PENOBSCOT WATERSHED CONFERENCE

Sharing our Heritage, Challenges, and Future

THE PENOBSCOT WATERSHED CONFERENCE: SHARING OUR HERITAGE, CHALLENGES, & FUTURE

On Saturday, April 9, 2016, at Point Lookout in Northport, Maine, the *Penobscot Watershed Conference* brought together more than 300 scientists, researchers, business leaders, nonprofit organizations, fishermen, government representatives, and others to discuss the state of the watershed past, present, and future: what needs to happen, what individuals might do, and recommendations for action.

The Planning Committee consisted of representatives from:

- Islesboro Islands Trust
- Penobscot Nation
- Maine Sea Grant
- University of Maine Cooperative Extension
- Penobscot East Resource Center
- Friends of Sears Island
- Penobscot Marine Museum
- Lower Penobscot Watershed Coalition
- Belfast Bay Watershed Coalition
- Island Institute
- Natural Resources Council of Maine
- Sierra Club Maine
- Maine Lakes Society
- The Nature Conservancy
- Maine Coast Heritage Trust

Sponsors

- Maine Sea Grant
- National Oceanic & Atmospheric Administration (NOAA)
- The Nature Conservancy
- GBL Charitable Foundation
- Island Institute
- Islesboro Islands Trust
- Maine Coast Heritage Trust
- Natural Resources Council of Maine
- Penobscot East Resource Center
- Penobscot Nation
- Penobscot Indian Nation Enterprises
- Penobscot Marine Museum
- Pendleton Yacht Yard
- The Nature Conservancy
- Bangor Savings Bank
- Front Street Shipyard
- Hamlin's Marine
- Islesboro Marine Enterprises
- Charles Verrill
- Maine Boats, Homes & Harbors Magazine
- Raymond James Financial
- Wooden Boat Publications
- Belfast Bay Watershed Coalition
- Friends of Sears Island
- Sam Mitchell

seagrant.umaine.edu/penobscot-watershed-conference

Welcoming Remarks

hosted by Paul Anderson, Maine Sea Grant

Chief Kirk Francis, Penobscot Nation

Curt Spalding, Regional Administrator, US EPA Region 1

US Representative Chellie Pingree, 1st Congressional District of Maine

Keynote Presentation

Navigating the Penobscot River through Turbulent Times toward an Uncertain Future: A 4,000 Year Retrospective

Robert Steneck, Professor, University of Maine

The tendrils of the Penobscot River ecosystem stretch from beyond Baxter State Park to the Gulf of Maine. Humans and this ecosystem have both nurtured and stressed each other over millennia. Steneck reviewed the ecological history of the watershed and pondered the future of this amazing body of water and the people who depend on it.

Indicators of Environmental Health

Theme Purpose: To share current information on the health of the Penobscot Watershed, and explore connections between lakes, tributaries, the river, and the bay.

Lakes Moderated by Cheryl Daigle, Maine Lakes Society

Lakes are a prominent feature of the Maine landscape, and provide valuable fish and wildlife habitat, drinking water for nearly half of our residents, and diverse recreational opportunities – all integrally connected to the economic health of our communities and our sense of place. Protecting our water quality is critical to sustaining healthy human communities and the fish and wildlife resources that we rely on for cultural, recreational and consumptive uses. This session described the current state of our lakes within the Penobscot watershed, the threats and challenges to our freshwater resources, and actions underway to protect our lakes from harm.

LAKESMART: Educating home owners to maintain lake shoreland properties to protect water quality and increase lake resilience

Maggie Shannon, Program Director, The Maine Lakes Society and LakeSmart

Half of Maine drains to lakes, and these waterbodies drain to streams, rivers, estuaries and the Gulf of Maine. These nonrenewable resources, which provide irreplaceable environmental, social, economic, and aesthetic benefits to Maine residents and visitors, are in decline statewide. In economic terms alone, lakes generate $3.5 billion in economic activity, support 52,000 jobs, provide drinking water to one out of every three Mainers, and underpin the state's top industry, tourism. Lakes are the economic drivers in many Maine towns, where lakefront property taxes also fund essential public services and lakes play central roles in community and family life. The Maine Department of Environmental Protection names 172 Lakes as High Priorities for protection, 22 of which are already impaired. Hundreds more show measurable changes, indicating a widespread negative trend. Stormwater is the main cause of this damage. Sediment and other pollutants washed into lakes by stormwater affect water clarity, recreational use, aquatic habitat, shorefront home value, property tax revenues, business vitality and community wellbeing. Countermeasures are urgently needed because intense storm events associated with global climate change accelerate erosion. Public health is now at risk, too; warmer weather has also fostered the production of algal toxins harmful or fatal to animals and humans in lakes around the world.

The Vital Shorelands: Human activity anywhere in a lake watershed will affect water quality, but the narrow strip of land along the lakeshore has a disproportionate effect on lake health. When the U.S. Environmental Protection Agency conducted its first-ever National Lakes Assessment (2007-2009), they found that lakes with poor lakeshore conditions were three times more likely to experience poor water quality than those with well-vegetated shoreline cover. They concluded with a strong directive: "Local, state and national initiatives to protect the integrity of lakes should center on restoring the natural state of shoreline habitat—particularly vegetative cover." Public health, community wellbeing, and lake benefits depend on good land management in lake shorelands. Fortunately, hundreds of lake associations in Maine are dedicated to protecting lakes and the public benefits they provide.

Building Lake Resilience: LakeSmart is a voluntary program that promotes lakeshore management practices to reduce runoff and enhance shoreline habitat. Created by the Maine Department of Environmental Protection in 2004, the Maine Lakes Society adopted LakeSmart in 2013 and adapted it to the needs and capabilities of Maine's lake and watershed associations. Since then, the program has spread to 54 Maine lakes, 27 of which are on the High Priority Watersheds listing. The Society provides training, materials, on-site coaching, on-call advice, and certification of properties that qualify for the coveted LakeSmart Award. Host groups provide outreach to their members and support their trained volunteers who take expert knowledge about nonpoint source pollution and how to correct it to shorefront homeowners. Award signs, posted at driveways and on the waterfront advertise the program and help to demonstrate what good lake stewardship looks like. The goal in each lake community is to arrive at a knowledge tipping point which forms a community-wide norm of behavior.

Information about LakeSmart is available at ***mainelakessociety.org***.

