Jun 20th, 2:00 PM - 2:15 PM

Penobscot I: Monitoring the Penobscot River Restoration Project: Baseline Data to Inform Ecosystem Response

Molly Payne Wynne

George Aponte Clarke
Penobscot Trust

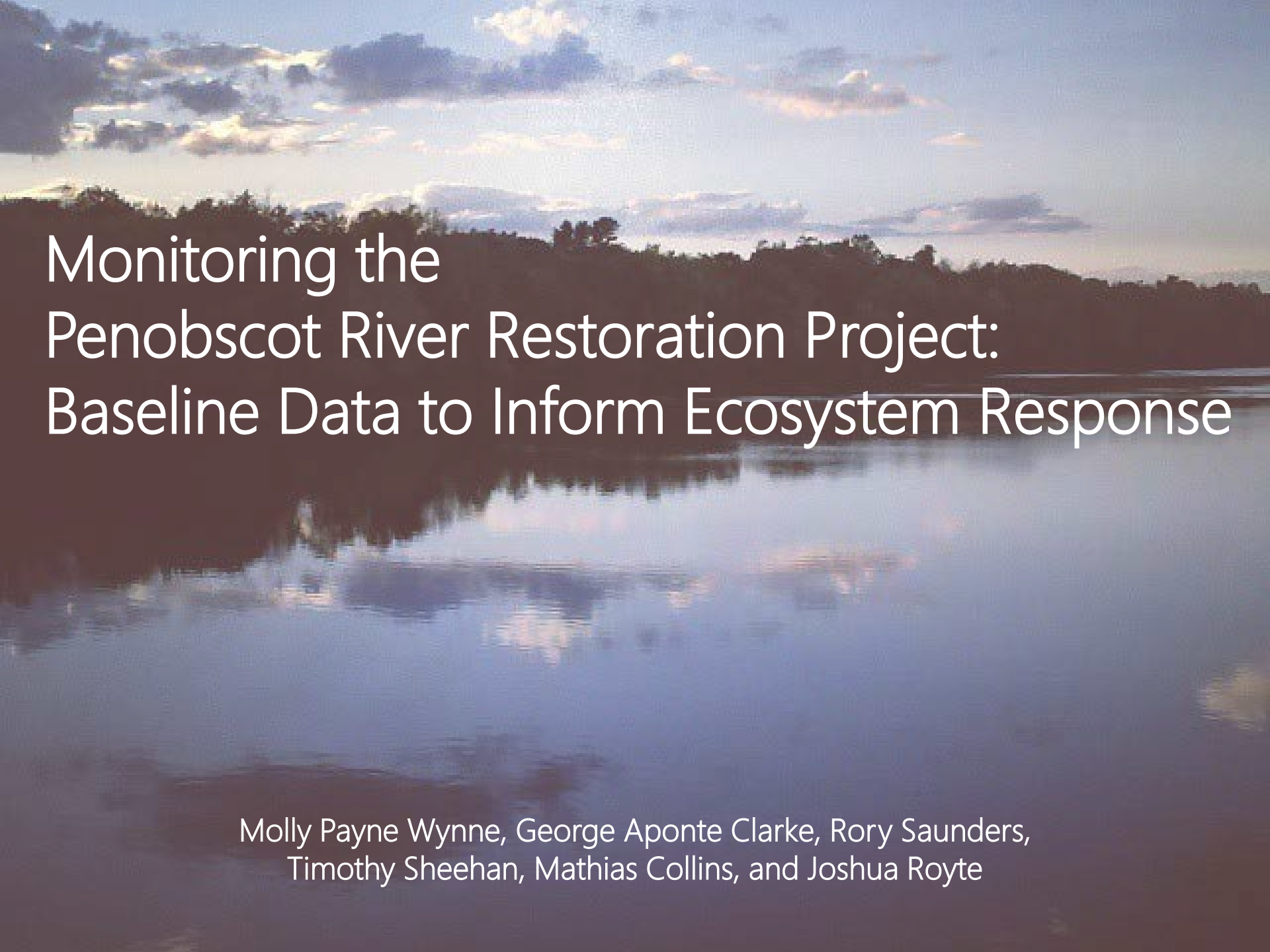
Rory Saunders

Timothy Sheehan

Mathias Collins

