



## **Survey of Diadromous Fish Species of Greatest Conservation Need in Southern Maine**

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Wells National Estuarine  
Research Reserve





## Project Background and Objectives

The Maine Coastal Program, the Maine Department of Marine Resources, and The Nature Conservancy identified a need to update existing GIS datasets representing the spatial distribution of diadromous fish species of greatest conservation need in the greater Piscataqua and Saco River watersheds. Updated spatial data would be used to refine GIS layers made available to resource managers through the Maine Stream Habitat Viewer (MSHV).

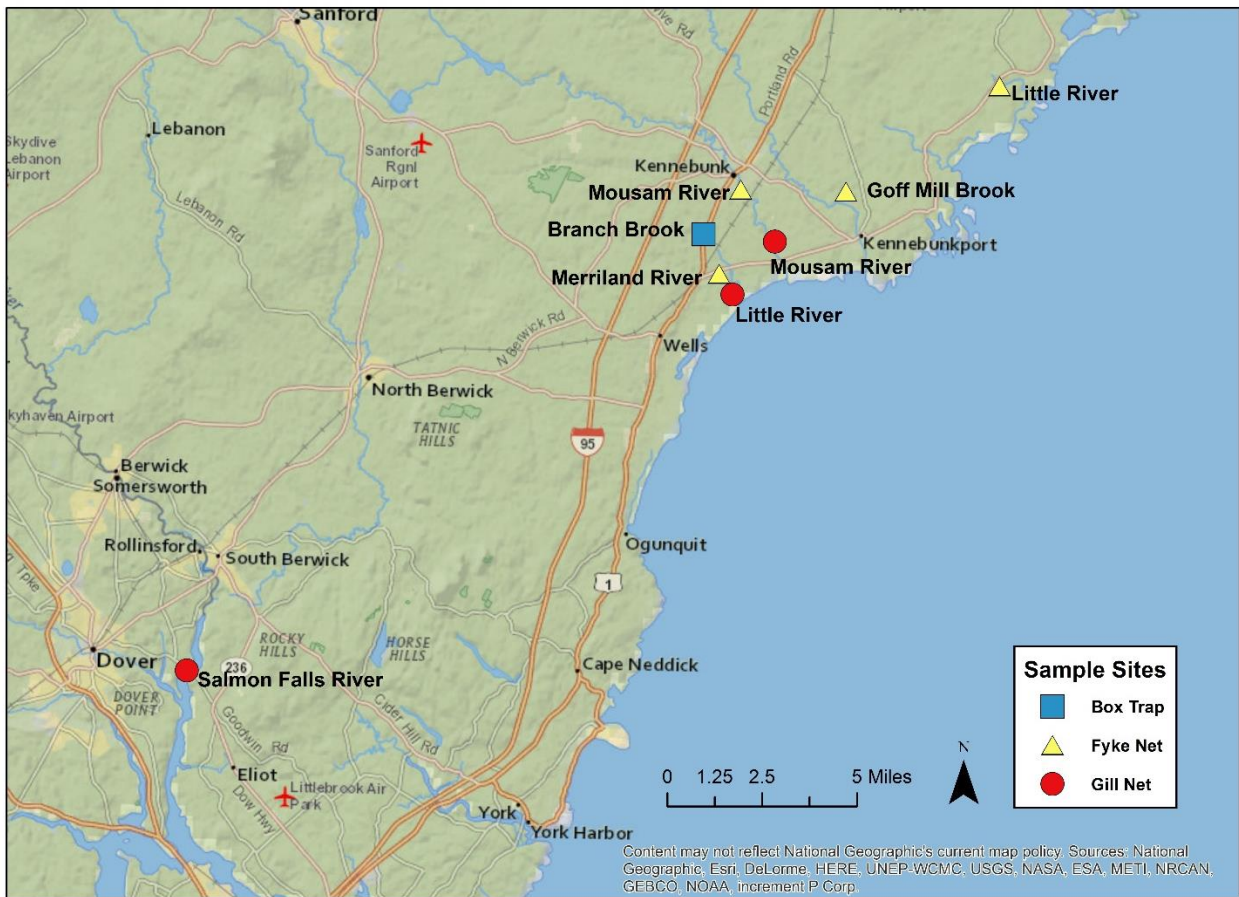
The Wells National Estuarine Research Reserve was contracted to conduct field surveys to document the presence or absence of diadromous species in these watersheds with a focus on rainbow smelt and alewives. The objectives of these surveys were to 1) collect field based quality assured data on the composition and abundance of diadromous species, 2) focus surveys in locations identified by DMR as priorities, and 3) use survey data to generate updated spatial habitat datasets.

