NOAA's Role and Experiences in Migratory Fish Passage and River Restoration in the Northeast

NOAA FISHERIES

Greater Atlantic Region

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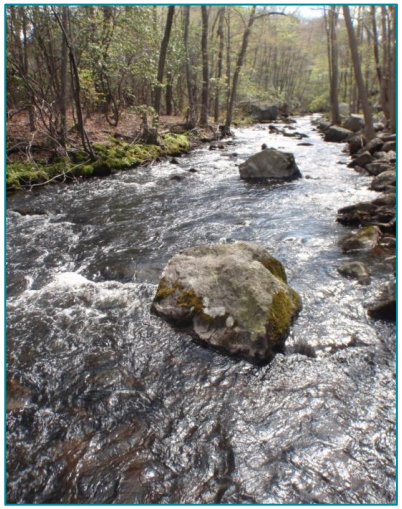
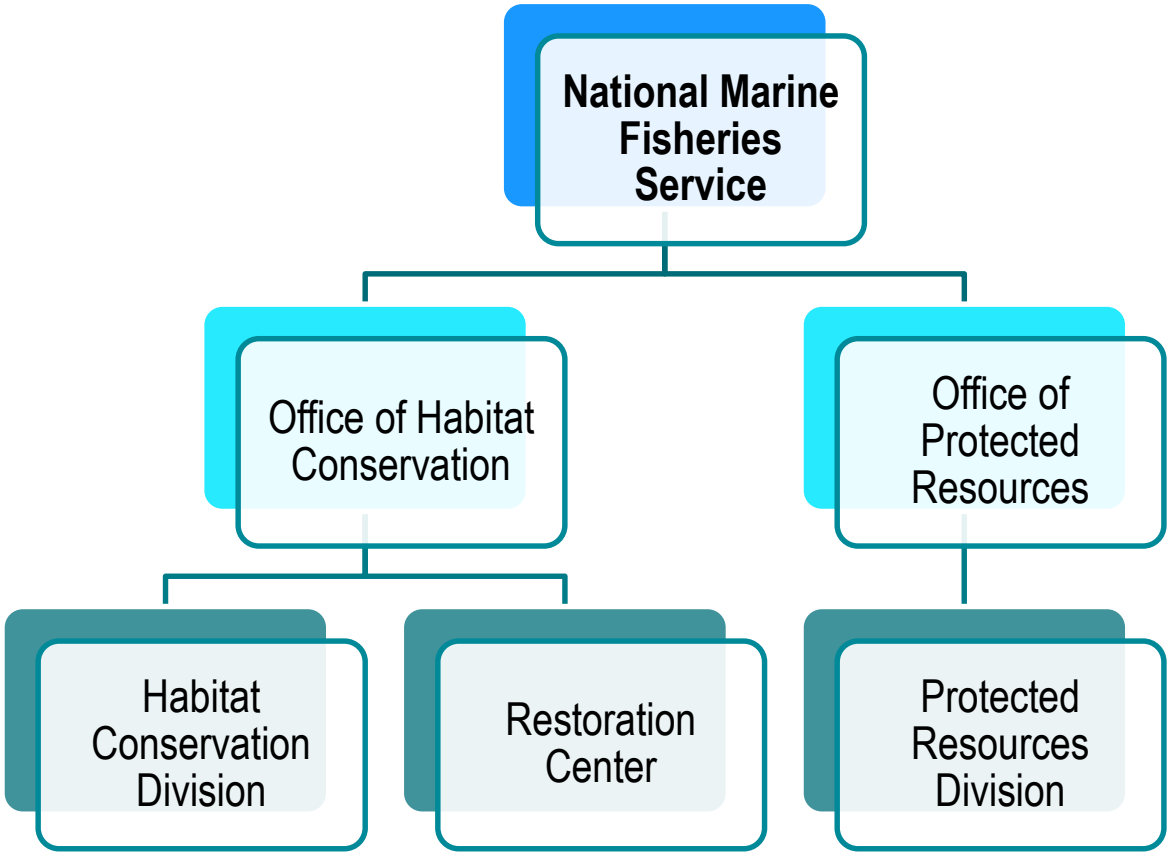
Southern New England
Soil and Water Conservation Society Meeting
Presentation
March 22, 2019

Presentation Outline



- Agency habitat focus, restoration programs, program outcomes
- Diadromous fish biology, passage needs and factors affecting passage
- Fish passage types, project challenges
- Examples of watershed-wide restoration

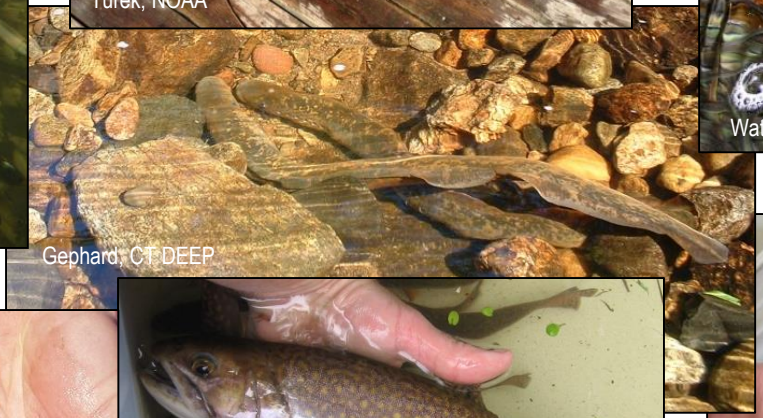
NOAA Fisheries Fish Passage Responsibilities



Programs:

- Community-Based Restoration Program (CRP)
  - Habitat Restoration
  - Coastal Resiliency
  - Atlantic Salmon
  - ARRA
- Damage, Assessment, Remediation and Restoration Program (DARRP)
- Hydropower Program
- ESA Program

A Diverse Fish Assemblage



A Diverse Fish Assemblage

East Coast Anadromous Fishes (13 species)

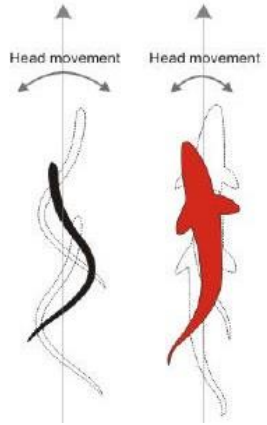
Alewife	*Alosa pseudoharengus*
Blueback herring	*Alosa aestivalis*
American shad	*Alosa sapidissima*
Hickory shad	*Alosa mediocris*
Gizzard shad	*Dorosoma cepedianum*
Atlantic salmon	*Salmo salar*
Sea lamprey	*Petromyzon marinus*
Atlantic sturgeon	*Acipenser oxyrincus oxyrinchus*
Shortnose sturgeon	*Acipenser brevirostrum*
Rainbow smelt	*Osmerus mordax*
Atlantic tom cod	Microgadus *tomcod*
Striped bass	*Morone saxatalis*
Sea-run brook trout	*Salvelinus fontinalis*