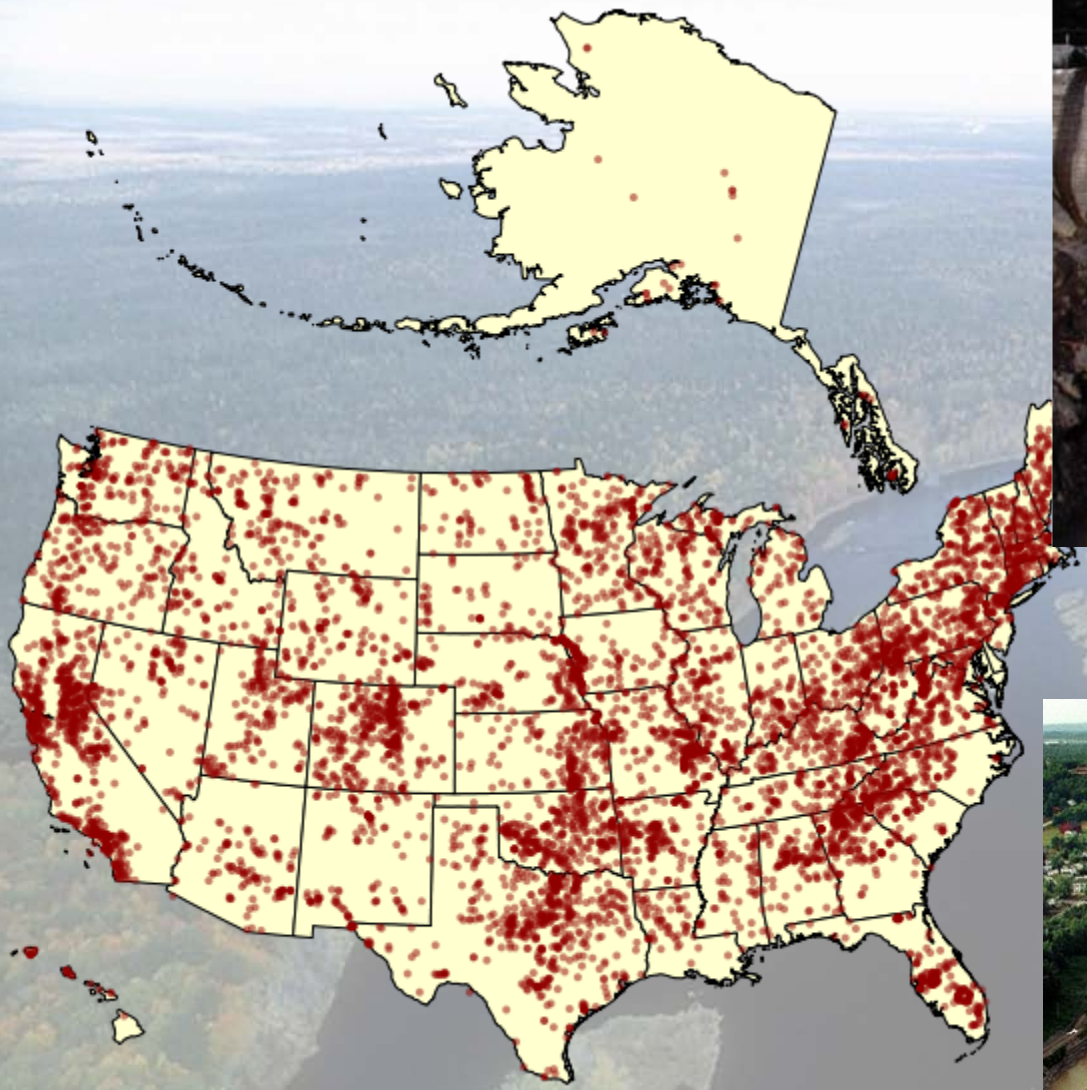
See next page for additional authors

Presenter Information
Molly Payne Wynne, George Aponte Clarke, Rory Saunders, Timothy Sheehan, Mathias Collins, and Joshua Royte



Monitoring the Penobscot River Restoration Project: Baseline Data to Inform Ecosystem Response