State of the Lakes in the Penobscot Watershed

Linda Bacon, Lake Biologist, Maine Department of Environmental Protection

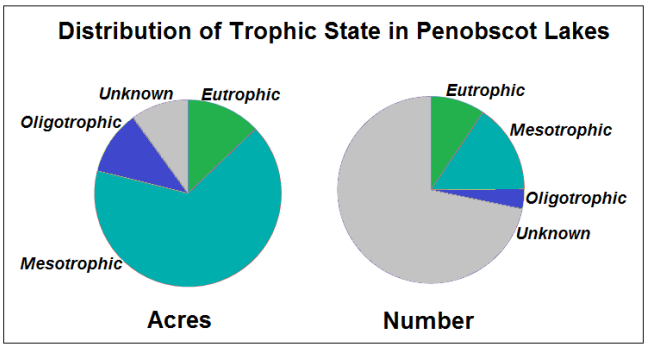
Some 1,694 lakes and ponds are located in the watershed, ranging in size from a few acres to more than 26,000 acres in Chesuncook. Collectively lakes and ponds cover 29% of the watershed. Many creatures make their homes in and around these waters, from microscopic plankton such as algae and zooplankton to larger fish such as togue, moose and the great birds of prey. DEP reviews lake data annually to determine if the lakes 'attain' the standards for their water quality classification. Great ponds, natural lakes and ponds less than 10 acres are classified as GPA: "suitable for the designated uses of drinking water after disinfection, recreation in and on the water, fishing, agriculture, industrial process and cooling water supply, hydroelectric power generation and navigation and as habitat for fish and other aquatic life. Class GPA waters shall be described by their trophic state based on measures of chlorophyll-a content, Secchi Disk transparency, total phosphorus and other appropriate criteria. Class GPA waters shall have a stable or decreasing trophic state, subject only to natural fluctuations and shall be free of culturally induced algal blooms which impair their use and enjoyment. There may be no new direct discharges of pollutants to GPA waters (with a few exceptions)."

Lake data are contributed by the Volunteer Lake Monitoring Program for many of the larger lakes in the watershed. Few have no data, specifically in more remote areas like the 100-mile wilderness area to the west-northwest of the Pemadumcook chain.

Measured Parameters: Transparency, Dissolved Oxygen & Temperature Profiles, Phosphorus, Chlorophyll, Color/DOC, Specific conductance, Alkalinity/pH, Silica, Cations/ Anions, Sediment Aluminum/Iron/Phosphorus

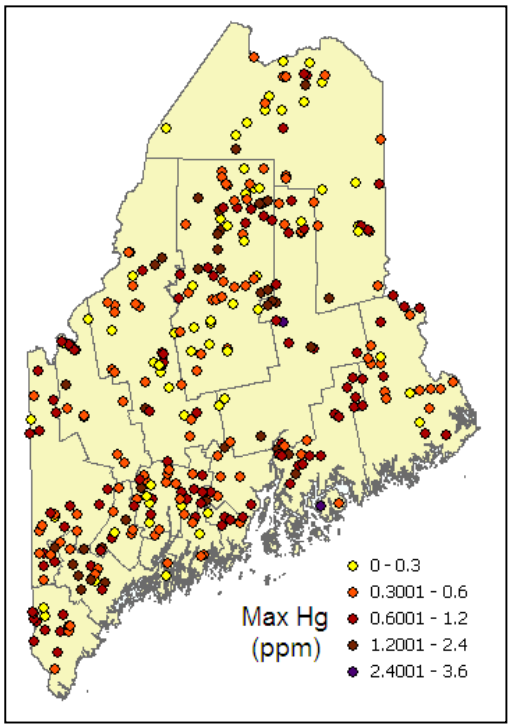
Zooplankton, Phytoplankton (Diatoms), Aquatic plants, macroinvertebrates

Mercury in fish tissue, Cyanotoxins



As far as we know, all lakes attain their GPA classification with respect to **Trophic Status**. There is a considerable range in trophic state with larger deeper lakes tending to be more oligotrophic and smaller shallower lakes more eutrophic. However, no lakes in the Penobscot watershed attain the designated use of fish consumption due to the statewide **mercury advisory**. The advisory originated in 1993 and has been subsequently tweaked.

Emerging threats to Maine lakes include invasive species, other global contaminants, and climate-change driven eutrophication and blooms of blue-green algae, which can be toxic to humans and pets. New England states respond to HABs in a variety of ways issuing advisories based on surrogates for toxins like cell-counts, transparency, and/or chlorophyll concentrations. Maine has no specific response right now. A recreation standard is expected to be released by EPA next year, and the DEP has conducted some pilot studies (in lakes outside the Penobscot watershed) to develop a protocol for monitoring and advising the public.



Maine Brook Trout Survey Project

Emily Bastian, Maine Audubon, and Maggie Shannon, Maine Lakes Society

Maine's wild brook trout waters represent a unique, valuable and irreplaceable ecological resource. Maine has the most extensive distribution and abundance of brook trout throughout their native range in the United States, and has been designated as the last true stronghold for wild brook trout. The Brook Trout Survey Project is a collaborative conservation initiative which began in 2011. Each project partner brings unique attributes to the project and helps contribute to its success. Maine Audubon provides volunteer recruitment, coordination, training, and support, as well as data management and reporting. Maine Department of Inland Fisheries and Wildlife complete follow-up surveys and make the final determination as to which waters will receive additional protections. Trout Unlimited connects with the angling community in Maine, supports the website and Google Earth map updates.

Remote ponds are an unmapped, unsurveyed resource. Maine contains nearly 6,000 lakes and ponds; close to 1,000 had never been surveyed up until just a few years ago. That is a large number of waters for which we have no official data, and represents a significant resource. Why never surveyed? These ponds tend to be: small (<20 acres), remote, and difficult for a survey crew with equipment to access. Although a relative stronghold for wild brook trout, Maine brook trout certainly have not escaped exploitation and still face serious threats, including development, the illegal and legal introductions of competing fish species, and angler exploitation in ponds; development, habitat fragmentation, inadequate road/stream crossings, agriculture, damming, and angler exploitation in streams. Without adequate protections, we stand to lose even more. Maine is the last best hope for wild brook trout!

Penobscot Indian Nation Land Management and Stream Connectivity

Daniel McCaw, Fisheries Program Manager, Penobscot Indian Nation

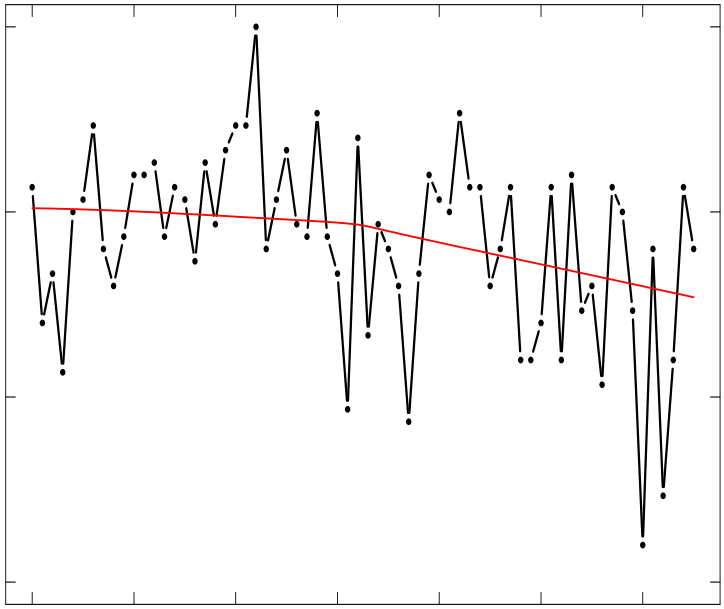
The Penobscot River Restoration Project removed two dams on the mainstem Penobscot River (at Great Works and Veazie) and constructed a natural bypass channel around a third dam. With the resulting increase in sea-run or diadromous fish, more work is needed to restore remaining habitat. Some of this work is being supported by the National Oceanic and Atmospheric Administration, which designated the Penobscot as one of ten "Habitat Focus Areas" nationwide in 2014. Additional momentum is created by related activities, such as evaluation of new fishways at Milford and Orono, relicensing of the Weldon Dam, UMaine research projects, and stocking of alewives by the Maine Department of Marine Resources.