To accomplish these objectives the Wells Reserve created a sampling plan, hired and trained two seasonal fisheries technicians, carried out sampling in priority streams, compiled and quality controlled survey data, conducted data analysis, and created and distributed data products to project partners.

## Project Planning

During January and February 2016 Wells Reserve staff worked with project partners to develop a sampling plan in accordance with the objectives of the project. Sampling was designed to target adult rainbow smelt and alewives during their respective migrations. Logistical and funding limitations were considered along with partner priorities and Wells Reserve familiarity with local streams to create a sampling plan that maximized spatial and temporal coverage and specified effective and efficient sampling methods for target species.

In February the Wells Reserve recruited and hired two seasonal fisheries technicians to assist with field surveys and data management. Amelie Jensen had been working for the Wells Reserve since 2014 as a research assistant on several fisheries projects and was thoroughly trained in fyke net sampling and fish species identification. Brenda Rudnický was selected through a competitive hiring process and chosen from a field of 114 applicants. Brenda had extensive experience with gill netting, fish identification, and smelt scale aging from her undergraduate work in the Sulikowski lab at the University of New England. Amelie and Brenda were primarily responsible for field sampling, data entry, equipment maintenance, weekly scheduling of field and lab work, and coordination of volunteer involvement. Additionally, Brenda received training in scale aging techniques from state biologists and aged all anadromous species scale samples.



**Figure 1. Project Site Map**

Sampling sites were selected using existing species habitat layers in the Maine Stream Habitat Viewer. Streams that were labeled as providing “Potential Habitat” for rainbow smelt and alewives were included in a list of possible sampling locations. This list was refined through consideration of logistical constraints such as travel time, proximity to other sampling locations, tidal range, and ease of access, and with a goal to provide as much spatial and temporal coverage as possible.

For rainbow smelt monitoring, sampling locations were identified in the Merriland River, Mousam River, Goff Mill Brook (Kennebunk River), and the Little River (Biddeford). This selection of locations enabled the field crew to sample four sites during the accessible daytime low tide due to the limited travel needed between sites. This also enabled our crew to sample each site on three consecutive days each week.



*Wells Reserve fisheries technicians relax while waiting to tend gill nets in the Salmon Falls River.*

For alewife monitoring, sampling locations were identified in the Salmon Falls River, Little River, and Mousam River. Of these, the Salmon Falls River and Little River were identified by DMR as having potential habitat, while the Mousam was identified as having a documented run. However, documentation in the Mousam River in recent years has been limited, and it was decided that the ongoing dam relicensing process at the first three dams would benefit from additional data. These rivers were all of suitable size for sampling with gill nets and each had necessary boat access.

*Table 1. Sample Site Coordinates*

<b>Site ID</b>	<b>Waterbody</b>	<b>Longitude</b>	<b>Latitude</b>
GMB	Goff Mill Brook	-70.485265	43.378497
KKWWD	Branch Brook	-70.559363	43.361323
LR_Bid	Little River (Biddeford)	-70.405731	43.419690
LR_WNERR	Little River (Wells)	-70.543676	43.338460
Mousam_Estuary	Mousam River	-70.522048	43.358904
Mousam_Sewer	Mousam River	-70.540434	43.378591
MR_WNERR	Merriland River	-70.550885	43.346234
SF_Eliot	Salmon Falls River	-70.824850	43.190834



