# The Acushnet River Restoration Project: A test pilot case study for future restoration projects in Massachusetts

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**Office of Habitat Conservation**

# Participating Agencies

Commonwealth of Mass.
Department Fish & Game
(*MarineFisheries*)

United States
Geological Survey

National Oceanic &
Atmospheric Administration
Office of Habitat
Conservation

New Bedford Harbor
Trustees Council

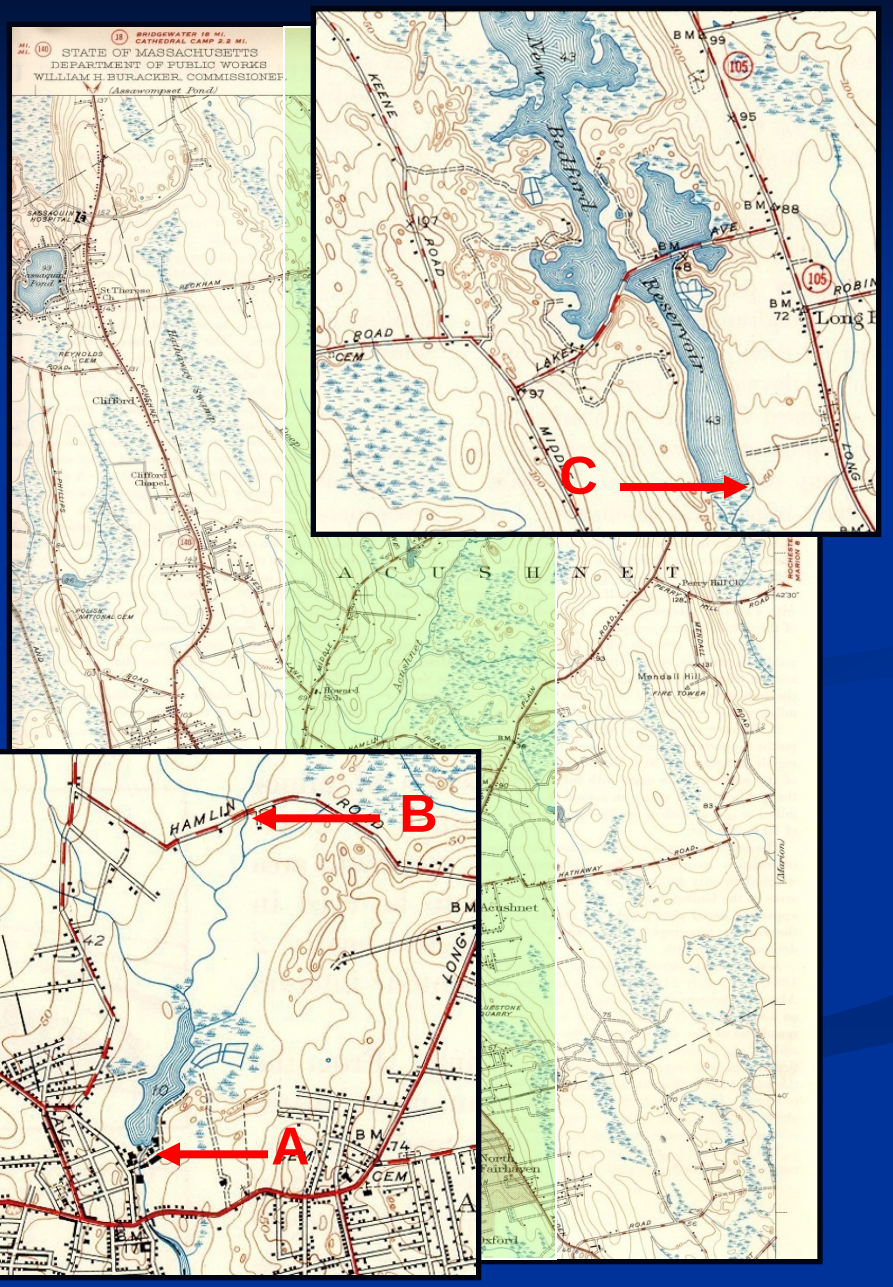
United States Fish &
Wildlife Service

The Coalition for
Buzzards Bay

# Presentation Outline

1. The Study Area
2. Study Objective
3. Fish Passage Improvements
4. Biological Monitoring

# 1. The Study Area: The Acushnet River




1. Stream Length – 8.2 miles (3rd order)
2. Diadromous species present:
   a. Alewife (*Alosa pseudoharengus*)
   b. Blueback herring (*A. aestivalis*)
   c. American eel (*Anguilla rostrata*)
   d. Smelt (*Osmerus mordax*)
   e. Striped bass (*Morone saxatilis*)
3. USEPA – Superfund National Priorities List
4. Three Main Obstructions:
   a. Acushnet Sawmill Dam
   b. Hamlin Street Dam
   c. New Bedford Reservoir Dam