The Penobscot Indian Nation is currently restoring connectivity in the Mattamiscontis Stream drainage in the Penobscot River, including East Branch Lake, Mattamiscontis Lake, Little Mattamiscontis Lake, and South Branch Lake. This work will restore the form and function of the streams, protect infrastructure and reconnect stream and lake habitats important to the recovery of many diadromous fish species in the Penobscot River. Three lake outlets are being "rebuilt," six road culverts are being replaced, and the lakes and streams planted with adult alewives and Atlantic salmon eggs.

Role of winter climate variability on the early spring ice-out date of Maine lakes

Mussie Beyene, University of Maine Senator George J. Mitchell Center for Sustainability Solutions

Ice out date refers to the time in spring when ice completely disappears from a lake surface. The US Geological Survey maintains a network of 8 HCN (Historical Climatology Network) stations, including Sebec Lake in the Penobscot watershed. Maine lakes are showing high variability in their winter ice season. The trend towards earlier ice-out dates is an outcome of the long term warming of winter and spring. The year-to-year fluctuation is a consequence of the year-to-year variability in winter and/or spring climate. The year to year fluctuation in winter temperature and ice out date has a predictable component, largely stemming from El Nino-Southern Oscillation pattern.



Our study shows that there are threshold winter degree days above/below which produce early ice out dates the following spring. It was also found that during negative tropical Northern Hemisphere pattern, which occurs during El Nino years, the likelihood of an early ice out date in Maine lakes increases significantly. Almost half of the early ice out events in the eight lakes (40/80) occurred in the fifteen years between 1996-2010.

Rivers & Streams Moderated by Gayle Zydlewski, University of Maine

More than 16,000 km of rivers and streams flow through the Penobscot River watershed. The Penobscot River Watershed is undergoing an unprecedented restoration, including dam removals and other improvements in fish passage. What is the current state of the river, and what challenges remain to be addressed before restoration goals can be fully realized?

Mentoring through measurement, monitoring, and modeling the Penobscot River

Sean M. C. Smith, University of Maine

The Penobscot River restoration initiatives provide an opportunity for students at the University of Maine to become intellectually involved with research and monitoring activities in one of the most iconic, historically important and intriguing river systems in the United States. The close proximity of the river to the Orono campus allows for student participation in monitoring and education exercises that provide learning experiences and feed information into long-term documentation of river channel stability and ecosystem services. Measurement of physical conditions, monitoring changes to the conditions over time, and modeling of scenarios relevant to river processes involve consideration of landscape, watershed, reach and feature spatial scales of resolution. Students and faculty are involved in analyses at each of those scales. An example of an interdisciplinary research effort that expanded understanding of the Penobscot River system at the reach scale with undergraduate and graduate student involvement is the recent evaluation of sturgeon habitat upstream of the Veazie Dam site following its removal. New research interests emerging from that work is concentrating on specific features such as structures on the riverbed and overbank areas in the riparian corridor. The Penobscot River system is also a targeted research site for a new multi-institutional NSF funded project involving UMaine faculty that centers on tradeoffs and decisions related to the management of dams in New England. The stakeholder-driven, solutions-focused research will examine the combined effects from climate changes, earth surface processes and human interventions to describe outcomes that affect the way the contemporary river system looks and functions with societal implications.

Dam removal and fish passage improvement influence fish assemblages in the Penobscot River, Maine

Jonathan Watson, University of Maine, with S. Coghlan, Jr., J. Zydlewski, D. Hayes, and I. Kiraly

We assessed fish assemblages before (2010-2012) and after (2014-2015) restoration actions on the Penobscot River using boat electrofishing surveys and a stratified-random design. Dams created habitat for slow-water specialists, and spawning habitat and refugia for resident fishes. Dam removal restored riverine habitat, with varied impacts on different species. We observed changes in distributions of both resident and diadromous fishes. River herring and American shad and American eel increased above the Veazie Dam site, as did largemouth bass. Fish typical of still waters, such as golden shiner and smallmouth bass, decreased.

Most sea-run species exhibited some response to increased access. River herring and American shad are now spawning above Milford Dam. Many resident fishes declined in former impoundments, and slow-water specialists exhibited the most pronounced decline although generalists were also affected. Our results demonstrate the potential for large dam removal projects to restore populations of anadromous fishes and alter riverine fish assemblages.

NOAA's Penobscot Habitat Focus Area and Future Restoration

Matthew Bernier, Contract Civil Engineer, NOAA Restoration Center

In 2014, as part of the National Oceanic and Atmospheric Administration's Habitat Blueprint initiative, the Penobscot River watershed was selected as one of only ten Habitat Focus Areas in the United States. The Habitat Blueprint is a framework for NOAA to work strategically across programs and with partners to protect and restore habitat. A Habitat Focus Area is a priority geographic area where the Habitat Blueprint is implemented – a place where NOAA's various programs cooperatively work together to leverage each other's resources and expertise to achieve regional goals. The Habitat Blueprint represents an opportunity for further large scale restoration, building off the successful removal of the two lowermost dams on the Penobscot River (supported with more than $24.5 million of NOAA investment). But more work is needed; many barriers remain in the watershed (108 non-hydroelectric dams, 31 hydroelectric dams, and more than 2,000 culverts). Approximately 70% of historic spawning and rearing habitat remains inaccessible due to the presence of other dams and passage barriers (Trinko Lake et al, 2012) and less than 8% of stream miles are free flowing and fully accessible (Kircheis, 2015).

The goals of the Penobscot River Watershed Habitat Focus Area are to (1) restore multiple diadromous species including river herring, rainbow smelt and ESA listed species (i.e., Atlantic salmon, Atlantic sturgeon and shortnose sturgeon); (2) improve the prey base for multiple offshore species including Gulf of Maine groundfish to support recreational, commercial and sustenance fishing; (3) increase the quantity and quality of accessible habitat in the watershed; (4) promote habitat restoration that results in indirect benefits to water quality, watershed-based recreation and the resiliency of coastal communities; and (5) increase collaboration across NOAA to meet the needs of constituents for products and information. Initial funding in 2014 supported restoration project work by The Nature Conservancy, communications by Maine Sea Grant, and continued monitoring of the Penobscot River Restoration Project. The three-part strategy addresses lower river habitat, alewife lakes, and headwater streams. Communities where work is ongoing include Penobscot Nation territory, and the towns of Frankfort, Orland, and Penobscot.

Stream Smart Road Crossing Training Program

Barbara Charry, Conservation Biologist and GIS Manager, Maine Audubon

Road crossing culverts are the major barrier fragmenting stream habitat. Surveys show that up to 90% of Maine culverts make movement difficult or impossible for wildlife at least part of the year. Within a part of the southern Penobscot River drainage alone, there are at least 350 fish barriers due to problem culverts. Many culverts are also vulnerable to more frequent and intense storm events that have been washing out roads around the state and the Northeast in recent years.

