Admin #573

Fw: Shad Program
Michael_Bailey to: Ericp Nelson 01/19/2011 09:03 AM

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

1 attachment

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Hi Eric,

I just heard you leave a message on Doug Smithwood's phone - which reminded me that I was going to send you the shad plan. As a quick introduction I am the new assistant project leader working with Joe McKeon and Doug. This is as final a copy as we have - this version has not been approved by the Merrimack River Anadromous Fish Restoration Program Policy Committee but has been looked over by the Technical Advisory Committee. A vote by the Policy Committee is planned for the 24th of this February.

Please feel free to give me a call to discuss - I am a bit new (6 months or so) but could try to answer any immediate question (Joe is out on Annual leave until the 24th). I look forward to working with you in the future.

Mike Bailey

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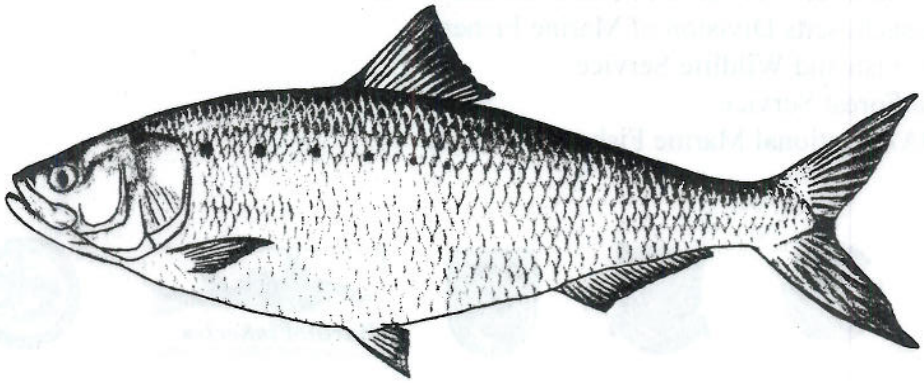
A PLAN FOR THE RESTORATION OF AMERICAN SHAD

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 (*Alosa sapidissima)* stocks within the Merrimack River watershed. This document (Plan) represents an update of the 1997 plan specific to American shad. The Technical Committee intends that this Plan be concise and flexible, whereby objectives, strategies, and related management measures will be adapted 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). Stevenson (1899) estimated that 830,000 shad were harvested from the Merrimack River in 1789, and as late as 1841, records indicate the landing of 365,000 adult shad in the 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 shad run upstream of the Essex Dam, Lawrence, MA. A remnant population of American shad remained 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, a fish lift was constructed 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 was constructed at Lowell, MA in 1830, enlarged in 1876, 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 2.0 km bypass reach between the Boott Hydroelectric Station tailrace and the dam; and (2) a fish lift in the Boott Hydroelectric Station that passes fish into a canal system that leads 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), and the next dam upstream of Lowell. No upstream fishways currently exist at the next two upstream dams, Hooksett (Hooksett) and Garvins Falls (Garvins) at rkm 50.4 and 54.2, respectively. Hydroelectric generation at Amoskeag, Hooksett, and Garvins are all part of the Merrimack River Hydroelectric Project, FERC No. 1893.