East Coast Catadromous Fish

American eel	*Anguilla rostrata*

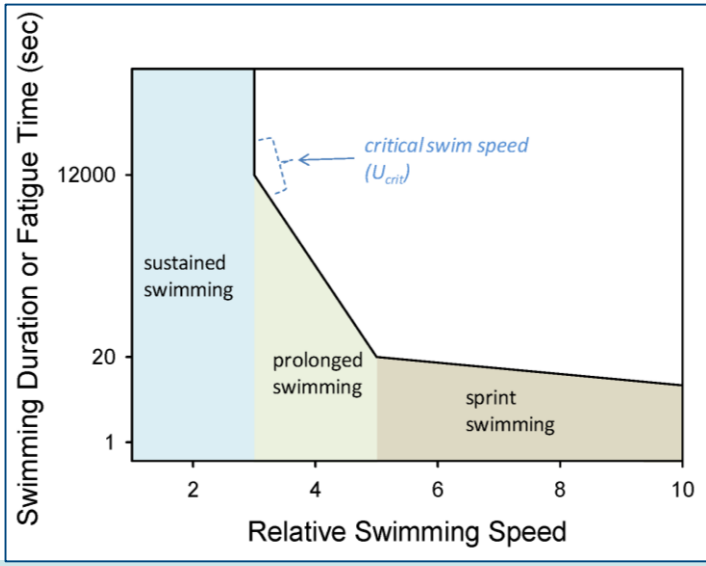
Swimming performance based on:

- Body shape and swim locomotion:
  - Anguilliform
  - Subcarangiform
  - Carangiform
- Body length
- Fish behavioral traits



Relative Swim Speed versus Duration

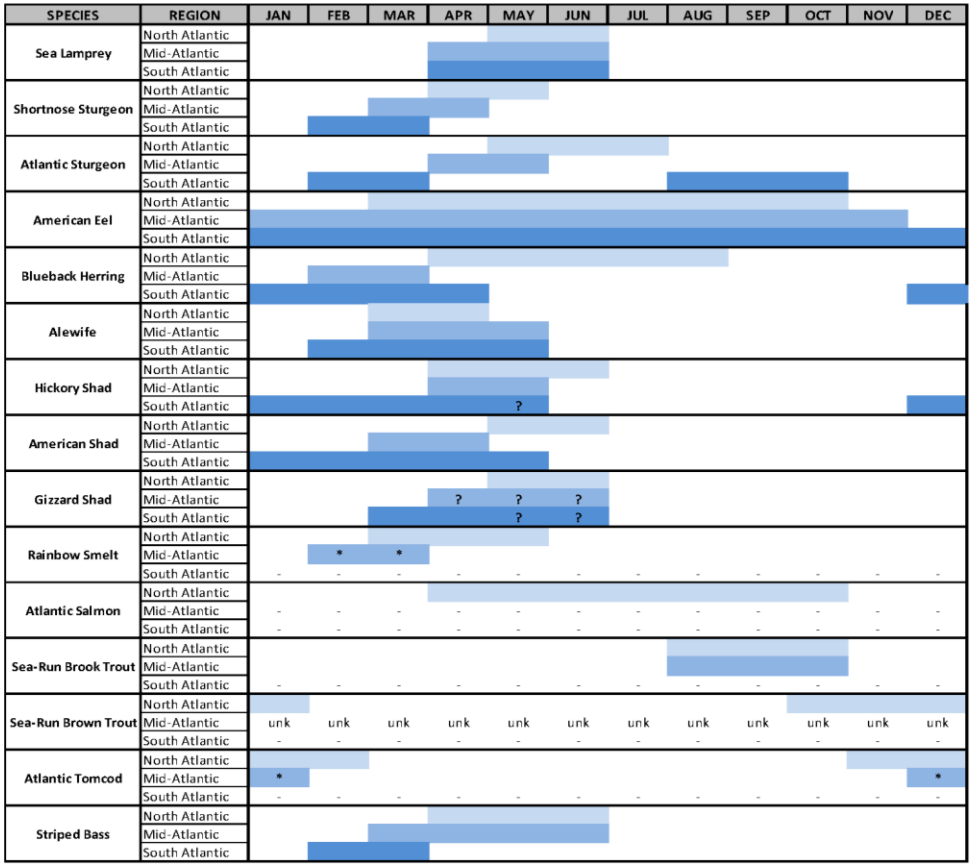
Source: A. Haro, USGS



Environmental Factors Affecting Fish Passage

Migration and passage affected by:

- River flow
- Hydraulics and turbulence
- Water temperature
- Location of passage site in the watershed
- Site conditions (e.g., bedrock)
- Changing climate, weather patterns



Run timing

Passage Flows Required for Design

Hydraulics develop in response to hydrology and geometry of passage site

Low (95% exceedence), normal (50% exceedence), and high (5% exceedence) run flows, derived from flow duration curves or tabulated as ranked order