# 2. Study Objectives

**Increase the size of existing river herring and American eel populations in the Acushnet River**

## Phase 1: Fish Passage Improvements

## Phase 2: Biological Monitoring

### Short Term Objective

**1. Improve existing upstream passage of adult river herring at the New Bedford Reservoir by 1000% (by 2011) over baseline conditions established during the pre-construction phase (2005 – 2007)**

**2. Improve access into the upper watershed for elvers by monitoring abundance pre- and post-construction**

# 3. Fish Passage Improvements (Phase 1)

1. New Bedford Reservoir Dam
2. Acushnet Sawmill Dam
3. Hamlin Street Dam

# Fish Passage Improvements (cont.): New Bedford Reservoir Dam

## Lower Section

**River Mile:** 8.1

**Dam Type:** Dam & elevation change

**Material:** Granite with wooden boards

**Impoundment:** 220 acres

## Upper Section

**Year Built:** 1867

**Owner:** City of New Bedford

**Spillway Width:** 50 feet

**Spillway Height:** 11 feet

# Fish Passage Improvements (cont.): New Bedford Reservoir Dam


**2002: State-of-the-art denil fishway constructed**

**Project cost: < $250,000**

# Fish Passage Improvements (cont.): New Bedford Reservoir Dam

**Fishway Design:** Denil

**Material:** Concrete with wooden baffles

**Length:** 264 feet

**Inside width:** 3 feet

**Outside width:** 5 feet

**No. baffles:** 26

**Notch width:** 21 inches

**Pool Length:** N/A

**Condition:** Excellent

**Functionality:** Passable (≈ 12 – 14 cfs)

# Fish Passage Improvements (cont.): Acushnet Sawmill Dam

**River Mile:** 4.4

**Type:** Dam

**Material:** Concrete & stone

**Impoundment:** Saw Mill Pond (9.5 acres)

**Mean flow(s):** HEC-RAS (1-D): 25 cfs; 8.2 cfs (low); 1.0 cfs (drought)

**Year Built:** 1746 (rebuilt in 1920)

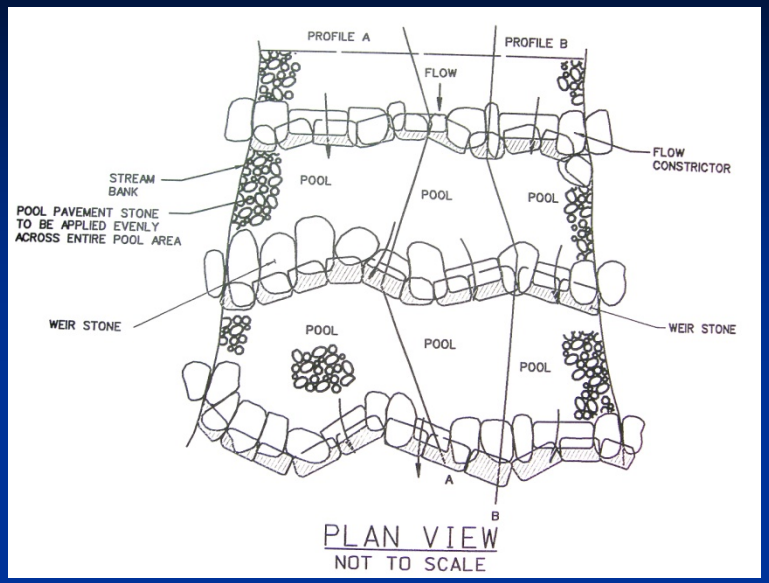
**Owner:** Acushnet Sawmill Co.