The collaborative Stream Smart program trains professionals responsible for road-stream crossings how to construct crossings that maintain fish and wildlife habitat while protecting roads and public safety. From 2012 through 2016 we have held 35 workshops with more than 850 participants including representatives from 120 towns (i.e., road commissioners, town planners, public works staff, etc.). These are professional workshops and the target audience includes contractors, public works staff, engineers, consultants, town officials, foresters, land trusts, property owners, and anyone responsible for the road-habitat interface. One of the highlights of the Stream Smart workshop is the interactive stream table. Participants learn about stream processes in fast time.

The Stream Smart approach follows a series of steps: (1) Avoid creating a crossing; (2) Remove the crossing; (3) If crossing is necessary, install an open bottom structure (bridge, arch or box culvert) that spans or exceeds the width of the channel; and (4) If an open bottom structure can't be used, install an embedded culvert that spans the channel width, is positioned at the right elevation and slope, and has natural river bottom material within the crossing.

For more information, visit ***streamsmartmaine.org***

Partners:

Casco Bay Estuary Partnership

Gulf of Maine Council on the Marine Environment

Maine Audubon

Maine Coast Heritage Trust

Maine Department of Agriculture, Conservation and Forestry

Maine Department of Environmental Protection

Maine Department of Inland Fisheries and Wildlife

Maine Rivers

Project Share

Sustainable Forestry Initiative Implementation Committee

The Nature Conservancy

US Army Corps of Engineers

US Department of Agriculture Natural Resources Conservation Service

US Department of Commerce, National Oceanic and Atmospheric Administration

US Department of Interior, Fish and Wildlife Service

Water Quality in the Penobscot River

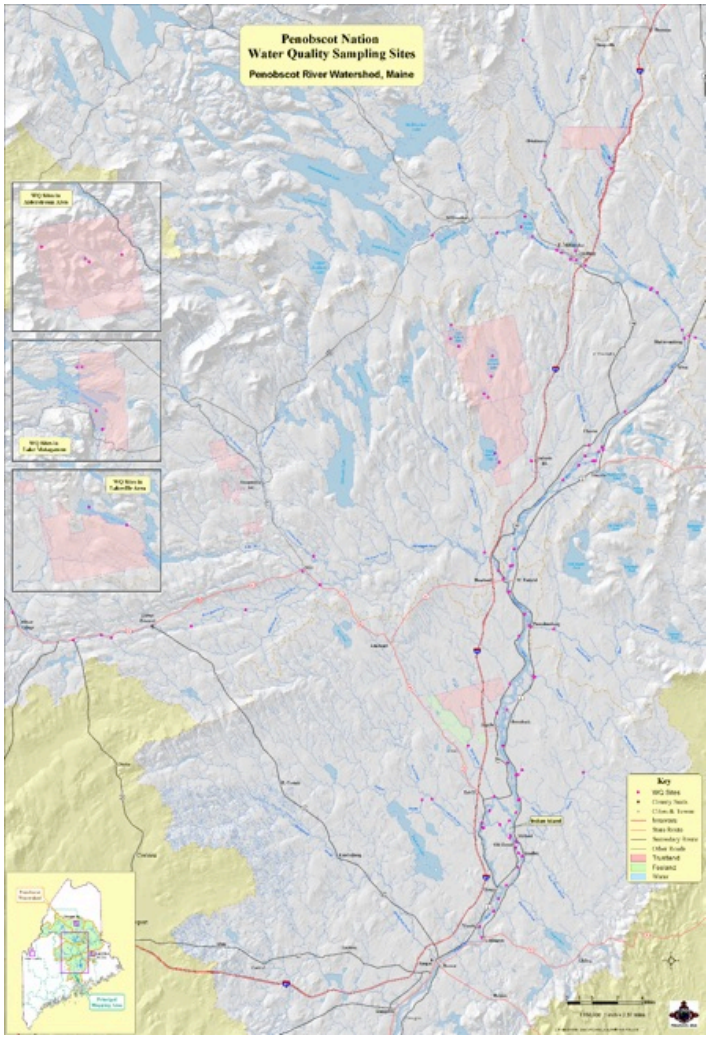
Daniel Kusnierz, Water Resources Program Manager, Penobscot Nation

The mission of the Penobscot Nation Department of Natural Resources Water Resources Program is to protect, enhance, and restore water quality and aquatic resources, and related aquatic ecosystems of the Nation's territories so that tribal members may fully carry out tribal traditional cultural practices and lifeways.

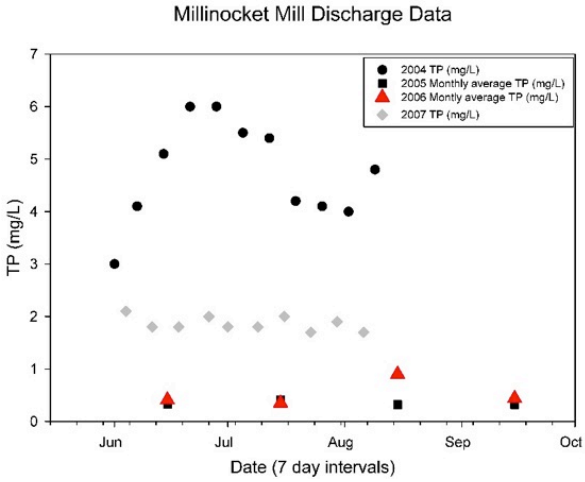
The Water Resources Program monitors 90 sites throughout the mainstem Penobscot, East and West Branches and tributaries. Sites include areas of industrial and municipal waste discharges, dam impoundments, areas of non-point source pollution, as well as "clean/healthy" sites for reference conditions and pre- vs. post-dam removal sites. Samples are analyzed in the Penobscot Nation Water Quality Laboratory.

The following parameters are monitored weekly:

- temperature
- dissolved oxygen
- conductivity
- biological oxygen demand (BOD)
- E. coli bacteria
- Total coliform bacteria
- total suspended solids
- turbidity
- secchi disc visibility
- foam (index)
- total phosphorous
- ortho-phosphorous
- chlorophyll a
- pH



A water quality indicator of particular concern is harmful algae, "blooms" of which occurred in 2001, 2004 and 2007, caused by inputs of phosphorus from the Millinocket pulp and paper mill. The 2004 bloom extended downstream to Lincolnville, and include algal species known to produce toxins. In response, the Water Resources Program installed a continuous monitoring platform near the outlet of the Dolby Pond impoundment, and the State of Maine established permit limits and monitoring requirements for phosphorous. No blooms have been observed since 2008, when the mill stopped operation. However, the sediments of the Dolby impoundment continue to store phosphorus, which could be affected by warming temperatures and other climate changes. As of 2016 the State of Maine had not finalized nutrient criteria for the Penobscot River.