Hydraulics for safe, efficient passage over entire operating flow range

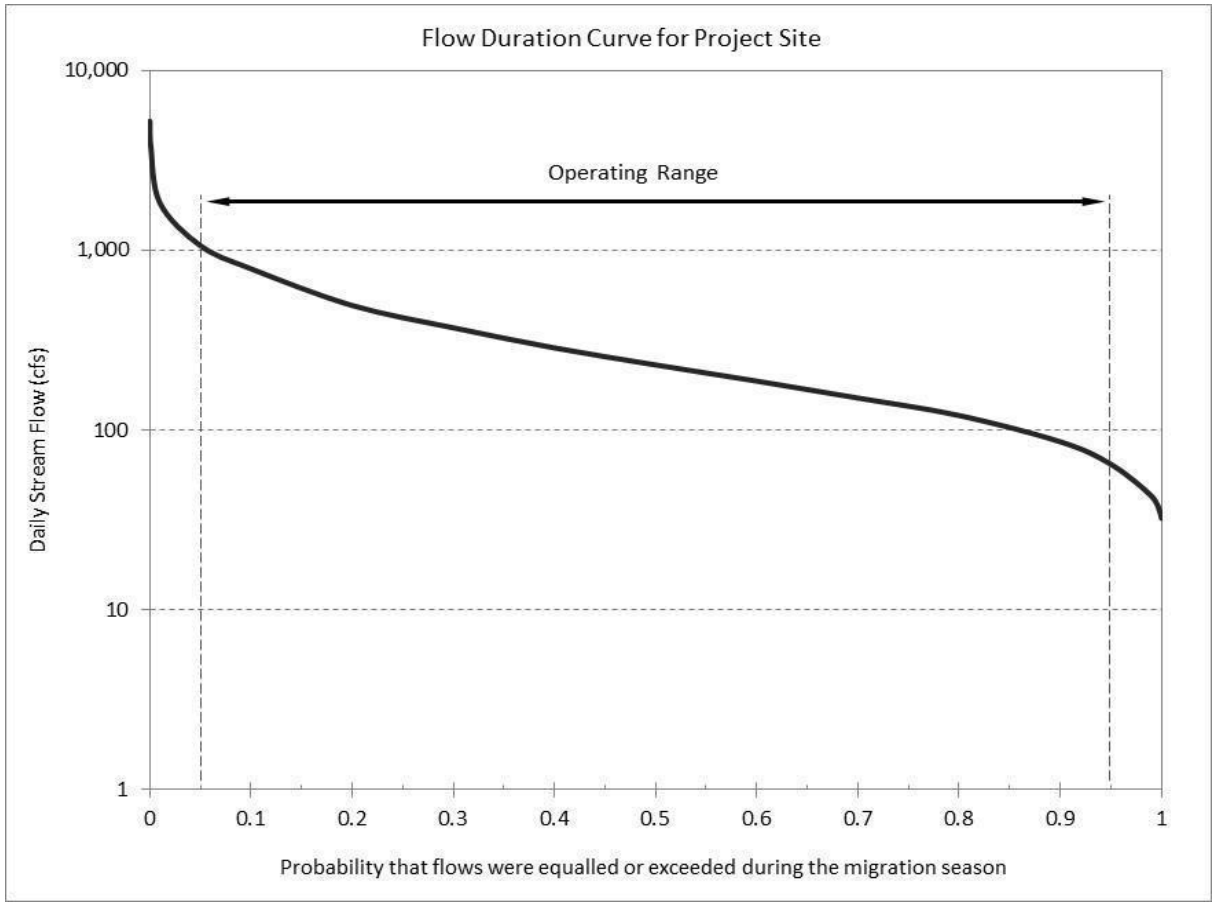
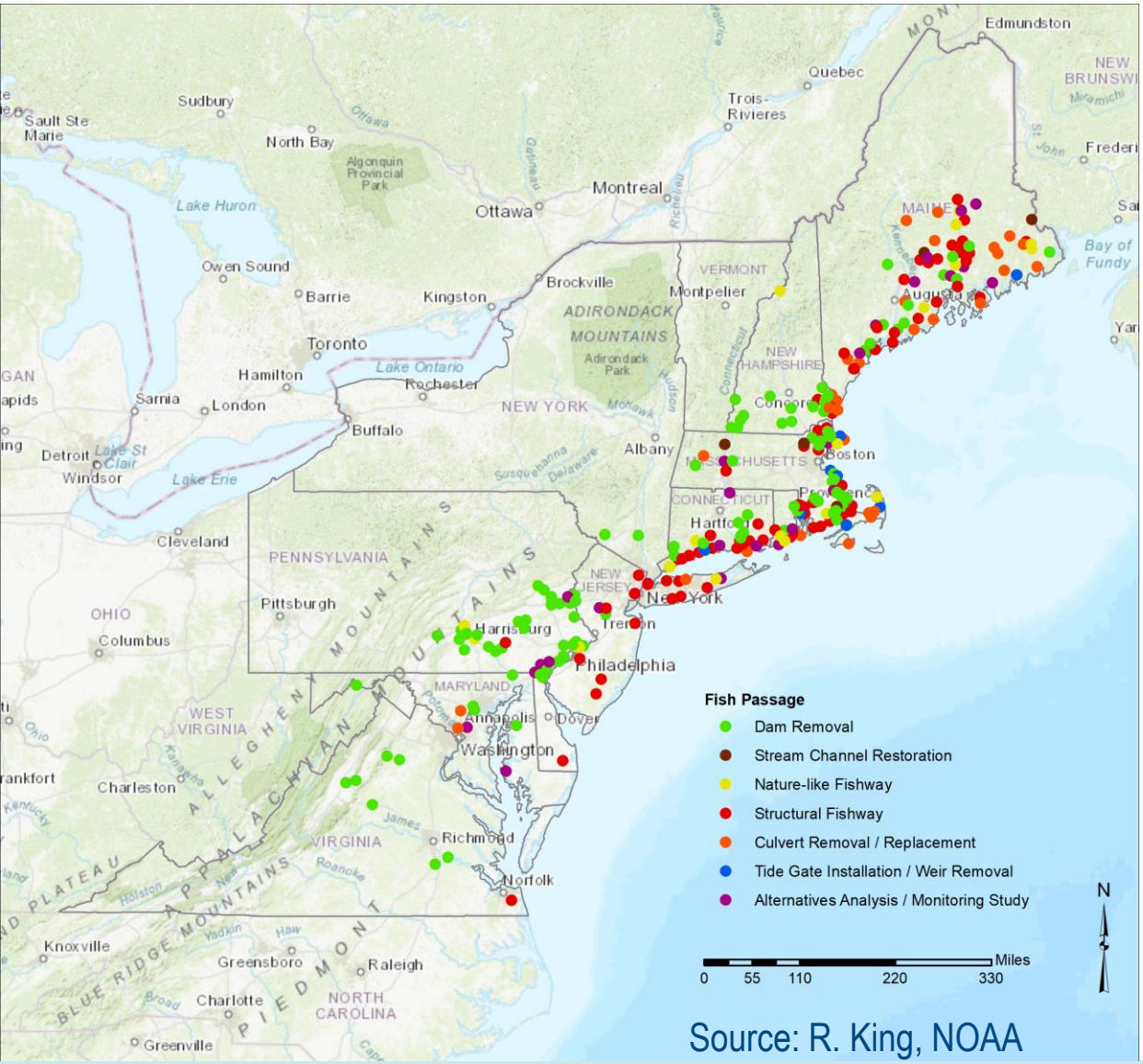


Figure Source: B. Towler, USFWS

NOAA Northeast Region Fish Passage: 1992-2018



Project Type

Dam Removals: **127** (39%)
Nature-like Fishways:**18** (6%)
Technical Fishways: **87** (27%)
Culverts: **38** (12%)
Stream Restoration: **6** (2%)
Tide Gates: **8** (3%)
Studies/FS: **38** (12%)
Total Passage Projects: **322**