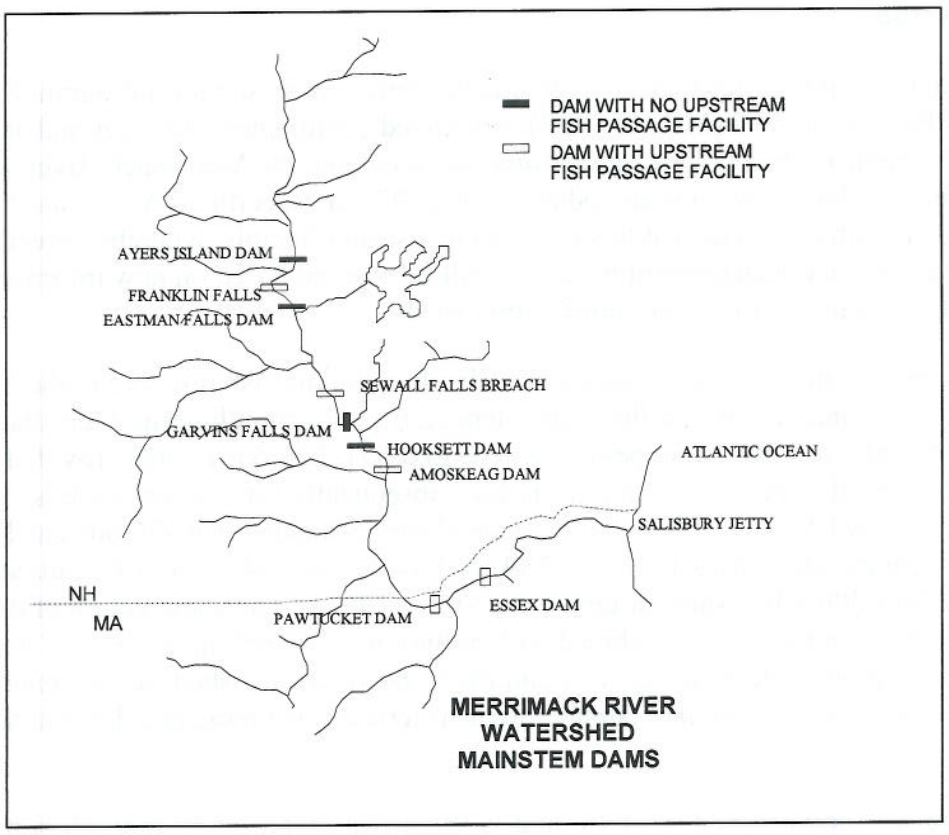


Figure 1. Map of Merrimack River watershed showing main stem dams and major tributaries.

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), National Oceanic Atmospheric Administration (NOAA), and 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 capture 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, a Section 18 Fishway Prescription was stipulated by the USFWS through the Department of the Interior (US DOI 2006).

The Prescription bases the implementation timing for upstream fish passage facilities on available shad and/or river herring habitat and estimated shad and/or river herring production in 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 are to 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 1, Kuzmeskus et al. 1982) and nine major tributaries where shad spawning and nursery habitat is known to exist. Generally, the locations of mainstem dams delineate river reaches. 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 Garvins 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.

The FPAP assumes a production level of 100 adult shad per acre of habitat, whereas other fishery resource agencies have used fishery management production estimates of 60 shad per acre of habitat (CTDEP 2000) and 98.9 shad per acre of habitat (MEDMR 2002). We describe habitat area using U.S. customary standards (i.e. acres) to ensure our calculations are reported similar to those cited, and to avoid confusion. Using a production figure of 100 adult shad per

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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. The Prescription also provides the alternative to trigger passage construction based on river herring passage numbers.

acre of habitat we estimate a total shad production potential for the watershed of 946,865 fish, and 902,638 fish for Reaches (including tributaries) I through VII, Garvins to Eastman, inclusive.

Our Plan identifies shad spawning and nursery habitat in the river reaches (Reaches VIII – IX; 443.08 acres) from Eastman to Ayers Island Dam [(Ayers), rkm 80.4; Table 1; Kuzmeskus et al. 1982]. However, in this plan we accept a continued deferred status for upstream fish passage measures at Eastman with expectation that if future improved shad spawning stock rebuilding in Reaches VI and VII: Garvins to Eastman occurs, then it would promote consideration of fish passage measures necessary at Eastman.