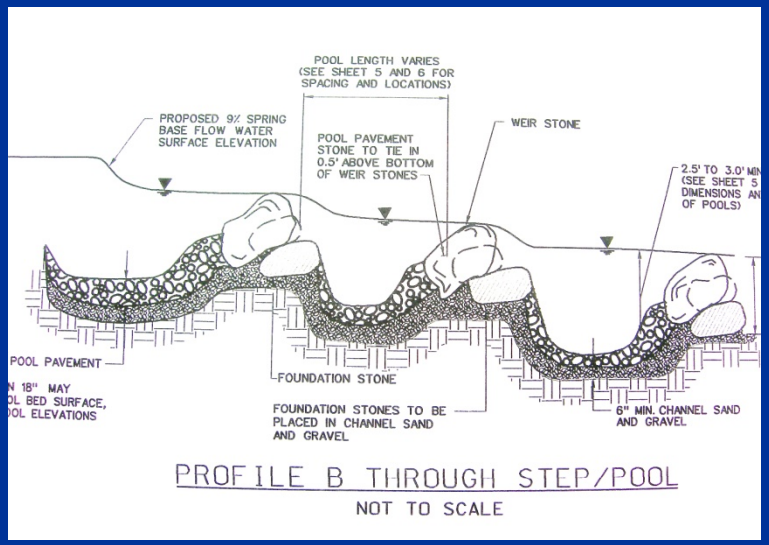
**Spillway Width:** 118 feet

**Spillway Height:** 4.6 feet

**Impairments:** Nutrients, pathogens, organic enrichment, low DO, vegetation

# Fish Passage Improvements (cont.): Acushnet Sawmill Dam




**Sawmill Dam fishway schematics**

**(EA Engineering, Science & Technology)**

**Sawmill Dam fishway construction: July, 2007**

**1. Fishway Type: Constricted weir, rock step-pool (11 rock weirs, 10 pools)**

**2. Length of dam reduced, stream channel re-defined**

**3. Top of dam notched and lowered 3 feet**

**4. Eleven weirs constructed of large boulders (3,000 – 5,000 lbs. each) placed at different elevations allows fish to ascend/descend at most water levels**