Habitat Access Opened

River Miles: 2,102
Lake/Pond Acres: 30,037

Project Funds

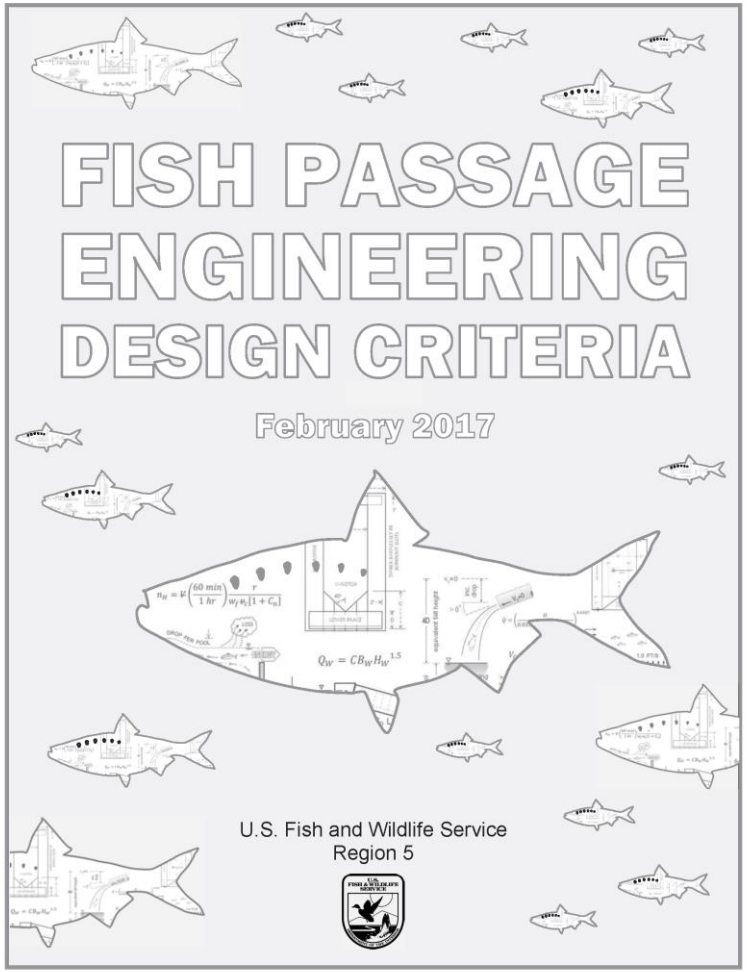
NOAA Funds: **$92.3M**
Federal Leverage: **$12.7M**
Non-Federal Funds: **$53.0M**

Passage Type: Structural Fishways

- Entranceway location and attraction flows
- Watershed size and flows
- Invert elevations of entrance and exit way
- Fishway slope
- Resting pools/turn pools
- Operation and maintenance

Structural Fishway Design

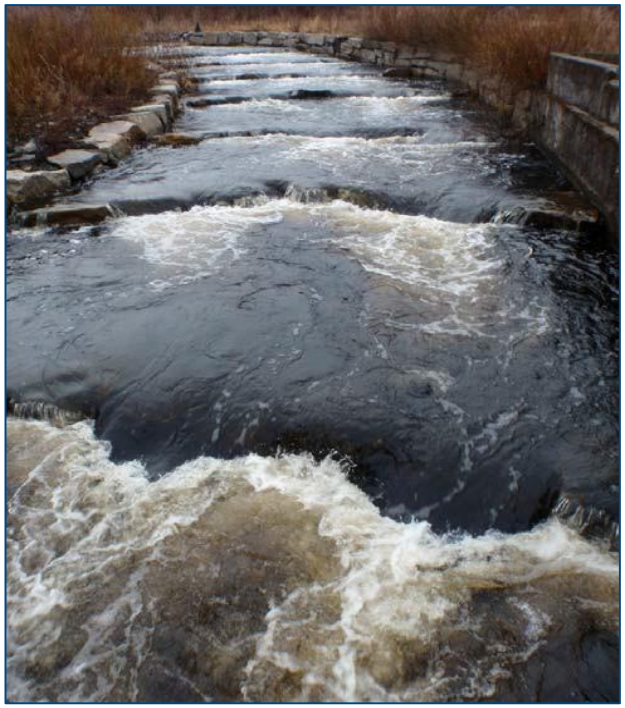
- USFWS Region 5 engineers
- NOAA OHC engineers



https://www.fws.gov/northeast/fisheries/fishpassageengineering.html

Passage Type: Nature-like Fishways

- Nature-like fishways (NLFs) may be a viable alternative when dam removal is not feasible due to one or more site constraints
- Layout and function:
  - In-channel alternatives
    - Full river-width
    - Partial width
  - Bypass alternative



Full River-Width NLF
Acushnet River, Acushnet, MA

Howland Bypass, Piscataquis River, Howland, ME

Passage Type:Nature-like Fishways

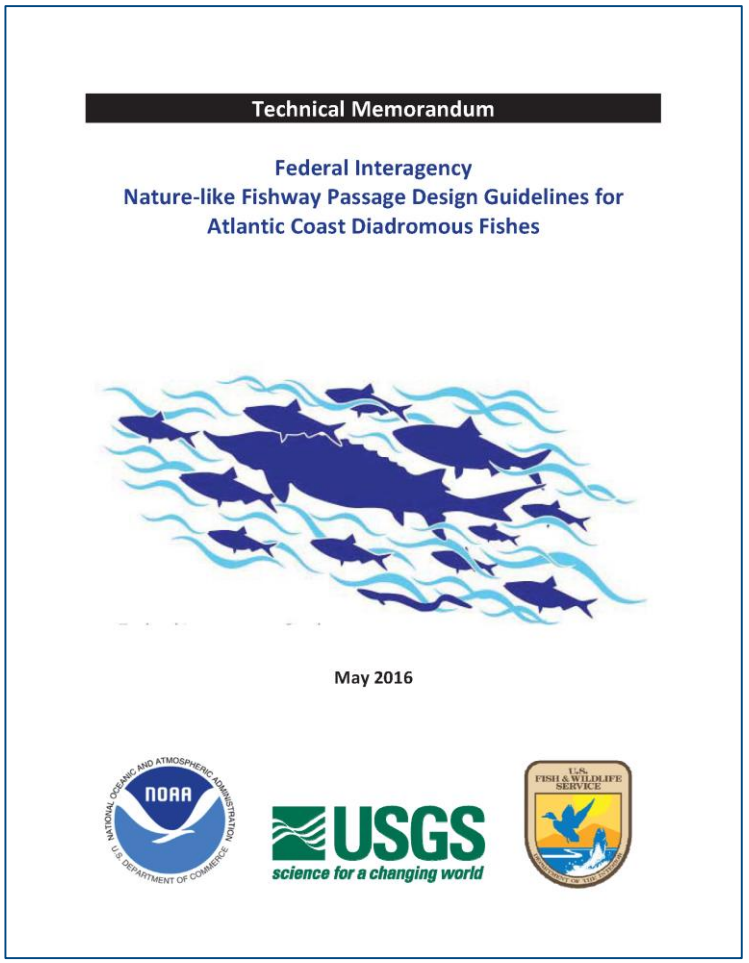
Hydraulic design alternatives:

