agency staff would assist in production, monitoring, and evaluation activities. All fry will be immersed in an oxytetracycline bath to mark otoliths prior to release. This stocking effort is expected to continue for an extended period of time, and further, it is expected that annual tasks would be modified by the Technical Committee based on the results of monitoring and evaluation efforts.

Adult Shad Transfer

We plan to enhance and augment juvenile production with the capture of approximately 5,000 adult shad from the Lawrence fish lift and subsequently transport and release them at spawning sites in the mainstem Merrimack River and select tributaries.

Monitoring

Monitoring and evaluation efforts will begin in the first year that shad fry are stocked into the Merrimack River and will include monitoring of juveniles and returning adults. The marking of

all fry prior to release will differentiate wild fish from hatchery fish throughout their lives, and assist in evaluating the effectiveness of shad fry stocking. Monitoring and evaluation efforts will be developed and coordinated by the Technical Committee, and will include but not limited to:

- Juvenile sampling at sites throughout the watershed, particularly the Garvins to Eastman river reach. Additional downstream sites may be monitored based upon the status of volitional passage at various dams, location of shad fry stocking, and stocking location of adult spawners.
- After upstream fishway construction at Garvins: Monitor sites between Garvins and Eastman from July 1 to October 1 of each year to document the presence of juvenile shad to determine if passed adults successfully spawned.

Fish Passage

1. Continue to support innovation and evolution in fish passage design with the ultimate goal of optimizing fish passage at Merrimack River dams.

2. Work to increase the efficiency of facilities at Lawrence and Lowell in passing adult and juvenile shad. At Lawrence, efforts will include but not be limited to completion and evaluation of an inflatable flashboard system, and gate installation in the fish lift entrance gallery to prevent debris loading during high tailrace conditions. At Lowell, efforts will include evaluation of, and where necessary, modifications to the fish lift and ladder, as well as assessment for installation of an inflatable flashboard system.

3. Evaluate shad passage at Amoskeag and request modifications as needed, including construction of a second spillway fishway if warranted.

4. Investigate the feasibility of fish passage and dam removal when and where efforts to increase fishway efficiency are not successful, or where no passage exists.

Program Evaluation

We will evaluate the success of the American shad restoration program annually and develop alternative approaches where necessary. Our evaluations will (a) develop and employ quantitative measures to define program success, and (b) develop methods for selecting alternative approaches, if current methods and measures fail to meet the criteria for success.

Research and Information Needs

1. Continue to develop and implement formalized data collection protocols to characterize the shad spawning stock in the watershed.

2. Evaluate results of pre-spawn adult transfers and fry stocking to determine the success of hatchery culture and spawning stock rebuilding.

3. Continue to document the location of and extent of spawning and rearing habitat in the watershed.

4. Evaluate the efficiency of upstream and downstream passage of juvenile and adult shad at hydroelectric and water development projects and mitigate impacts to juvenile and adult shad in the watershed.

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