Table 1. Estimates of American shad nursery habitat units (one unit = 100 yd^2) and adult shad production per acre of habitat 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 (100/acre)	% of Total
I	Merrimack	98,146	9,814,600	2,027.82	121,669	202,782	21.42
II	Merrimack	40,620	4,062,000	839.26	50,356	83,926	8.86
	Concord	4,348	434,800	89.84	5,390	8,984	0.95
II	Merrimack	98,042	9,804,200	2,025.67	121,540	202,567	21.39
	Nashua	8,695	869,500	179.65	10,779	17,965	1.90
	Souhegan	7,986	798,600	165.00	9,900	16,500	1.74
	Piscataquog	12,835	1,283,500	265.19	15,911	26,519	2.80
IV	Merrimack	23,232	2,323,200	480.00	28,800	48,000	5.07
V	Merrimack	15,197	1,519,700	313.99	18,839	31,399	3.32
	Suncook	5,617	561,700	116.05	6,963	11,605	1.22
	Soucook	3,098	309,800	64.01	3,841	6,401	0.68
VI	Merrimack	44,866	4,486,600	926.99	55,619	92,699	9.79
VII	Merrimack	28,314	2,831,400	585.00	35,100	58,500	6.18
	Contoocook	45,879	4,587,900	947.92	56,875	94,792	10.01
VIII	Pemigewasset	5,280	528,000	109.09	6,545	10,909	1.15
IX	Pemigewasset	16,126	1,612,600	333.18	19,991	33,318	3.52
X	Pemigewasset	0	0	0.00	0	0	
TOTAL		**458,281**	**45,828,100**	**9,468.65**	**568,119**	**946,865**	**100.00**

Goal

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

Objectives

1. Optimize adult and juvenile American shad migrations upstream to Eastman Falls Dam (Eastman) in Franklin, NH to achieve a spawning stock that approaches 1.0 million American shad in the Merrimack River watershed. We use the word optimize as described in Webster's Dictionary: to make as perfect, effective, or functional as possible.

2. Pass 744,083 adult shad at the Essex Dam (see habitat units Table 1).

3. Pass 651,173 adult shad at the Pawtucket Dam.

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

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

6. 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 Atlantic States Marine Fisheries Commission (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. 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 ASMFC to coordinate management and enhancement (including restoration) activities for American shad on the Atlantic seaboard (ASMFC 1985, 1988). This FMP set the stage for cooperative restoration efforts. Specifically, Recommendation 7.4 in the FMP encourages all state and federal agencies to cooperate in order to further restoration efforts. Recently, ASMFC implemented a coast-wide moratorium on the directed ocean fishery for American shad. This action, in conjunction with the identified FMP 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 alosine 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 the 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 the ASMFC Objectives 2 and 3 above and on reaching target fish passage numbers at dams and in river reaches upstream of Lowell. Target numbers are identified generally in Table 1 and specifically in the USFWS, Fishway Prescription for the Merrimack Hydroelectric Project (US DOI 2006). They represent the threshold above which volitional upstream fish passage will be instituted at each successive mainstem and tributary dam. Attainment of these target numbers will provide a sequential increase in available shad habitat and facilitate sequential increases in shad production. Attainment of sequential passage targets will help achieve the overall Goal of our 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 ongoing. An inflatable flashboard system was installed in 2008 and 2009 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. The recent installation of a fish lift entrance gate to protect the facility from debris loading during high flows should considerably enhance fish lift operations. In addition, cooperating agencies will continue to work 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 15,459 while the mean number passing Lowell was only 4,463 (28.8% 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 conducted and implemented.

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

4. Recent declines in shad passage at Lawrence from higher abundance levels observed during the period 1999-2003 (Figure 2) can be attributed in part to fish passage design issues, coupled with very high river flows during the spring passage seasons in these years. However, coast-wide declines in shad stocks likely also affected the number of shad

returning to the Merrimack River. Given depressed stock abundance (ASMFC 2007) it may take some time before spawning adults will utilize fishways at Hooksett and Garvins falls.

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 larvae.