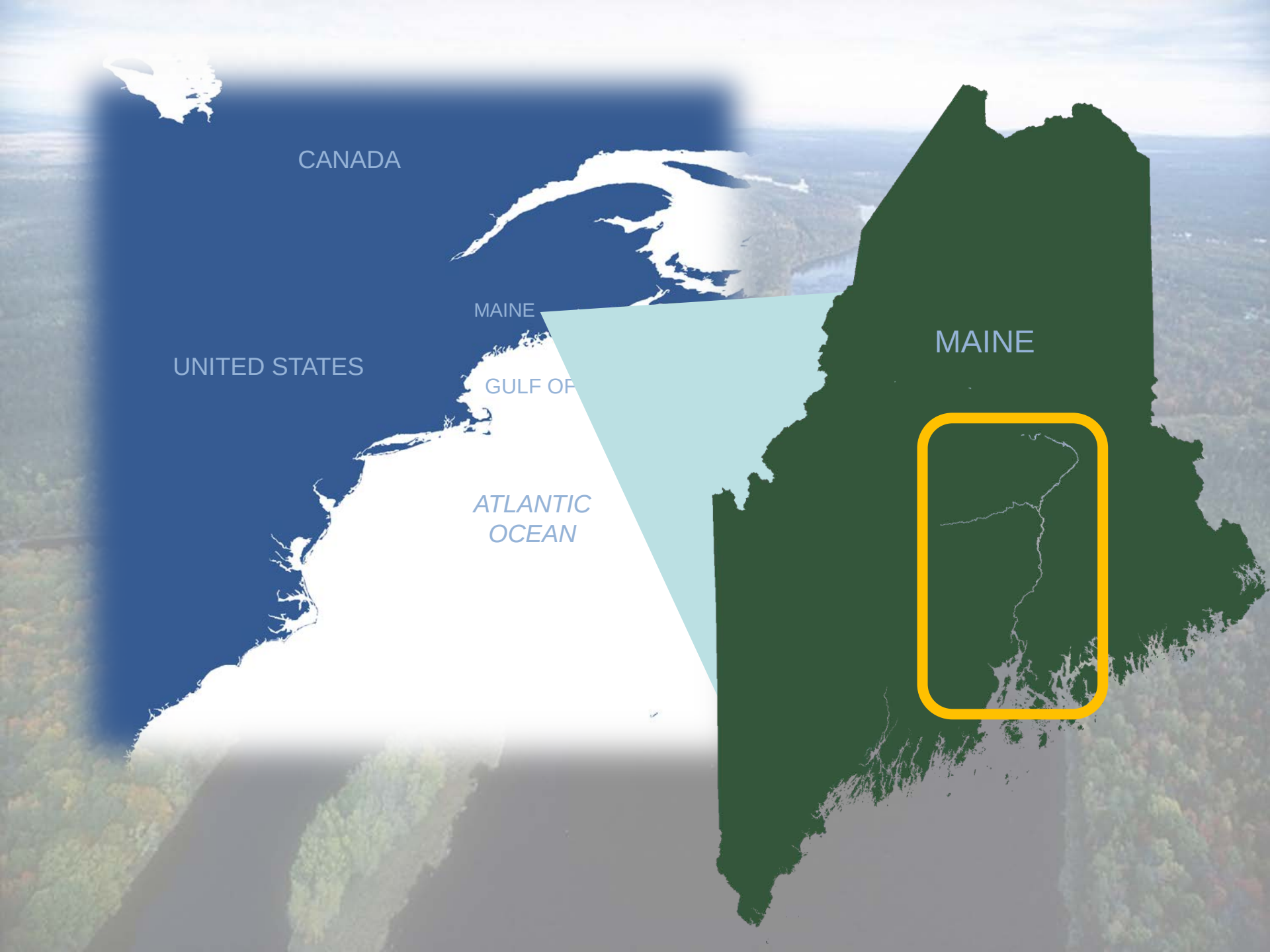
Molly Payne Wynne, George Aponte Clarke, Rory Saunders, Timothy Sheehan, Mathias Collins, and Joshua Royte