- Step-pool – pool-and-weir, rock arch rapids, cross vanes, backwatering weirs
- Roughened channel – rock ramp, rock riffle, perturbation boulder

Kenyon Mill step-pool NLF, Pawcatuck River, Kenyon, RI

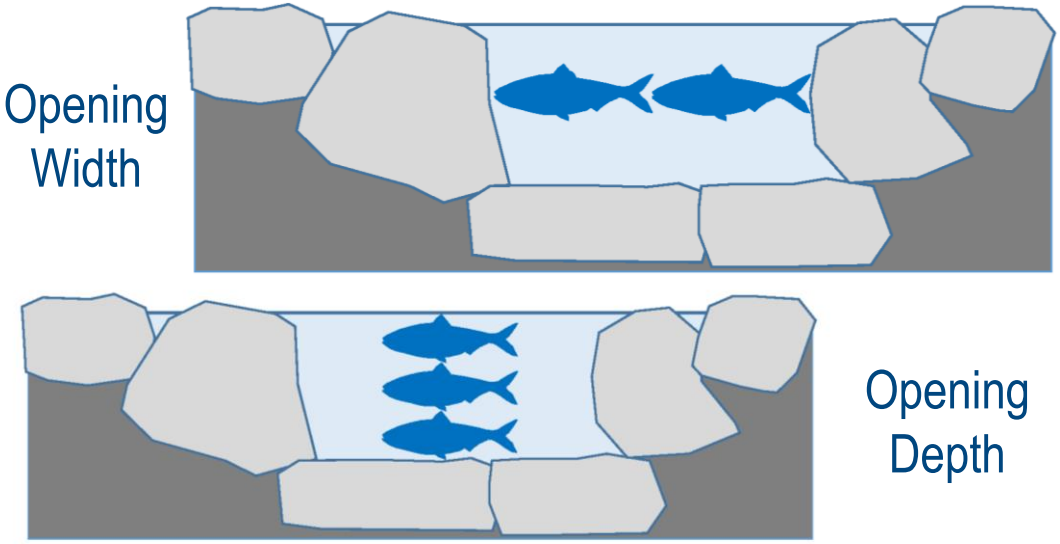
Billington Street roughened channel, Town Brook, Plymouth, MA

Nature-like Fishway Design Guidance



Biometric-based Guidelines

- Minimum pool width, depth, and length
- Minimum weir opening width and depth
- Fishway slope and maximum weir opening water velocity based on known U_{crit} or fish swimming mode and shortest body length



Passage Type: Dam Removal

Homestead Dam Removal, Asheulot River, West Swanzey, NH

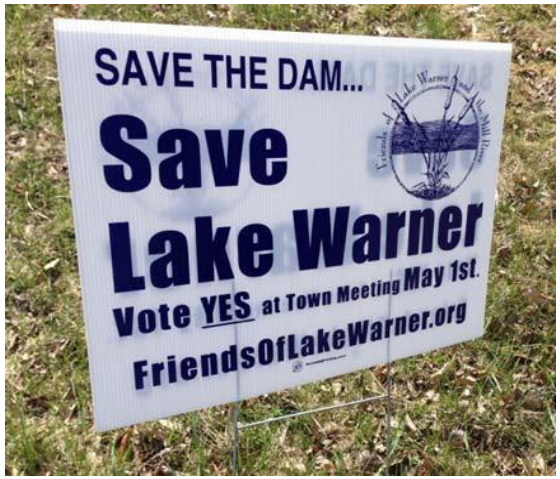
- NOAA considers dam removal as the preferred alternative for most passage barrier sites

- Often results in unimpeded passage, and restores, enhances and provides access to upstream spawning and rearing habitats

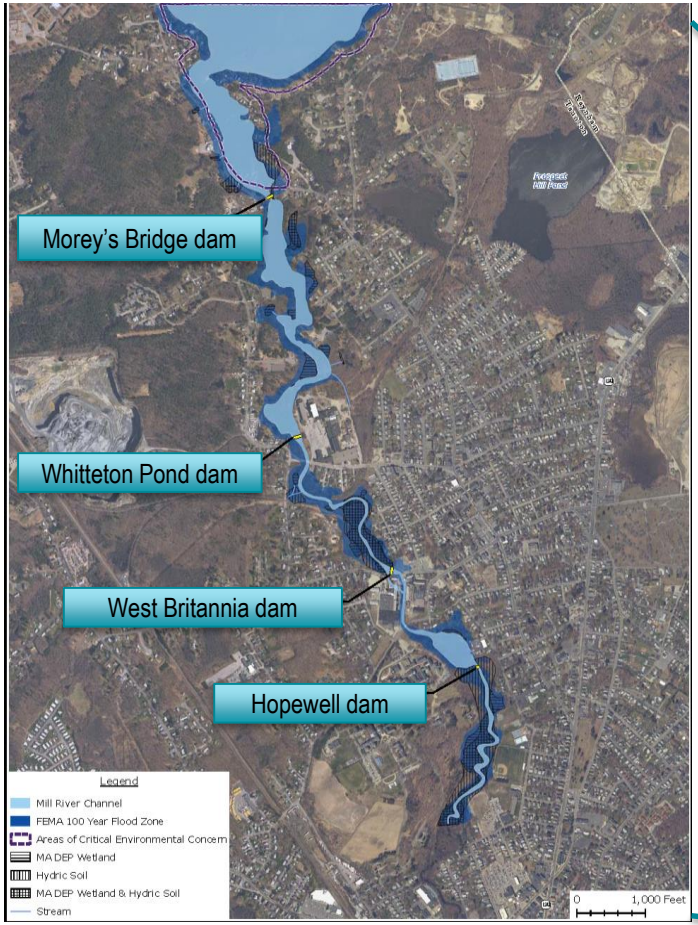
Passage Type: Dam Removal

Project Constraints and Challenges

- Technical – bridges, utilities, access and other infrastructure, wells, bedrock and other conditions
- Regulatory – wetlands, contaminated sediments, RTE species
- Cultural – historic, recreation, iconic feature
- Social and Political – sentimental values, opinions, rhetoric