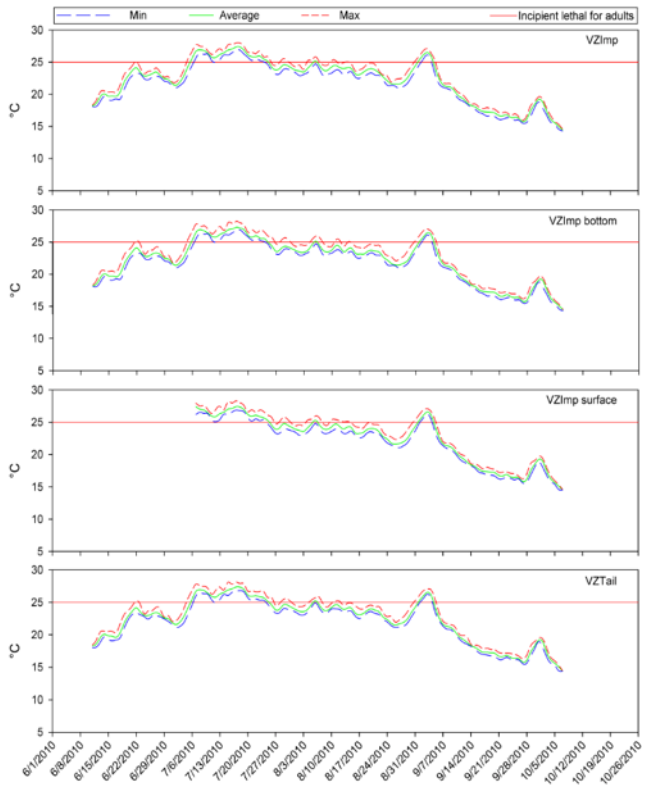


Toxic contaminants in fish are another concern.

1994/96/97 SWAT reports						
		Dioxins	***CoPlanar PCBs***	***Total Dioxin-like Toxics***	***Total PCBs***	***Mercury***
		(ppt)	(ppt)	(ppt)	(ppb)	(ppm)
West Branch - Penobscot						
	Smallmouth Bass	0.3	0.7	1	6.2	0.98
	White Suckers	0.4	2.2	2.6	17.6	0.17
Above Lincoln						
	Smallmouth Bass	0.5	0.6	1.1	4.5	0.53
	White Suckers	0.4	1	1.4	6.7	0.25
Below Lincoln						
	Smallmouth Bass	0.8	1.2	2	8.6	0.38
	White Suckers	2.7	1.1	3.8	95	0.16
Bangor						
	Eel	0.9	1.1	2.1	37.4	0.53

The State of Maine has issued a blanket fish consumption advisory, last updated in 2000, due to mercury pollution. The Penobscot Nation has a modified advisory for tribal members. [print advisories] The advisory originated in the 1980s, when dioxin, a carcinogenic pollutant, was discovered in the river as well as widespread mercury and PCBs documented in the 1990s. While dioxin levels have decreased, advisories are still in place for dioxin, mercury and PCBs. In 2010 the EPA and ATSDR recommended that tribal members continue to follow existing advisories, which means that tribal members are unable to carry out their traditional sustenance fishing rights.

Dissolved oxygen is also a concern. Prior to 2007, many sections of the river designated Class B did not meet the minimum dissolved oxygen (DO) criteria of 7 ppm; and some sections (at Weldon Dam) did not meet Class C criteria of 5 ppm; the State's water quality model showed that DO criteria would not be met in several locations. Phosphorus discharges have declined significantly since the mills closed, and dissolved oxygen criteria have been met.



Water temperature sometimes exceeds lethal thresholds for Atlantic salmon, although trends are difficult to discern because of variability and large data sets. Temperature could be more of a concern in the future due to global climate change, affecting habitat suitability for native fish.

The Water Resources Program participates in the region-wide Stream Temperature Monitoring Group; the data inform modelling efforts that could provide guidance on where to focus cold water habitat protection.

Biomonitoring of aquatic insects complements chemical parameters. Aquatic insects live in the river for a long time, and are exposed to the cumulative impacts of all chemical and physical pollutants.

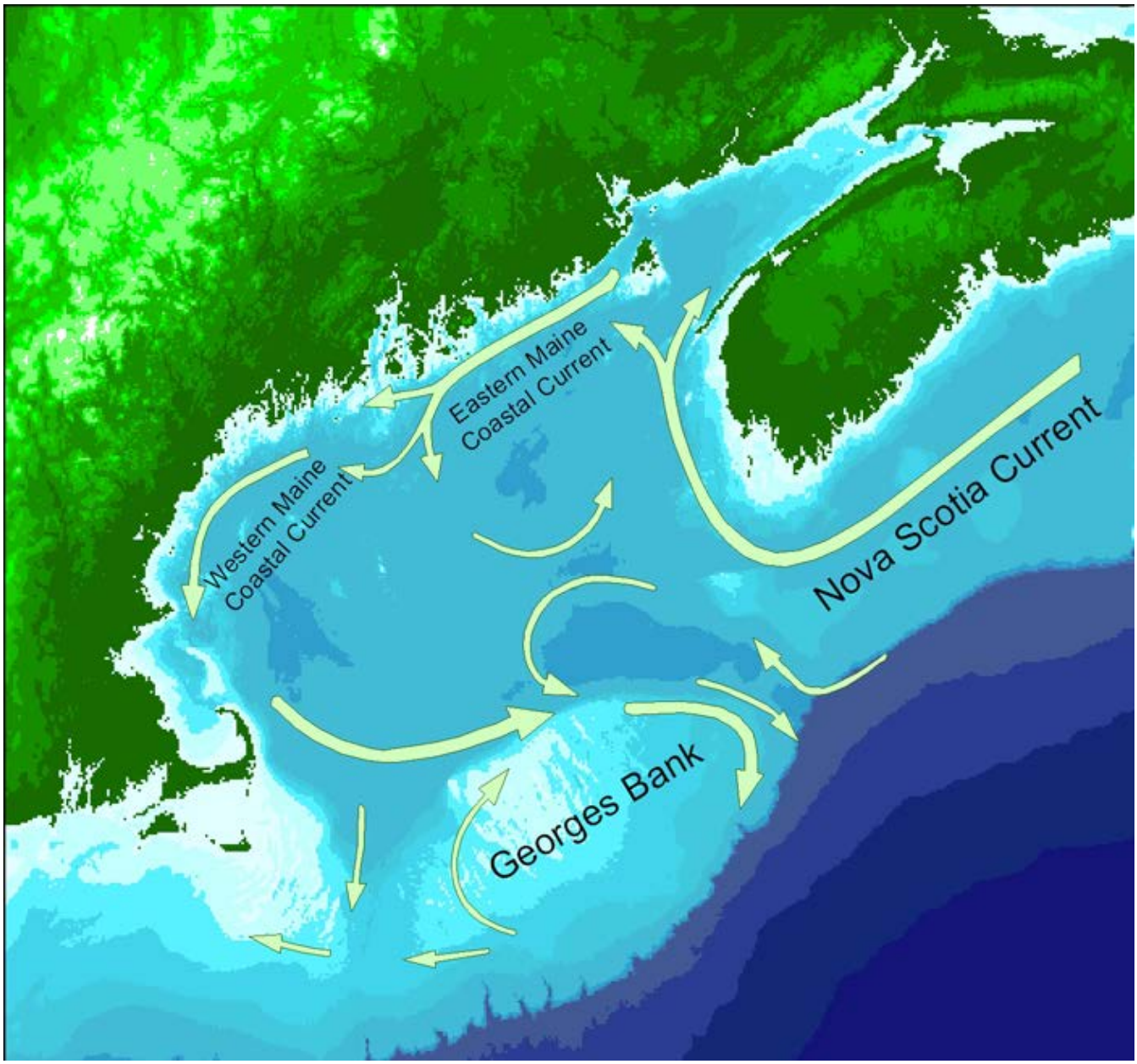
PIN has been monitoring the benthic communities at Veazie and Great Works areas to compare how the communities respond to dam removal. Preliminary results show that the average number of benthic organisms is highest in free-flowing sections, and the numbers of organisms has increased in areas restored to free-flowing with dam removal.