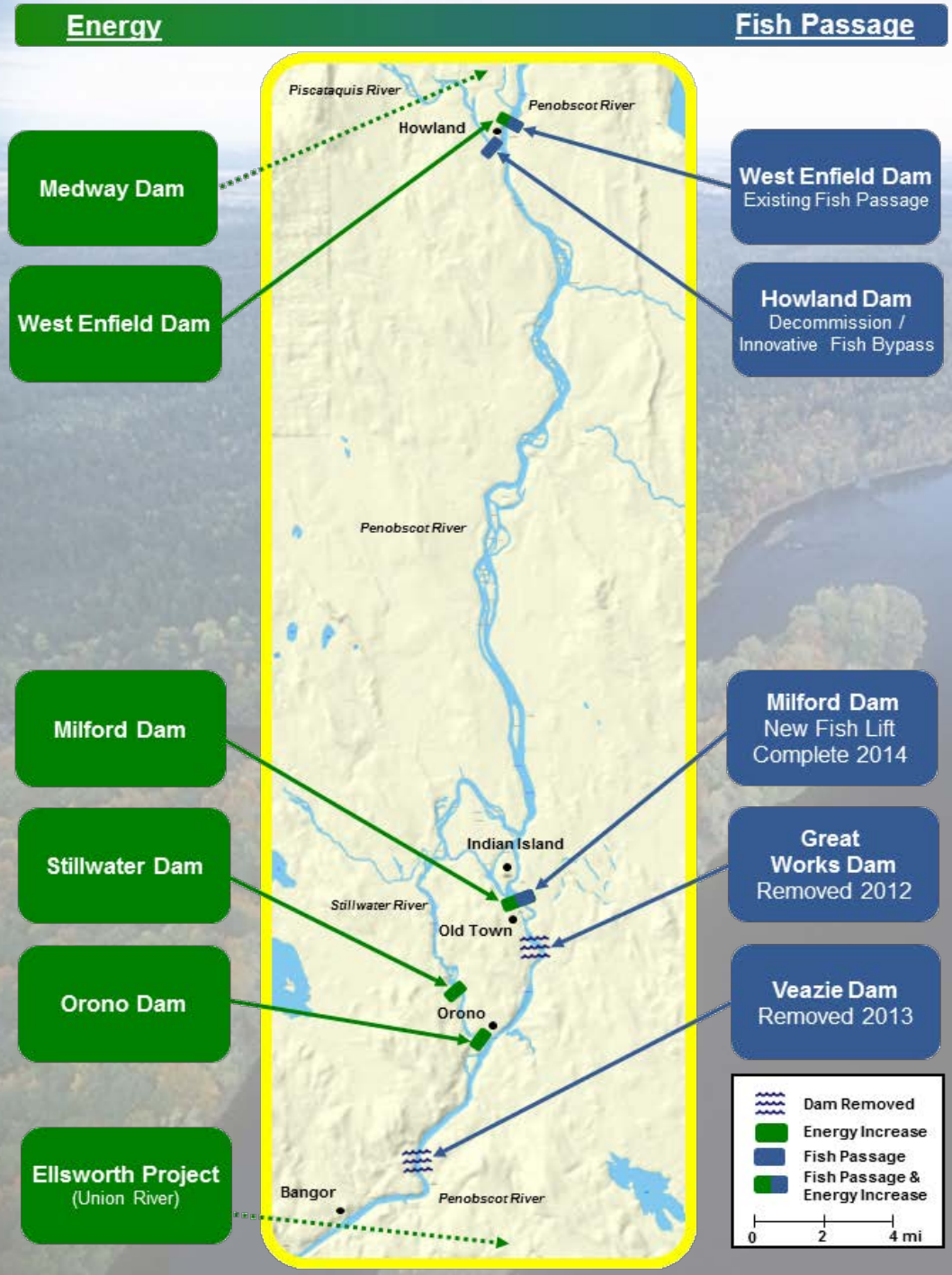
National Inventory of Dams-
Major US Dams 2006

Condit Dam, White Salmon River

Edwards Dam, Kennebec River


CANADA
MAINE
UNITED STATES
GULF OF
ATLANTIC
OCEAN
MAINE

Comparison of rivers in the Northeast U.S.



Guiding Image/ Objective

→ Removed Two Dams
closest to sea: Veazie & Great Works

→ Bypass Howland Dam
for inland habitat access

→ Improved Fish passage
at four other dams

→ Increased Energy
to maintain power generation

→ Enhanced Habitat Access
1,000 miles of historic habitat

→ Help Restore:
11 species of native sea-run fish associated traditions, culture, and economic opportunities

Project Monitoring:

Before-After Approach

Physical Channel

Fisheries

Water Quality

Habitat Use

Riparian Zone and Wetlands

Food Webs

Project	Objectives	Investigators
Channel Geometry, Bed Sediments and Photographic Monitoring	channel elevation, sediment characterization, and repeat photographic monitoring at permanent cross sections.	Kelley and Belknap 2012
Water Quality, Water Temperature, and Benthic Marco-invertebrate Monitoring	water quality/chemistry, water temperature, and benthic macro-invertebrates	Kusnierz et al. 2012
Fish Passage: Upstream Passage of Salmon and Other Diadromous Species (PIT tag methods)	PIT tag technology assessments of fish passage and migration timing/movements of Atlantic salmon, American Shad, and alewife.	Sigourney et al.
Fish Passage: Seaward Migration of Salmon Smolt (active tag methods)	Movement rates and survival of downstream passage for salmon smolts Passive tracking using an array of acoustic receivers cooperatively maintained by USGS, University of Maine and NOAA.	Stich et al.
Fish Passage: Shortnose Sturgeon Habitat Use and Spawning	monitoring of shortnose sturgeon to identify preferred habitat, spawning and population size estimates.	Zydlewski et al.
Fish Passage: Diadromous Species Assembling Below Lowest Dam (hydroacoustics)	continuously record the presence and direction of travel of diadromous fish moving through the lower river.	Zydlewski & Erbland 2012
Fish Community Monitoring at the Reach Level (electrofishing and seining methods)	quantify and characterize fish assemblages in the lower ~70 kilometers of river system using electrofishing and other methods.	Kiraly et al. 2012
Wetland and Riparian Habitat Mapping	monitoring of wetland and riparian plants and habitat repeated one year and five years following dam removals.	Boyle Associates 2012; TNC PRRT, et al.
Marine-Derived Nutrients and Ecosystem Function (stable isotope methods)	Determine incorporation of marine-derived nutrients and organic matter in to riverine food webs	Wilson and Sherwood 2012
The Penobscot Estuarine Fish Community and Ecosystem Survey	Investigate novel fish capture techniques and hydroaccoustics methods to monitor changes in species composition over time and space in the Penobscot estuary.	NOAA