### Survey Implementation

Sampling for rainbow smelt was carried out from ice-out (late March) until the last week in April. Fyke nets were set downstream of the head of tide and oriented to sample fish moving upstream from the estuary. Nets were typically deployed for three consecutive 24-hour periods, with daily visits around low tide to collect and process the catch. All fish were identified to the species level and length and weight measurements were recorded. Rainbow smelt were sexed and scale samples were collected for ageing. Nets were removed and cleaned each week. Once adult smelt were identified in the weekly sample, visual surveys for eggs were conducted weekly in upstream spawning areas. All captured fish were released upstream of the fyke net.



*A fyke net set below the head of tide in the Mousam River to catch fish moving upstream.*

Sampling for alewives was carried out from the first week in May until the first week in June. Each river was sampled once per week, and weekly sampling alternated between daytime and nighttime. Gill nets were deployed by boat in the main stem of the river. Nets were anchored to the river bottom and suspended in the water column by buoys. Nets were retrieved after short 30 minute sets to reduce stress on captured fish. All captured fish were identified to species, and length and weight measurements were recorded. Alewives were sexed and scale samples were collected for ageing. All captured fish were released near the point of capture.

Field data were digitized and compiled by seasonal technicians and quality assured by Wells Reserve staff. Data were formatted by Wells Reserve staff according to DMR guidelines. Spatial data layers were created by Wells Reserve staff in coordination with DMR and MSHV

Data Manager. Digital and hardcopy survey data were submitted to DMR. Spatial data were submitted to DMR and MSHV Data manager.

### Survey Results

Sampling efforts targeting the rainbow smelt migration season consisted of 58 samples (individual fyke net sets) and 1408 hours of fishing effort (time nets fished). Rainbow smelt were present in low numbers at three sampling sites. Several other diadromous species were sampled along with numerous resident species. In total, 5,086 fish were sampled with fyke nets from March through April.

*Table 2. Rainbow Smelt Monitoring Catch Totals*

<b>Waterbody</b>	<b>Total Catch</b>	<b>Alewife</b>	<b>American Eel</b>	<b>Atlantic Tomcod</b>	<b>Rainbow Smelt</b>	<b>Sea Lamprey</b>	<b>Brook Trout</b>	<b>Other Species</b>
<i>Goff Mill Brook</i>	44				1	3	1	39
<i>Little River</i>	4445	6	5	5			1	4428
<i>Merriland River</i>	233		1	6	1	2		223
<i>Mousam River</i>	364	1	21	16	4			322

*Table 3. Rainbow Smelt Biological Data*

<b>Waterbody</b>	<b>Fished Date/Time</b>	<b>Sex</b>	<b>Year Class</b>	<b>Length (mm)</b>	<b>Weight (g)</b>
<i>Goff Mill Brook</i>	13-Apr	M	2	190	37.2
<i>Merriland River</i>	21-Apr	F	2	127	12.9
<i>Mousam River</i>	14-Apr	M	2	189	34.8
	19-Apr	F	2	168	29.7
	19-Apr	M	2	165	22.9
	21-Apr	F	2	180	32.8

Sampling efforts targeting the alewife migration season consisted of 40 samples (individual gill net sets) and 20 hours of fishing effort (time nets fished). Alewife were present at all three sites.

*Table 4. Alewife Monitoring Total Catch*

<b>Waterbody</b>	<b>Total Catch</b>	<b>Alewife</b>	<b>Striped Bass</b>	<b>Atlantic Menhaden</b>
<i>Little River</i>	35	22	13	
<i>Mousam River</i>	10	8	2	
<i>Salmon Falls River</i>	36	8	10	18