Discussion Points:

- The ecosystem is responding to dam removals.
- Alewives are important to other fisheries – groundfish offshore, forage buffer for salmon. The Penobscot Nation hopes to use alewives as a food source, as in the past.
- Smelt are being studied, too—all species are being studied, and it is important that we continue to look at all species, with an emphasis on habitat restoration that benefits multiple species. Dam removals in the Kennebec and Penobscot have benefited sturgeon. Sturgeon have been documented moving beyond the Veazie Dam site.
- The success of the Milford fish lift is being evaluated by UMaine graduate students. Fish are experiencing delays, and salmon have been hesitant. The Department of Marine Resources keeps passage numbers on their website.
- Mercury, dioxin, and PCBs persist in Maine waters, and bioaccumulates in fish tissue. Right now fish are inedible for women and children.

The Bay **Moderated by Rory Saunders, NOAA Fisheries**

Penobscot Bay is one of the largest embayments on the East Coast of the United States, and the largest estuary system in Maine. Freshwater flows have a major influence on the circulation currents of the Gulf of Maine. The bay encompasses a diversity of habitats, including islands, salt marshes, mudflats, eelgrass meadows, and beaches. What are the current status and trends in estuary and bay habitats, and what is being done to monitor indicators of environmental health in the bay?

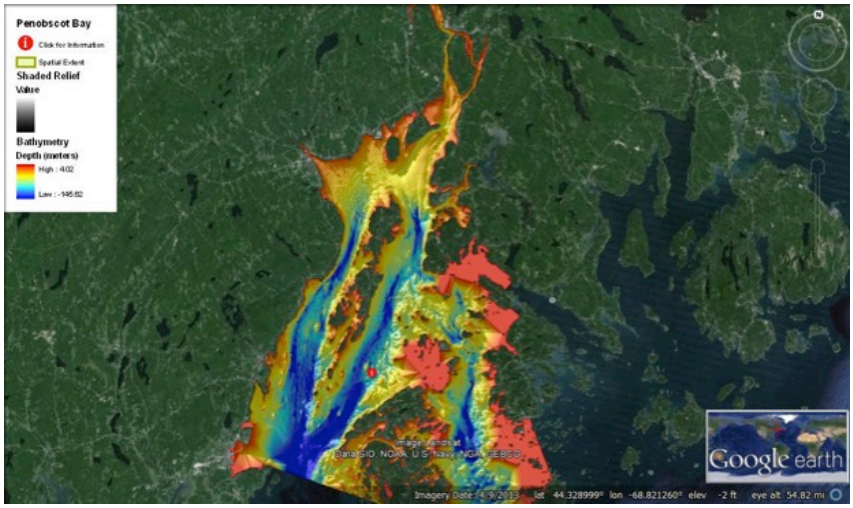


The Oceanography of Penobscot Bay

Lauren Sahl, Professor, Maine Maritime Academy

The Penobscot Bay estuary is a coastal plain, partially mixed estuary. The interaction of river and ocean water creates a situation whereby particles are concentrated in the river near Bucksport, and the river water forms a thin plume in the bay.

The concentration of particles near Bucksport sometimes results in an estuarine turbidity maximum, where particle concentrations greatly exceed those found elsewhere in the system. For example particle concentrations near Bucksport can be one-hundred times greater than the concentrations in the bay. The composition of the particles varies within the system and over seasons. Wood chips are an important component of the mix near Bucksport. The ratio of lithogenous to organic particles is higher in the winter than in the summer, probably due to seasonal variability in primary productivity.



When the river plume enters the relatively deep bay it forms a thin surface feature. When river discharge is high the salinity of this plume can decrease significantly throughout the bay. Winds also impact surface salinity, to a lesser extent, by mixing deeper, saltier seawater up into the plume. In the bay the plume tends to hug the western shore, regardless of the wind direction. As a result of this the western bay surface waters are warmer, in the summer, than those in the eastern bay. This river plume water exits the bay and contributes to the circulation of the Gulf of Maine in the Maine Coastal Current.A

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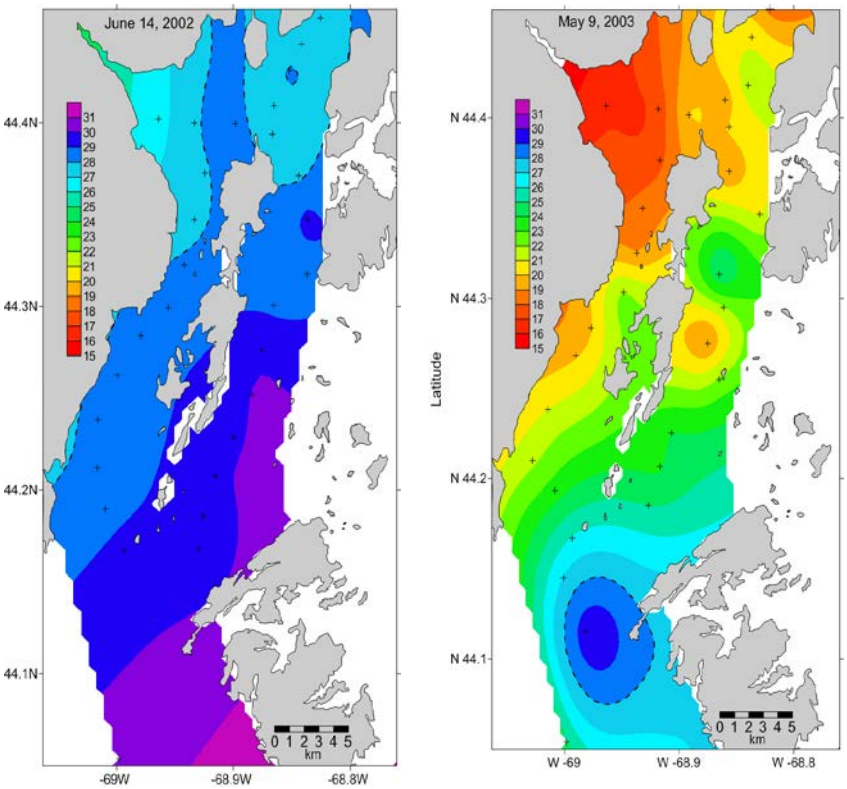
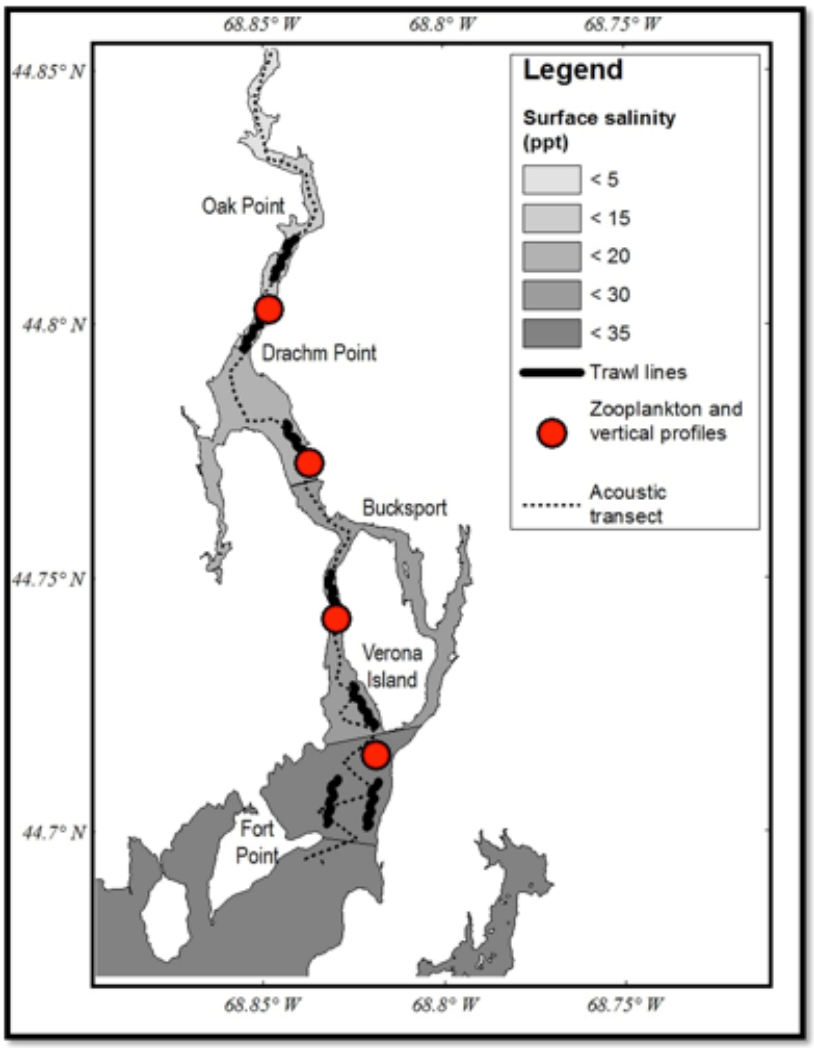