# Fish Passage Improvements (cont.): Acushnet Sawmill Dam

**Pre-Construction**

**Acushnet Sawmill Fishway (Autumn, 2005)**

**Post-Construction**

**Acushnet Sawmill Fishway (Autumn, 2007)**

**A relatively new innovation which effectively eliminates dams without removal.**

**Only a few exist on the east coast (first in the Commonwealth).**

# Fish Passage Improvements (cont.): Hamlin Street Dam

**River Mile:** 5.3

**Type:** Dam

**Material:** Concrete with wooden boards

**Impoundment:** 12.5 acres

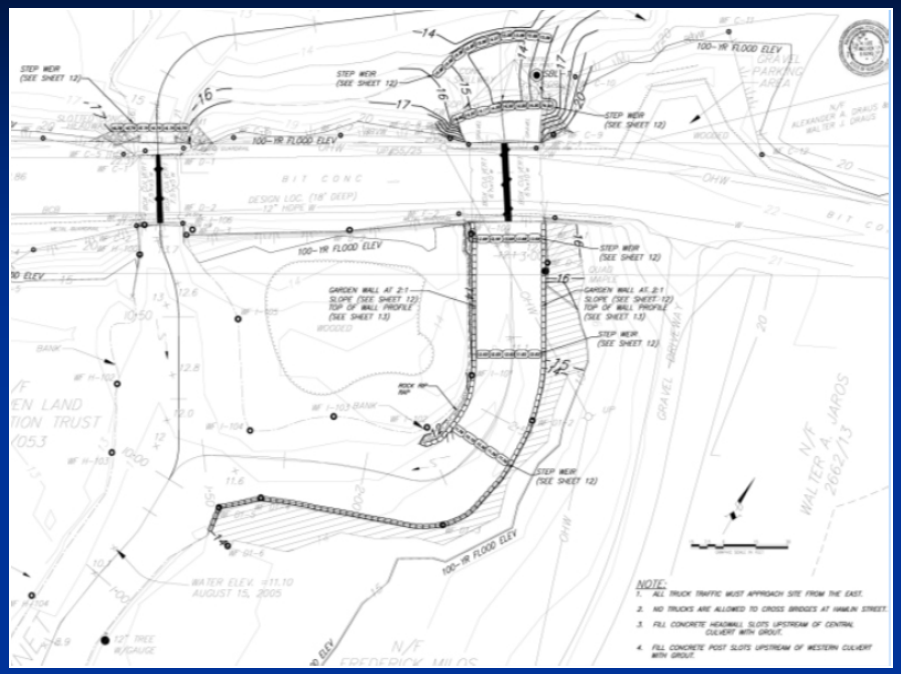
**Year Built:** 1920

**Owner:** Town of Acushnet

**Spillway width:** 4.7 feet

**Spillway Height:** 1.7 feet

# Fish Passage Improvements (cont.): Hamlin Street Dam




**Hamlin Street Fishway Schematic**

**(EA Engineering, Science & Technology)**

**Hamlin Street Fishway**

**(May, 2008)**

**Similar structure built at Hamlin Street to overcome smaller elevation differential (5 rock weirs, 4 pools)**

**Total cost (Sawmill and Hamlin Street fishways) = $1.2 million**

# 4. Biological Monitoring (Phase 2)

## 1. River herring

## 2. American eel

# Biological Monitoring (cont.): River herring sampling results

| Year | Date Deployed | Date Removed | Alewife | Blueback Herring | River herring (Combined) | Peak Observations | Annual Difference | % Annual Difference |
|---|---|---|---|---|---|---|---|---|
| 2005 | 4/1/05 | 6/10/05 | 395 | 0 | 395 | 5/3-5/6 | | |
| 2006 | 3/29/06 | 6/6/06 | 202 | 0 | 202 | 4/25-4/28 | -193 | -48.9% |
| 2007 | 3/28/07 | 6/15/07 | 371 | 0 | 371 | 4/23-4/27 | 169 | 183.7% |
| 2008 | 4/1/08 | 6/6/08 | 977 | 1 | 978 | 4/10-5/1 | 607 | 263.6% |
| 2009 | 3/30/09 | 6/5/09 | 1,695 | 5 | 1,700 | 4/19-5/2 | 722 | 173.8% |
| 2010 | 4/1/10 | 6/10/10 | 2,703 | 7 | 2,710 | 4/6-5/4 | 1,010 | 159.4% |
| 2011 | 3/28/11 | 6/3/11 | 3,608 | 71 | ***3,679*** | 4/8-5/2 *5/14-5/16 | 969 | 135.8% |
| Totals | | | 9,951 | 84 | 10,035 | | | ****1140%** |
| Pre-construction Means (2005 - 2007) | | | 323 | 0 | ***323 (baseline)*** | | -12 | 67.4% |
| Post-construction Means (2008 - 2011) | | | 2,246 | 21 | 2,267 | | 827 | 183.2% |