Table 5. Alewife Biological Data

<b>Waterbody</b>	<b>Date</b>	<b>Sex</b>	<b>Year Class</b>	<b>Length (mm)</b>	<b>Weight (g)</b>
<i>Little River</i>	18-May	F	3	262	160
	18-May	F	4	283	200
	18-May	F	4	300	240
	18-May	F	5	262	130
	18-May	F	5	281	190
	18-May	F	5	284	200
	18-May	F	5	292	210
	18-May	M	3	245	110
	18-May	M	3	252	140
	18-May	M	3	268	170
	18-May	M	3	270	150
	18-May	M	3	270	160
	18-May	M	4	252	130
	18-May	M	4	256	150
	18-May	M	4	259	140
	18-May	M	4	277	180
	18-May	M	4	282	170
	18-May	M	4	283	210
	18-May	M	4	287	220
	18-May	n/a	3	235	130
	18-May	n/a	3	245	130
<i>Mousam River</i>	6-Jun	F	3	260	115
	6-Jun	F	4	245	115
	6-Jun	F	4	256	135
	6-Jun	F	4	262	135
	6-Jun	M	3	229	95
	6-Jun	M	3	246	115
	6-Jun	M	3	255	115
	6-Jun	M	4	247	115
<i>Salmon Falls River</i>	9-May	F	4	285	150
	9-May	F	4	286	156
	9-May	F	4	290	150
	9-May	F	4	292	159
	9-May	M	3	254	151
	16-May	F	6	340	350
	16-May	M	3	233	120
	16-May	M	4	255	160



Additional sampling was conducted during the rainbow smelt and alewife migration seasons with alternate gear types as part of ongoing restoration monitoring efforts in Branch Brook and Goff Mill Brook.

*Table 6. Supplemental Restoration Monitoring Catch Totals*

<b>Waterbody</b>	<b>Total Catch</b>	<b>Blueback Herring</b>	<b>Alewife</b>	<b>American Eel</b>	<b>Sea Lamprey</b>	<b>Brook Trout</b>	<b>Other Species</b>
<i>Branch Brook</i>	20				3	11	6
<i>Goff Mill Brook</i>	114	1	11	4	4	20	74

A box trap was deployed at the fish ladder in Branch brook from the first week of April to mid-June. The trap targeted diadromous and resident species that could be expected to ascend the fish ladder, and rainbow smelt were not included with these. No alewives were sampled in the box trap, though other diadromous species were present. A fyke net continued to be deployed in Goff Mill Brook after the rainbow smelt migration season targeting diadromous species that could be expected to pass upstream of the site of a former dam, removed in 2015. No adult alewives were present, though juveniles were. Additional diadromous species were also present.



*A gill net is retrieved from the Salmon Falls River with a catch of alewives and striped bass.*

## Discussion and Analysis

Our efforts were successful in documenting adult rainbow smelt in spawning condition at three of four fyke net sampling locations. The Little River was the only site where no smelt were sampled. Overall relative abundance of rainbow smelt was low, which was not unexpected.

We were also successful in documenting adult alewives in spawning conditions at all three of our gill netting sites. Overall relative abundance of alewife was high, but this is slightly misleading because of the selectivity of the gill nets



*A rainbow smelt caught in Goff Mill Brook.*

The disproportionately high catch at the Little River (Biddeford) was due primarily to the capture of schools of three-spine sticklebacks numbering in the thousands of individuals. This results in much lower abundance of diadromous species than at other sites. Additionally, gill net sampling was very selective for size, and so abundances are relatively higher due to the smaller number of different species sampled.

*Table 7. Diadromous Species Relative Abundance*

<b>Waterbody</b>	<b>Alewife</b>	<b>American Eel</b>	<b>Atlantic Tomcod</b>	<b>Blueback Herring</b>	<b>Brook Trout</b>	<b>Rainbow Smelt</b>	<b>Sea Lamprey</b>	<b>Striped Bass</b>
<i>Goff Mill Brook</i>	7.0%	2.5%		0.6%	13.3%	0.6%	4.4%	
<i>Branch Brook</i>					55.0%		15.0%	
<i>Little River (Bid)</i>	0.1%	0.1%	0.1%					
<i>Little River (Wells)</i>	62.9%							37.1%
<i>Mousam River (gill)</i>	80.0%							20.0%
<i>Mousam River (fyke)</i>	0.3%	5.8%	4.4%			1.1%		
<i>Merriland River</i>		0.4%	2.6%			0.4%	0.9%	
<i>Salmon Falls River</i>	22.2%							27.8%