Mill River Watershed Restoration

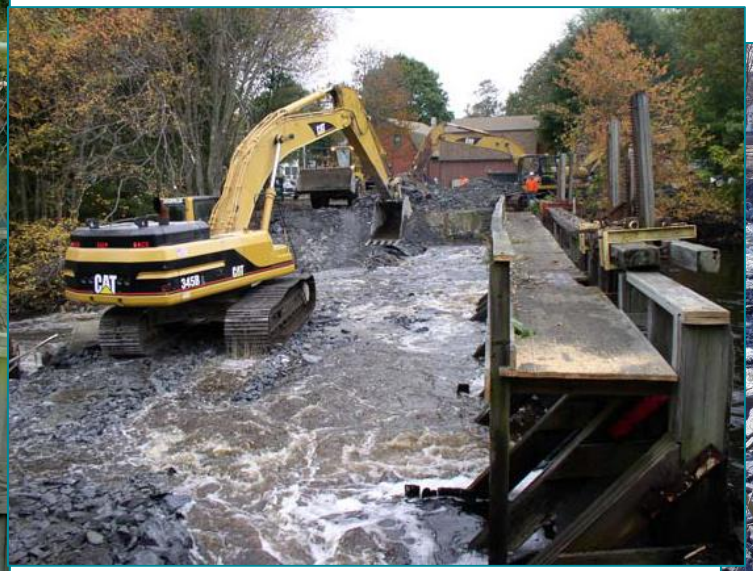


4-mile river, 4 passage barriers, Taunton, MA ("Herringtown")

Mill River Watershed Restoration

Whitteton Pond Dam

- October 2005 flood
- Whitteton Pond dam imminent failure
- 2,000 Taunton residents evacuated at cost of $1.5M
- Temporary emergency dam repair
- Dam removed in 2013



Mill River Watershed Restoration

Hopewell Dam Removal

Construction:
July-December 2012

Mill River Watershed Restoration

Hopewell Dam Removal

2018

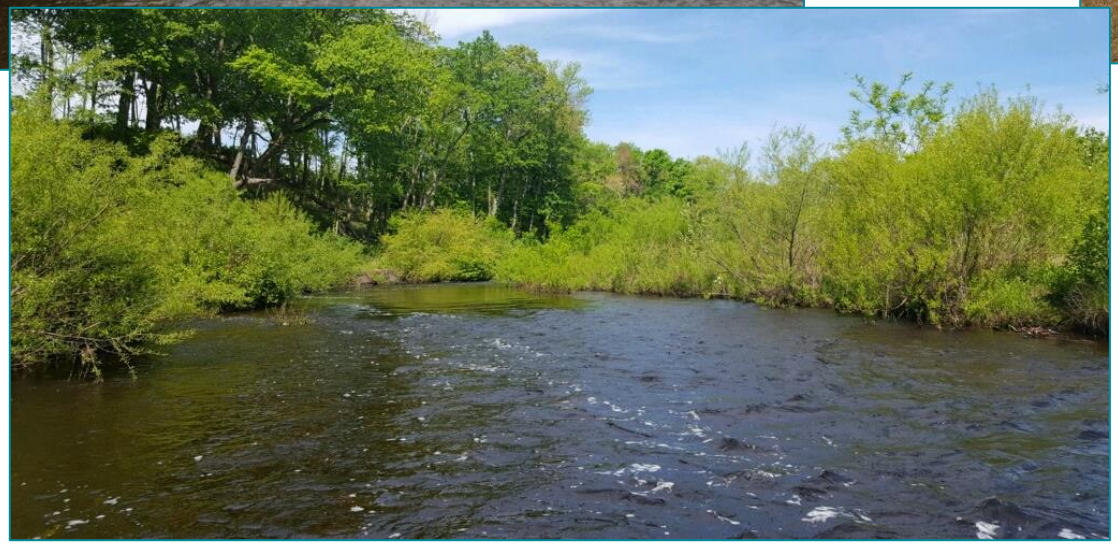


Photo Source: B. Lambert, MA DER

Sediment disposal site capped and converted to pollinator field

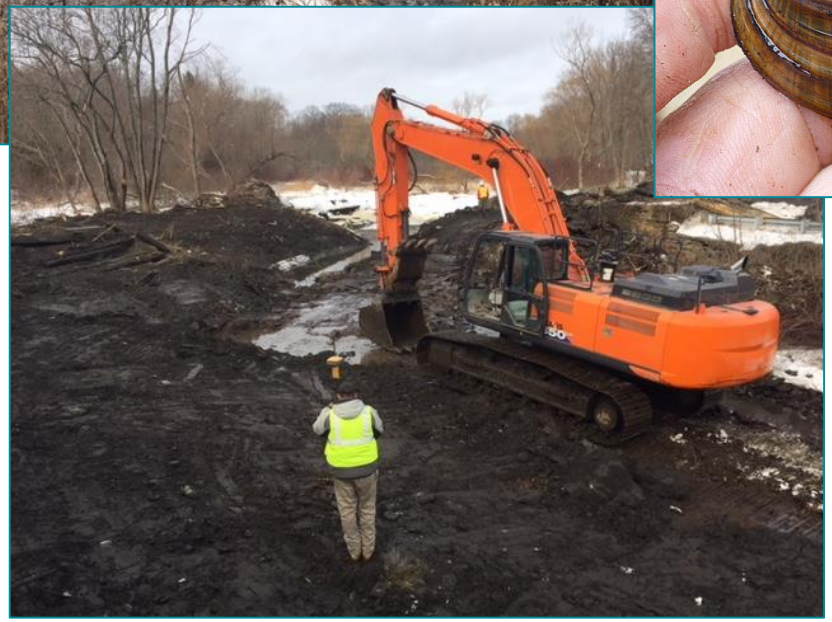
Restored river channel and floodplain, 2017