Water Quality

Benthic macroinvertebrate community composition

- Maine DEP aquatic life model
- Indices of community structure

Water quality changes

- Temp, DO, conductivity, BOD, E. coli bacteria, total coliform, total suspended solids, turbidity, secchi disc visibility, total P, chlorophyll a, pH

D. Kusnierz, Penobscot Indian Nation

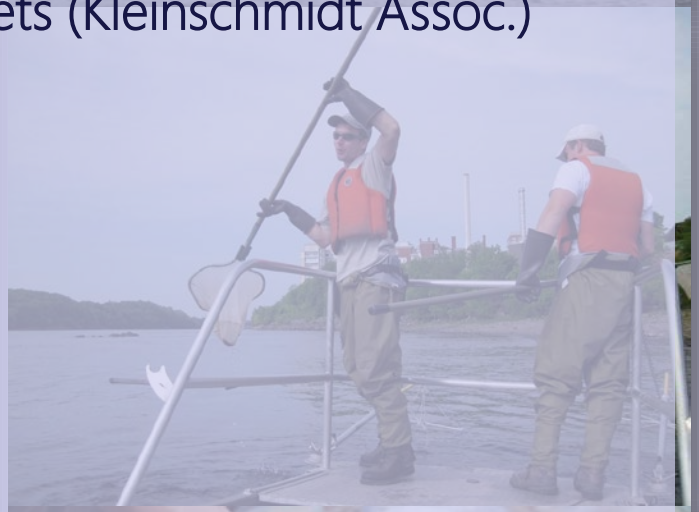
Geomorphology and Hydrology

Quantify river geomorphology and sediment profile

- Bathymetry surveys, grain size characterization, and photographic monitoring
- Monumented cross sections

A. Kelley, Univ. Maine; G. Stewart, USGS

Fish Community



Quantify fish community structure

- Continue and expand 2008 and 2009 data sets (Kleinschmidt Assoc.)
  - Applied electrofishing methodology

Hydroacoustics

- Estimated abundance at lower reach
  - Cross river section

Photo by Bridget Besaw, courtesy of Penobscot River Restoration Trust

S. Coghlan Univ. Maine; G. Zydlewski, Univ. Maine

Fish Passage

Upstream Passage

- Homing efficiency
- Migratory delay at fishways
- Passage rates
- Environmental and operational variables effecting connectivity

Downstream Atlantic salmon smolt passage

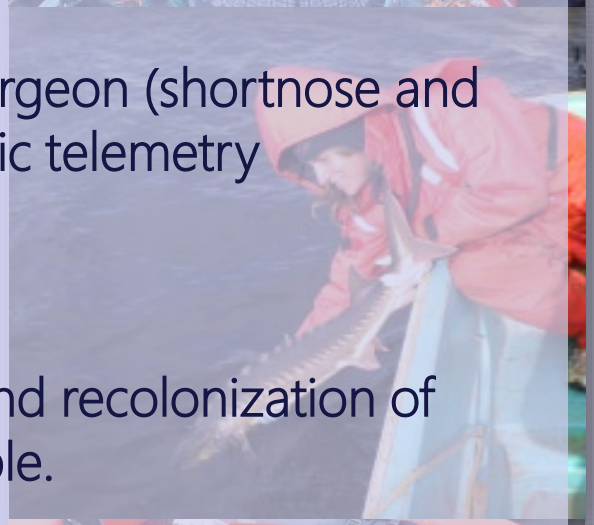
- Downstream survival
- Evaluate path choice
- Radio and acoustic telemetry methods

Hydroacoustics

- Estimated abundance at lower reach
- Cross river section

J. Zydlewski, Univ. Maine; G. Zydlewski, Univ. Maine

Sturgeon Reproduction and Habitat Use



Habitat use

- Assessment of two species of endangered sturgeon (shortnose and Atlantic sturgeon) in the lower river via acoustic telemetry

Assessment of spawning habitat

- Habitat modeling; monitor dynamics and recolonization of suitable spawning habitat now accessible.
- Larvae and egg surveys

G. Zydlewski, Univ. Maine

Photos C.Daigle, E. Aldrich; ESA Permit (16036) Compliant

Wetland, Riparian, and Ecosystem Response

- Assessing Marine-Freshwater Food Web Linkages Using Stable Isotopes
- Wetland and Riparian Habitat Mapping
- Bird Community Monitoring
- Estuarine Fish Community Monitoring