In order to standardize a catch per unit effort (CPUE) calculation for all of our sampling, we used a basic fish-per-hour calculation. The CPUE varied with both site and gear type. Again,

the presence of large numbers of three-spine sticklebacks has inflated our results giving the Little River (Biddeford) much higher CPUE than the other fyke net sites.

Figure 2. Catch Per Unit Effort by Site

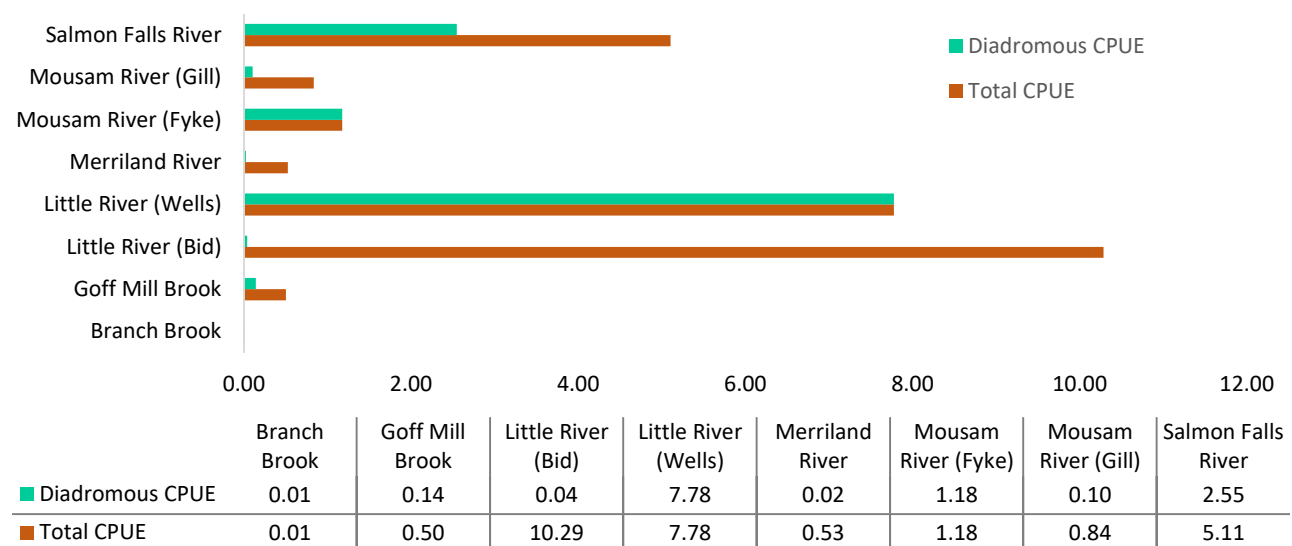
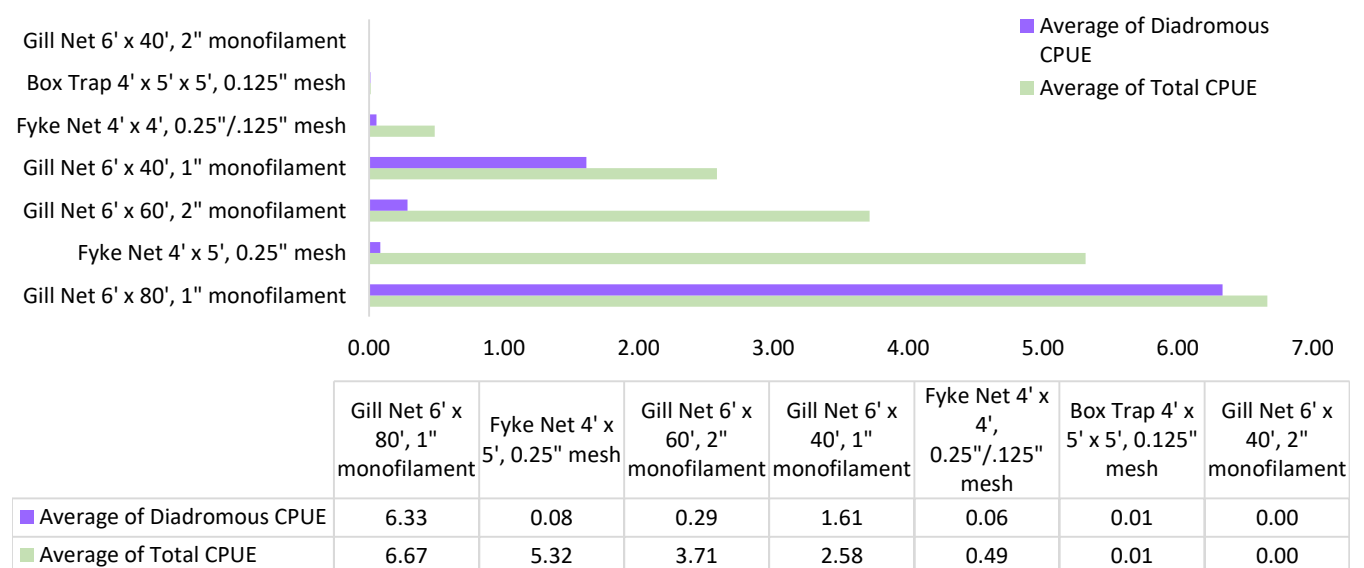