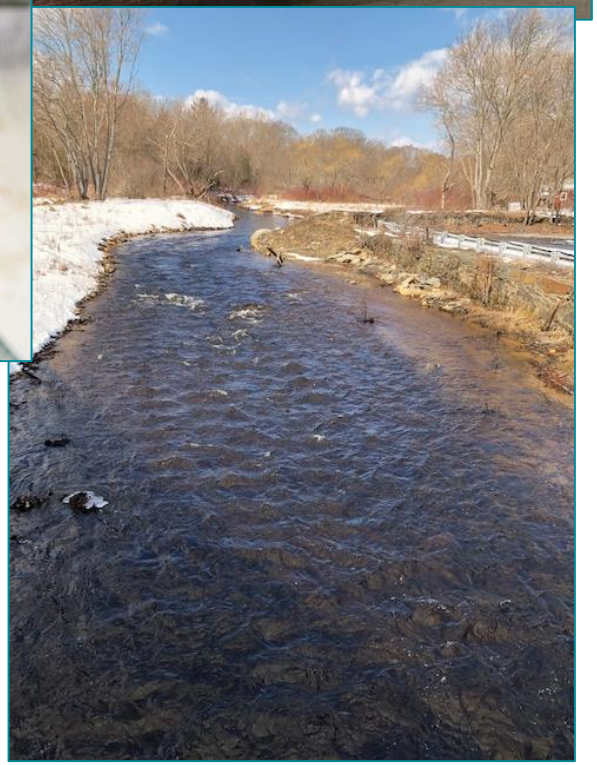
Mill River Watershed Restoration

West Britannia Dam Removal

Construction:
December-April 2018

Mussel Photo Source:
Biodrawversity





Mill River Watershed Restoration

Performance Monitoring

Video monitoring

<2014

2018>

Lake Sabattia Technical Fishway
Video Photo Source: S. Turner, MA DMF

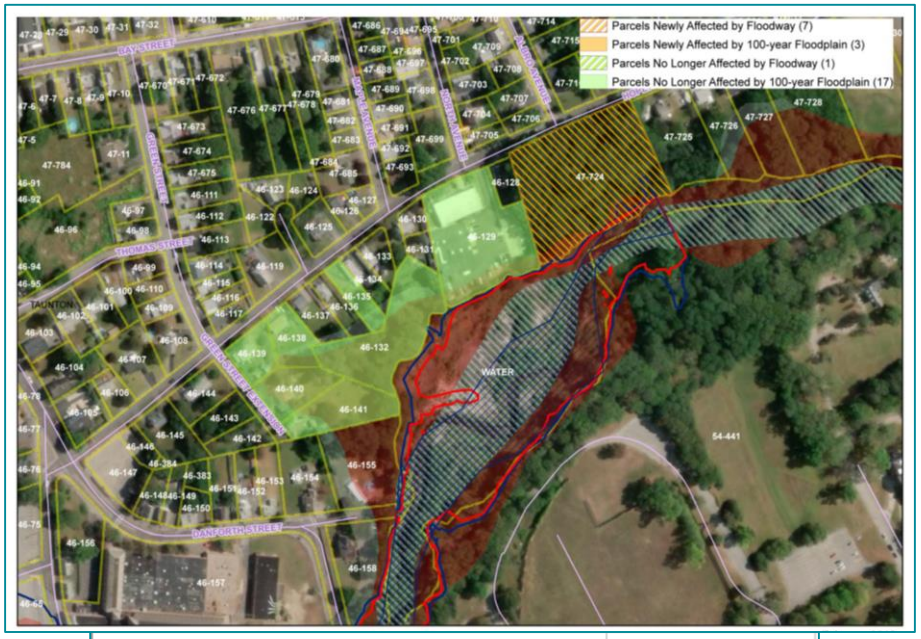
Sea lamprey nest counts
Photo Source: M. Trainor, MA DMF

Juvenile herring age and growth

Mill River Watershed Restoration

Letter of Map Revision (LOMR)

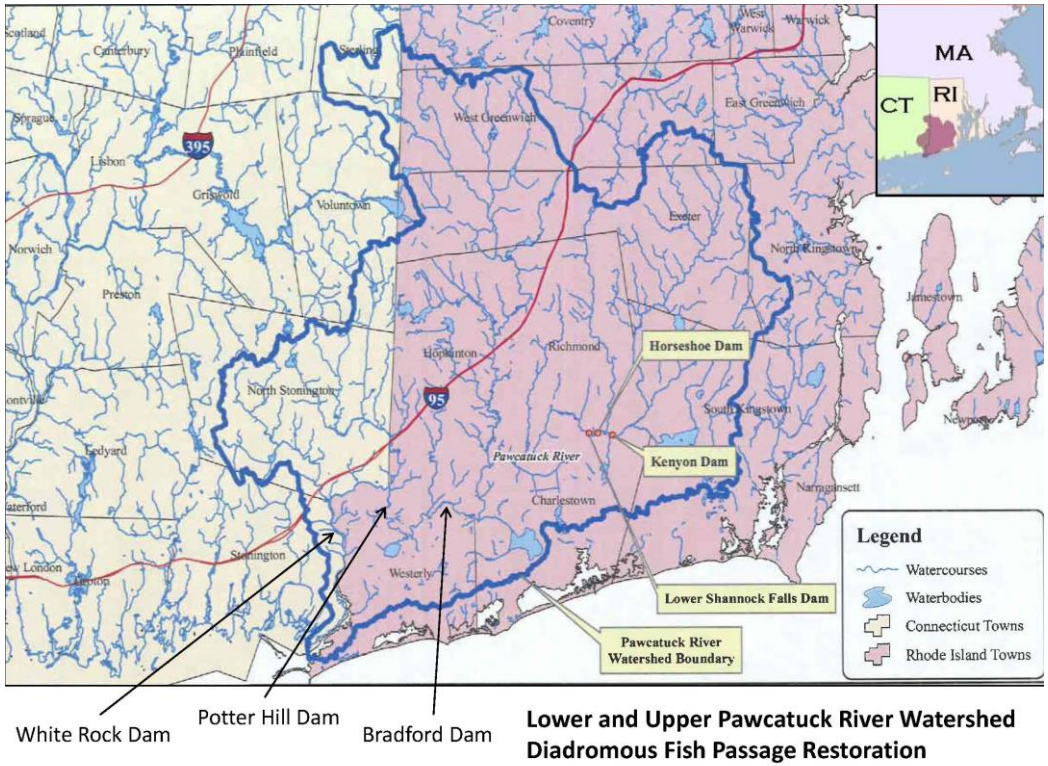
State Hospital Dam: Reductions in the 100-year Flood Profile



Changes to the Special Flood Hazard Areas	Quantity of Parcels Affected
100-Year Floodplain	
Newly Affected by 100-year Floodplain	3
Floodplain Narrows	43
Floodplain Widens	7
Floodplain Widens and Narrows	25
Removed Completely Floodplain	17
Floodway	
Newly Affected by Floodway	7
Floodway Narrows	5
Floodway Widens	11
Floodway Widens and Narrows	13
Removed Completely from Floodway	1