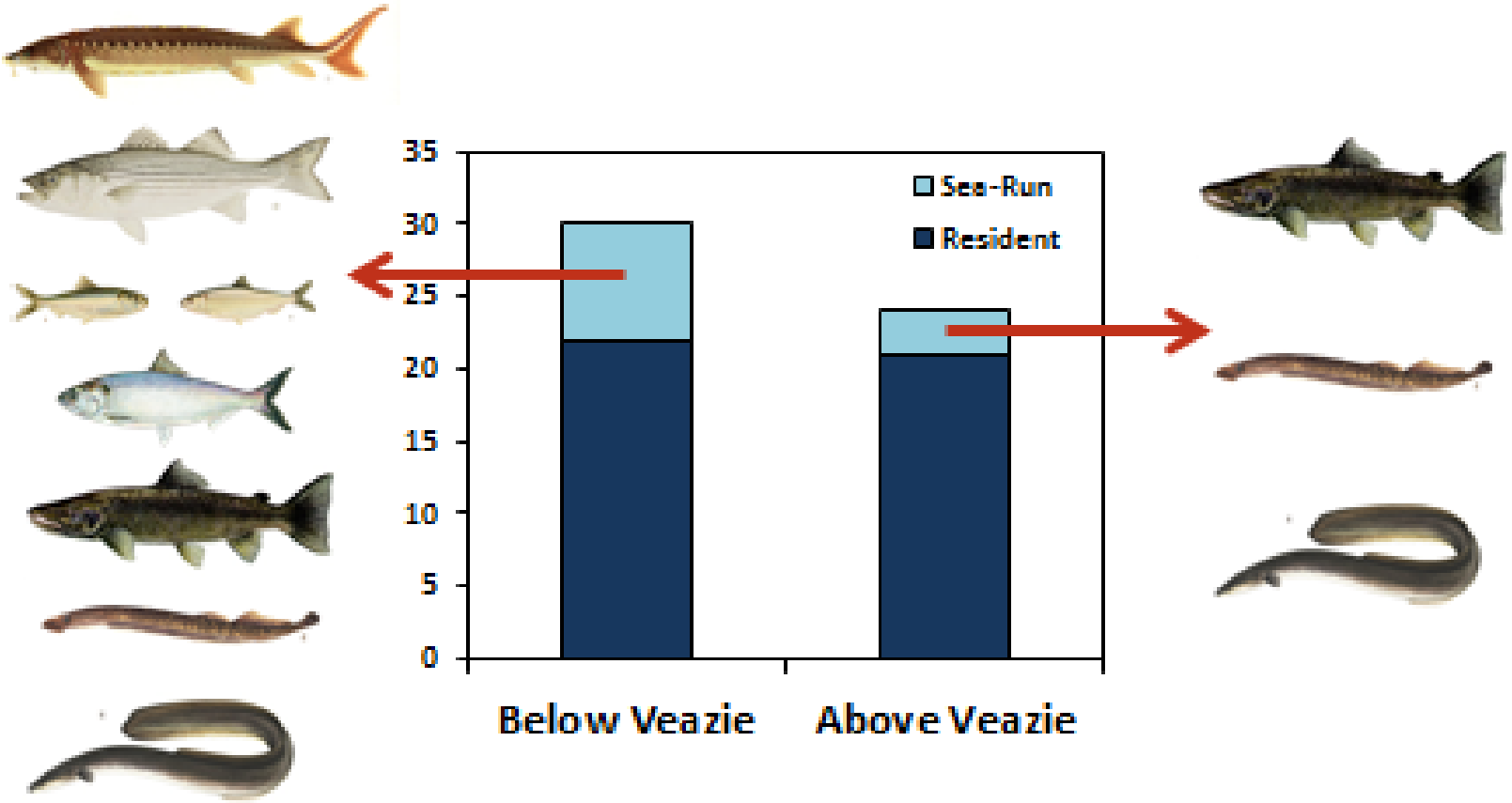
Wilson, USM & Sherwood, GMRI; Call, Univ. Maine; Lipsky, O'Malley, Stevens, Kocik, and Saunders; NOAA

Baseline Patterns

1. All 12 native diadromous species of fish are present in the Penobscot River, many of which are successfully reproducing on their own
2. Diadromous species persist despite having access to only a small percentage of their historic habitat
3. Veazie Dam represented a near complete barrier to migration of most species of diadromous fish.
4. Water quality does not appear to be limiting for most diadromous species
5. Large changes to flow, sediment regime, and habitat (except in the immediate vicinity of the former dam sites) are unlikely.