When the river plume enters the relatively deep bay it forms a thin surface feature. When river discharge is high the salinity of this plume can decrease significantly throughout the bay. Winds also impact surface salinity, to a lesser extent, by mixing deeper, saltier seawater up into the plume. In the bay the plume tends to hug the western shore, regardless of the wind direction. As a result of this the western bay surface waters are warmer, in the summer, than those in the eastern bay. This river plume water exits the bay and contributes to the circulation of the Gulf of Maine in the Maine Coastal Current.

Life in Transition: Characterizing Small Guys with Big Impacts in the ETZ

Rachel Lasley-Rasher, Postdoctoral Researcher, University of Maine

The Penobscot Estuarine Transition Zone (ETZ) is a seven kilometer area of steep gradients, elevated turbidity, and abundant zooplankton and phytoplankton, which are prey for larger organisms. Phytoplankton (algae) produce oxygen, fix carbon, and serve as the base of marine food webs. Zooplankton are the most abundant multicellular organisms, and transfer primary production by algae to larger members of the food web. Current research in the Penobscot is sampling and identifying zooplankton species, their distribution in the estuary, and changes over time in response to restoration of migratory fish such as alewives and blueback herring. Zooplankton and mysids (small shrimp) decreased dramatically from 2013 to 2014, the result of increased numbers of predator fishes.



The Food Web of the Penobscot Estuary: The Fish

Karen Wilson, University of Southern Maine

Migratory fishes overlap in time and space. Some are more “salty” than others: striped bass spend a good portion of their life in the estuaries, and move freely between fresh and salt water, usually following food (other migratory fish). Stripers spawn in July. Juvenile blueback herring are also highly tolerant of salt water. The onset of spawning migrations is related to temperature, flow, and possibly moonlight.

Pulses of spawning alewives arrive over a period of days or weeks. Adults (usually 20 cm or more in length) move into freshwater lakes in early spring (May- June in Maine) where a single female can lay 30,000-120,000 eggs. Eggs hatch within ~14 days, and young of the year spend the summer growing in the lake. They can leave anytime between July and October, depending upon lake conditions and exit stream water levels, among others possible cues. Juveniles spend three to five years at sea before returning to their natal river to spawn. Adults can spawn multiple times; it is not uncommon to find eight-year-old fish returning to spawn. Because of this life history, these fish are easy to reintroduce by trucking ripe adults to lakes in the spring. Four years later, adults return to spawn for the first time.

Alewife stocking began in the Penobscot in 2010 (Chemo Pond) and continued through 2015. Combined with dam removals at Veazie and Great Works, and fish passage improvements at the lakes, the number of fish returning to the Penobscot River increased from fewer than 100,000 to nearly 1 million.

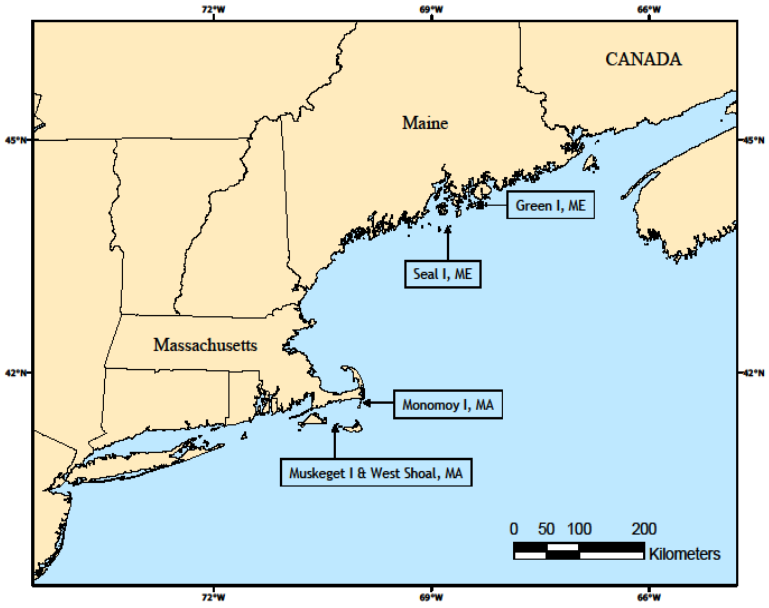
Alewives in the estuary are being monitored as part of a NOAA funded study, with a focus on the ~40 km from head tide to upper bay (Bangor to Fort Point south of Bucksport). This area represents the greatest change in habitat from full freshwater at the north to near seawater at the south. Of 132 Alewife stomachs analyzed from May to September 2013, 97% had identifiable food items in their stomachs, all of which were estuarine organisms. Prey was dominated by estuarine copepods, mysid shrimp, and barnacle larvae. I am using the carbon isotope signature as an indicator of where this food came from to infer habitat use. Muscle tissue values from young-of-year fish collected in four different lakes in the Penobscot system show a freshwater carbon isotope signature; in contrast, larger individuals that were collected in the bay by the ME/NH inshore trawl survey show a much stronger marine signature typical of adults coming back from the ocean to spawn. Smaller fish appear to have a more estuarine/freshwater signature in contrast to the larger fish which appear to have a much more marine signature. Both large and small fish from marine and freshwater seem to be using the estuary between May and September. The overall pattern for spring surveys is an increase in total fish biomass from 2012 through 2015. This pattern is indicative of larger numbers of fish, larger fish, or both, but regardless a measureable change in the system in the past four years.