* Peak observation period for blueback herring in 2011

** Percent change in 2011 over baseline conditions (mean observations during the pre-construction phase)

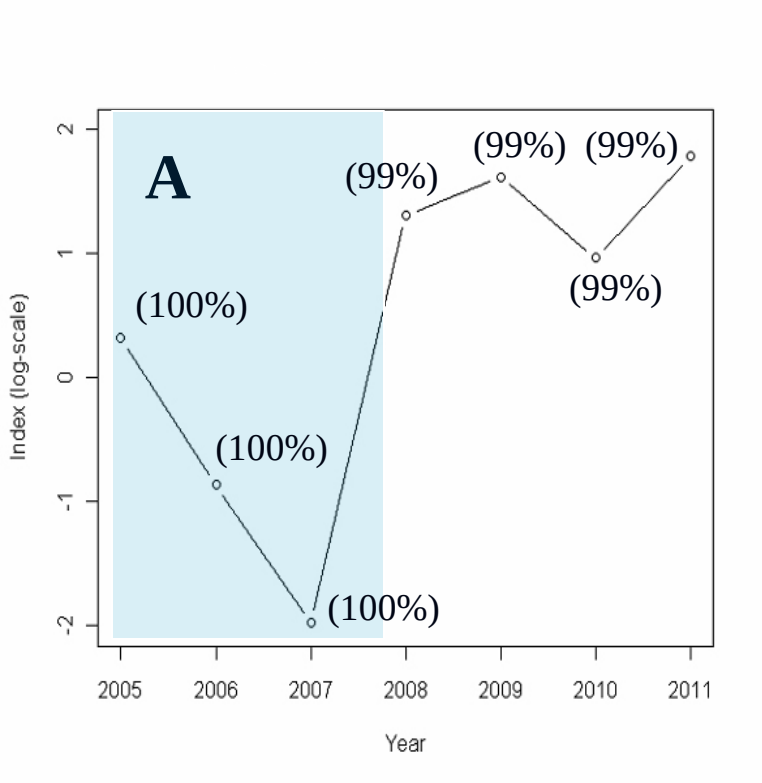
**Pre-construction (2005 – 2007)**

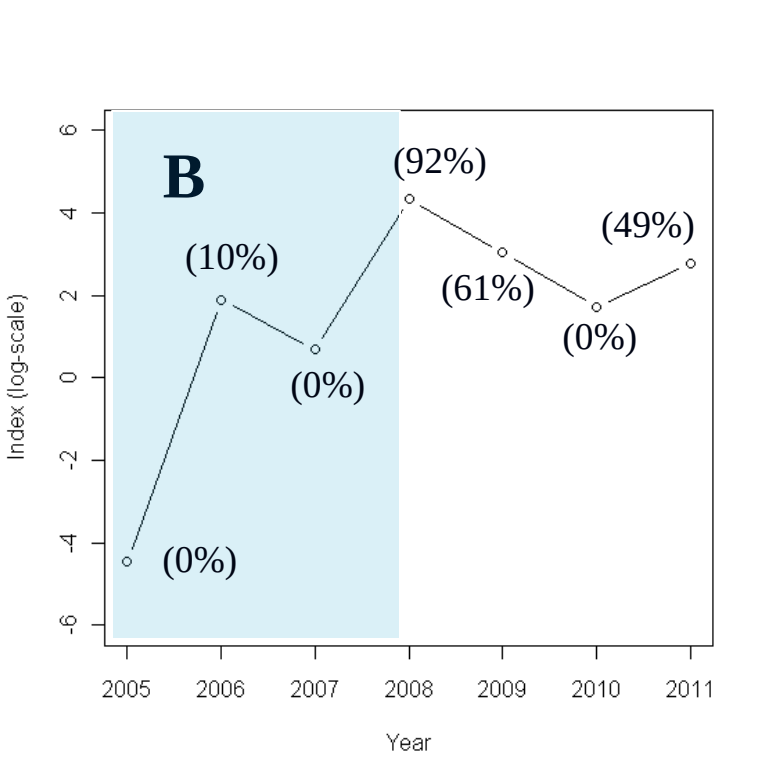
1. Mean counts of alewives during pre-construction phase were low ($N_{PRE}$ = 323) and served as baseline level and 1000% enumeration target ($N_{1000}$ = 3,230)
2. Peak migrations occurred within short temporal frames (less than 1 week)

**Post-construction (2008 – 2011)**

1. Total counts increased during the post-construction phase (183% mean annual increase)
2. Total count in 2011 ($N$ = 3,679) indicates an increase of 1140% over baseline conditions
3. Peak observations increased post-construction (2 – 4 weeks)

# Biological Monitoring (cont.): Elver sampling results




**A. Sawmill** **(*F* = 11.7, *p* < 0.01, *df* = 6)**

**B. Reservoir** **(*F* = 23.1, *p* < 0.01, *df* = 6)**
**By period** **(*F* = 2.0, *p* < 0.2, *df* = 1)**

1. Analysis of Deviance showed that year is a significant factor, indicating differences in CPUE among years
2. Increased catch rates at the Sawmill station during post-constriction. YOY comprised 99% of the catch and migrations occurred over longer temporal scales.
3. Increased catch rates at the Reservoir station. Catch rates grouped by monitoring period (pre v. post). Variability in catch rates too great to detect differences. Higher proportions of YOY were observed post-construction.

# Biological Monitoring (cont.): Summary Observations

1. Results suggest new fishways have resulted in improved access to spawning and nursery habitat (New Bedford Reservoir) for river herring
2. Increased recruitment of elvers into the watershed during the post-construction period
3. In particular, YOY elvers have access to the upper watershed (increased numbers present in samples)

# Acknowledgements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2. ***MarineFisheries* staff – Phillips Brady, Ed Clark, Luis Carmo, Derek Perry, David Kowalske, Joe Fascendola, Dan Syriala, Josh Black, Talia Bigelow, Andrea Petrella, Jeff Devine, Kelly Kleister, Ray Jarvis**

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4. **Richard Quinn and staff (USFWS)**

5. **Dr. Alex Haro, Abigail Franklin and staff (USGS)**

# Future Efforts

1. Mill River (Taunton) – Three dam removal projects in planning

2. Jones River (Kingston) – Plans to facilitate passage into Silver Lake

3. Fore River/Monatiquot River (Weymouth, Braintree) – Plans to facilitate passage into Great Pond Reservoir