Source of LOMR materials: S. Widing, Interfluve

Pawcatuck River Watershed Restoration



- Passage restored at 6 mainstem dams
- Multiple target fishes – river herring, American shad, American eel
- Restoration 2004-2018
- ~$6M+ for passage restoration, to date

Kenyon Mill Dam Removal and NLF

Pawcatuck River Watershed Restoration

Passage Performance and Habitat Use

- USGS-led telemetry study, 2018-2019, 208 alewife PIT tagged, 43 shad radio tagged
- Efficiency at passage sites – alewife passed each site with relatively high efficiency (60-90%)
- Habitat access and use – 48+ river and stream miles and 1967 lake and pond acres

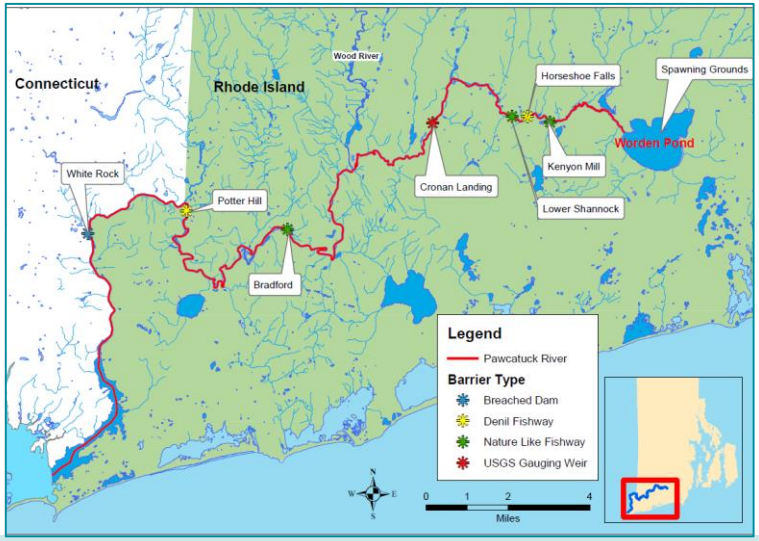


Figure Source:
S. Anderson, URI

Coonamessett River Watershed Restoration

Lower Bog Dam Removal and Restoration

Coonamessett River Watershed Restoration

Lower Bog Dam Removal and Restoration

Channel reconstruction, pool-and-mound wetland restoration, 2017

Restoring, 2018

Coonamessett River Watershed Restoration

Performance Monitoring

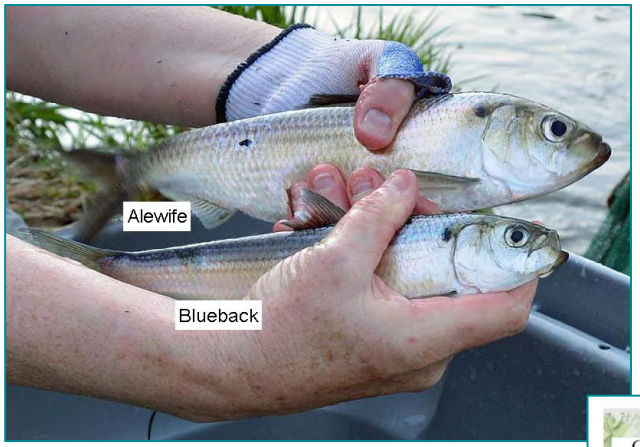


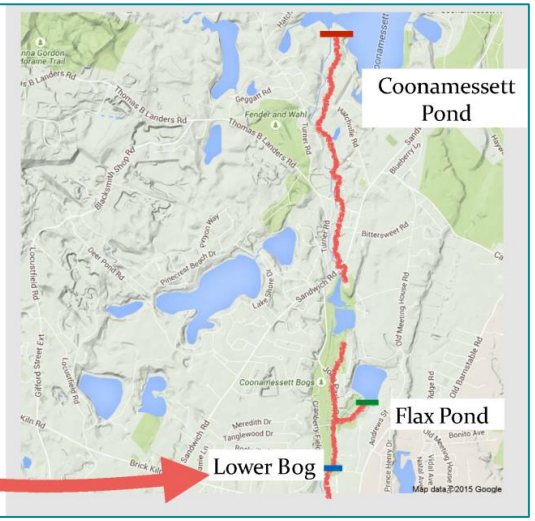
Photo: A. Carter, CRWT

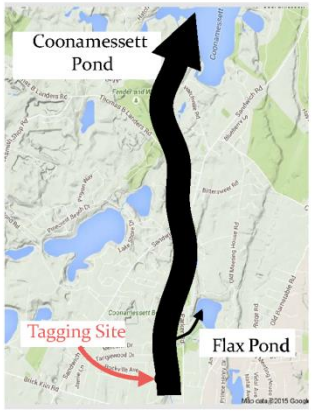
Herring predation by gulls

Tagged 2,080 herring over 4 years (2015-2018)

1,720 alewives and 360 blueback herring

Both upriver migration and outmigration evaluated





2015: 90% Coonamessett Pond and 10% Flax Pond

2016: 88% Coonamessett Pond and 12% Flax Pond

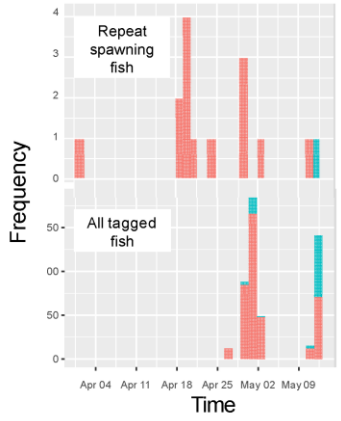
2017: 94% Coonamessett Pond and 6% Flax Pond

2018: Fish are still migrating!

Overall, many more alewives reached ponds

85-90% of bluebacks remained in lower sections in each year

Graphics and analysis:
A. Jones, NOAA



~ 25% of individuals outmigrating in 2015 returned in 2016

Most arrived early in the season

Moved rapidly upstream

Tracks from 2015 suggest limited time in freshwater

NOAA Program Outcome Summary

- Our program has matured over 25+ years to focus on dam removals resulting in substantial fish passage and population restoration benefits, plus increase community resiliency and benefit local economies
- NOAA supports use of nature-like or technical fishways when dam removal is not an option, but projects need to advance from engineer/science-based analysis guiding efficient passage of the target fish species or assemblage
- More often than not, Northeast fish passage projects have multiple challenges affecting how a project will be implemented or whether it will occur, at all
- Fish passage projects take time and require funds often from multiple partners – strong communication and transparency on funding and budgets, technical issues and stakeholder concerns are essential
- A committed project manager who is willing to take on and anticipates the many challenges is essential to project success

Thanks for Listening!

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