Figure 3. Catch Per Unit Effort by Gear Type



## Project Outcomes

This project was able to meet its objectives to collect quality assured field data on the presence or absence of diadromous species in priority Southern Maine streams where previous data were lacking. Our results indicate that several species of greatest conservation need are present, but in low numbers.

Additionally, the Wells Reserve was able to augment these efforts through a complimentary grant from the Maine Outdoor Heritage Fund, which enabled the inclusion of historical datasets from additional streams where data were lacking, and in some cases, target species were not expected to be present. These data have significantly enhanced the overall impact of the project and resulted in the addition of six waterbodies to the species habitat layers for the MSHV.

These data were used in the creation of several project deliverables including:

- A quality assured dataset, formatted in MS Excel, with over 15,000 data points.
- A list of recommendations for updates to species distribution spatial data.
- An ESRI shapefile for sampling events including summary data for each event.
- An updated ESRI shapefile with updated habitat status attributes for species of greatest conservation need.

*Table 8. Recommended Updates to Rainbow Smelt Habitat Layers*

<b>Stream Name</b>	<b>Date of Most Recent Data</b>	<b>Current MSHV Status</b>	<b>Recommended Change to MSHV Status</b>
<i>Bass Cove Creek</i>	2001	None	Limited Spawning
<i>Dolly Gordon Brook</i>	2001	None	Limited Spawning
<i>Smelt Brook</i>	2001	None	Limited Spawning
<i>Southside Brook</i>	2001	None	Limited Spawning
<i>Branch Brook</i>	2015	None	Low Potential
<i>Merriland River</i>	2016	Potential	Limited Spawning
<i>Mousam River</i>	2016	Potential	Limited Spawning
<i>Goff Mill Brook</i>	2016	None	Limited Spawning

*Table 9. Recommended Updates to Alewife Habitat Layers*

<b>Stream Name</b>	<b>Date of Most Recent Data</b>	<b>Current MSHV Status</b>	<b>Recommended Change to MSHV Status</b>
<i>Salmon Falls River</i>	2016	Potential	Active
<i>Little River</i>	2016	Potential	Active
<i>Branch Brook</i>	2015	Potential	Active

<i>Little River (Biddeford)</i>	2016	None	Uncertain Potential
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### Acknowledgements

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