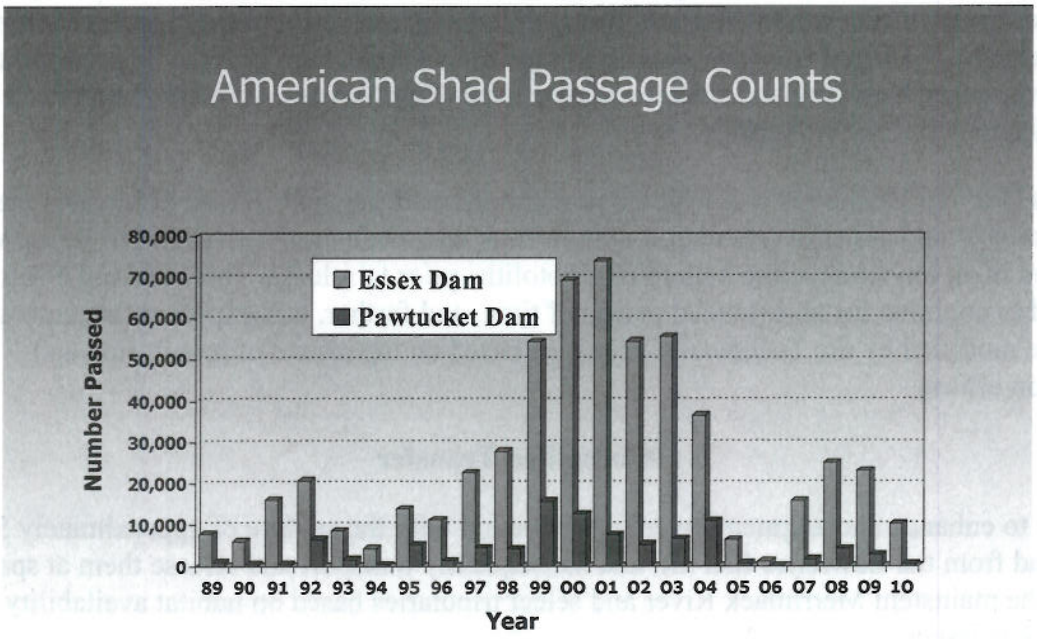

Figure 2. Number of American shad enumerated at Essex (Lawrence) and Pawtucket (Lowell) dams on the Merrimack River for the period 1989-2010.

Restoration Strategies

Shad Production

We will strive to release approximately four million marked American shad larvae annually into the Merrimack River watershed to speed stock colonization in accordance with our Objectives 1-3. Larvae 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 larvae would also be stocked into select Merrimack River tributaries.

Whereas USFWS hatcheries will lead the production, marking, and release of larvae, other agency staff would assist in production, monitoring, and evaluation activities. All larvae 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 based on habitat availability and fish passage issues.

Monitoring

Monitoring and evaluation efforts will begin in the first year that shad larvae are stocked into the Merrimack River and will include monitoring of juveniles and returning adults. The marking of all hatchery larvae prior to release will differentiate wild fish from hatchery fish throughout their lives, and assist in evaluating the effectiveness of shad larvae stocking. Monitoring and evaluation efforts will be developed and coordinated by the Technical Committee, and will include but not be 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 larvae stocking, and stocking location of adult spawners.

- Following 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 and to determine if adults successfully spawned.

Fish Passage

1. Continue to support innovation and evolution in fish passage design with the ultimate goal of optimizing fish migration and 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, evaluation of the inflatable flashboard system, and new fishway gate in permitting earlier operation of the lift, operation under higher river flow levels, and improved passage due to spill control and manipulation. At Lowell, efforts will include evaluation of, and where necessary, modifications to the structures and/or operations of the fish lift and fish ladder. An, assessment of an inflatable flashboard system will also be needed if this structure is proposed and installed by the project owner.

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 larvae stocking to determine the success of hatchery culture and spawning stock rebuilding.

3. Re-evaluate and further 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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