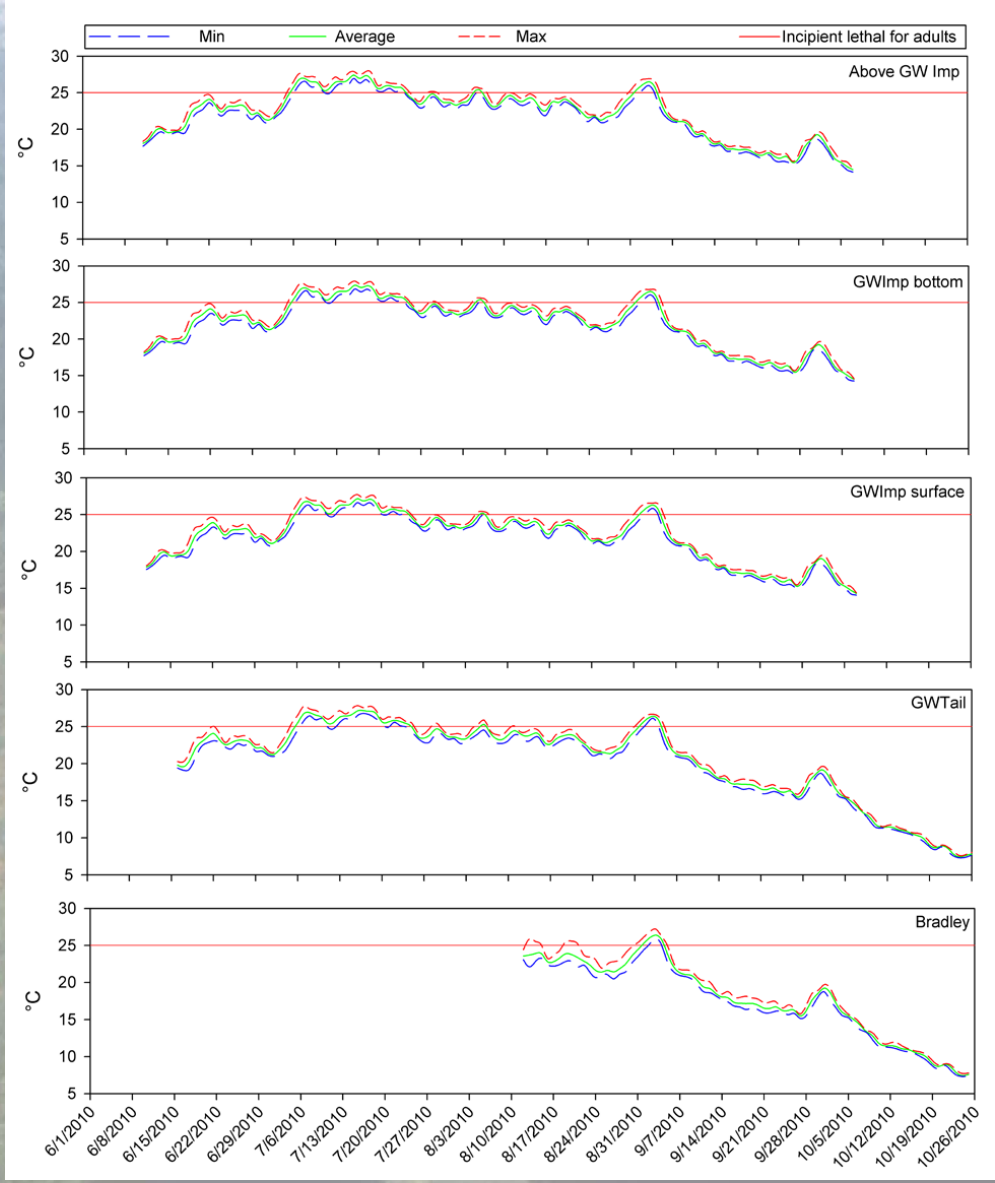
3. *Veazie Dam represented a near complete barrier to migration of most species of diadromous fish.*

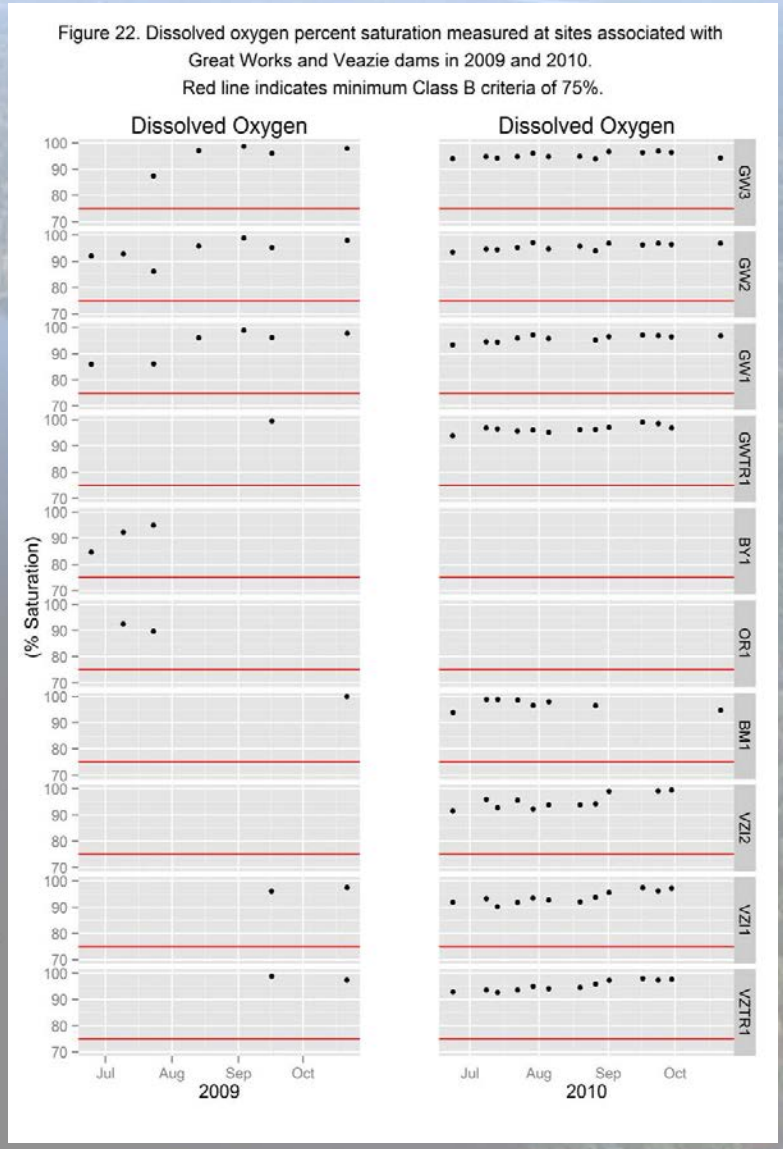
Sea-run species documented below vs. above Veazie Dam



Slide Courtesy of Dr. Stephen Coghlan, University of Maine

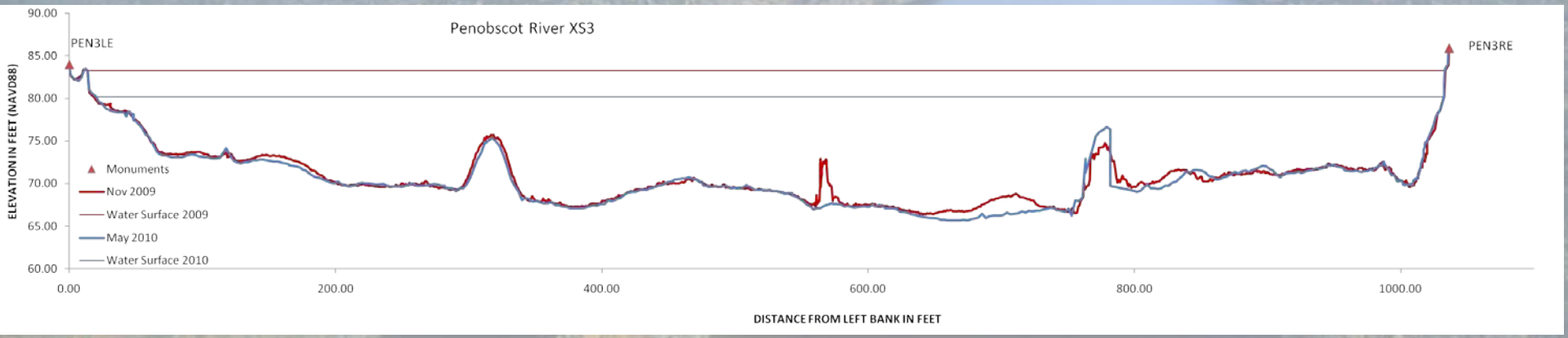
4. Water quality does not appear to be limiting for most diadromous species





Kusnierz et al. 2010

5. *Large changes to flow, sediment regime, and habitat (except in the immediate vicinity of the former dam sites) are unlikely.*



Baseline Conditions

Importantly, we have a snapshot of pre dam removal conditions and thus an objective basis for evaluation of restoration outcomes post project implementation.

A River Reborn?

C. Daigle, PRRT

2016 Fish Counts*

Atlantic salmon	**190**
River herring**	**1,194,577**
American shad	**2,945**
Striped bass	**195**
Sea lamprey	**582**

* As of June 13, 2016; Maine DMR at Milford Fish Lift

** An additional 464,979 river herring counted at Blackman Stream

Acknowledgements

Research Collaborators from:

- University of Maine, University of Southern Maine, Gulf of Maine Research Institute, Penobscot Nation, USGS, NOAA
- Diadromous Species Restoration Research Network (DSRRN), Brookfield Hydro
- And the countless others who made this work possible…


M. Payne Wynne, TNC