Seals of Penobscot Bay

James Gilbert, Professor Emeritus, University of Maine

Marine mammals play a significant ecological and cultural role in the Penobscot Bay and lower river. Nearly 1,000 ledges and islands along the Maine coast are used by harbor seals during the pupping season. Penobscot Bay is the center of the New England harbor seal population. Pups grow from 10 kg to 20 kg in 24 days of nursing. Harbor seal pupping does not peak until May 23 and is nearly complete by June 4.

Gray seals are also present. Gray seals pup in January, on Seal Island and Green Island near Penobscot Bay, and move throughout the Gulf of Maine. Gray and Harbor seals both have increasing populations, in part because people are not living on the islands as much as they were historically, so pupping habitat has increased. Seals are also now protected. They eat fish of smaller size and greater variety that humans are trying to harvest through fishing, therefore have sufficient food sources.



How healthy is the Bay?

Larry Mayer, University of Maine

What is healthy? Do we mean pre-human conditions? Pre-European conditions? Some type of intended garden? In terms of the Penobscot, habitat (temperature, salinity, sedimentation, available nutrients) appears suitable for most species that would be normal for this place. Water temperatures are normal (but recently rising). Salinity remains unchanged, on average, but dam removal and changes in precipitation patterns and land use will affect annual variations. Bottom habitat has been altered through dredging, harbors, causeways, debris, and fishing. The legacy wood chips in the Penobscot affect turbidity in the river.

Is there enough nutrition in the bay? Important sources of nutrients are rivers and the ocean. The base of the food chain seems "normal." The principal threats in this system appear to be chemical in nature, and include metals such mercury and copper, persistent organic pollutants (few of which have been studied), and acidity. Biological threats that affect Bay health include fishing, which changed the food web, noxious species such as red tide and pathogens, and eutrophication or biological oxygen demand. Sources of pollution need to be addressed at the source.

Tackling the sources of fecal contamination impairing coastal water quality in the bay

Keri Kaczor, Marine Extension Associate, UMaine Cooperative Extension/Maine Sea Grant

The Maine Healthy Beaches Program, supported by the US Environmental Protection Agency and the Maine Department of Environmental Protection, addresses the sources of fecal contamination impairing coastal water quality. Elevated fecal bacteria levels threaten public health and coastal economies largely sustained by tourism. Pollution sources come from sources throughout the watershed, are typically complex, and difficult to identify and remediate, requiring collaboration at all levels. The Maine Healthy Beaches Program works with beach communities, conducting sanitary surveys, developing precautionary rainfall advisories, and providing information to coastal visitors about protecting beach water quality. Four Penobscot Bay beaches participate in the voluntary program: Lincolnville Beach, Goodies Beach, Laite Beach, and Sandy Beach in Rockland.

For more information, visit ***mainehealthybeaches.org***

Penobscot: Fresh and Saltwater Workshop, A Work in Progress

James Wilson, University of Maine

Today, a clean environment is an economic necessity, generating jobs and income. What is the future of the Penobscot watershed in this context, and can history inform our assessment? Some 30 scientists, professionals, faculty, and students from 10 universities, colleges and agencies, and more than 12 disciplines are looking at the human-natural system of the Penobscot. The history of the watershed is well documented, with many good studies about distinct events. But no or very few studies tie the whole together. Beginning with history, the research team is identifying dominant historical patterns, especially those that are likely to continue into the near future, and verifying those patterns with reference to existing scientific work. But the system is complex. When we look at the aggregate data on fishing effort, landings, values, etc., the data appear messy with few clear trends.

We have identified some tentative patterns:

- Natural system diversity declines continuously over time with a sharp break prior to or just after WWII. Other apparent transitions occur in the 1820s to 1840s, the 1880s, and the early part of the twentieth century.
- At the same time landings tend to move southward out of the river and upper bay.
- The scale and kinds of fishing gear increase and become more specialized, again with a strong break in the 1930s and ‘40s and also moving down the river and bay.
- Licensing or access also becomes narrower and more specialized.
- The decline in diversity appears to be matched by a continuous increase in the value of landings, because of improving access to national and international markets, better storage, more reliable transportation and growing population.
- Each step along this timeline is precipitated by an external event or shock: a new dam or other technology that affects the physical system, transportation changes and improvements, new harvesting technologies, new markets, new methods of storage and so on.

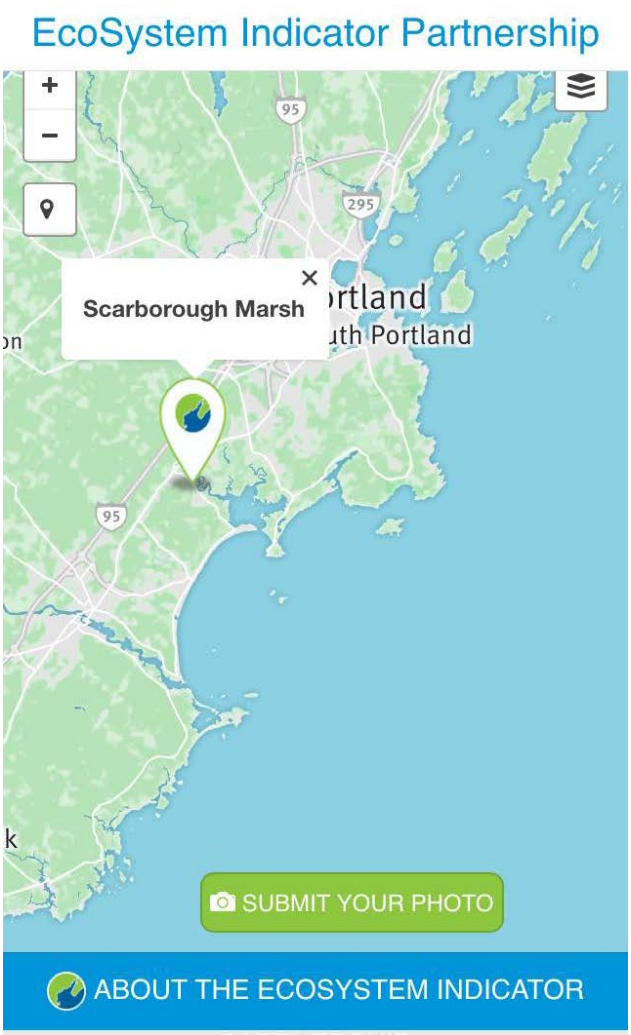
In the ocean, the changes in almost all these dimensions have seriously reduced the ability of humans to adapt. Declining natural diversity, increasing specialization, a general depletion of the lower river and bay make each new event or shock a little harder to deal with. The groundfish fishery in the late 1980s early 1990s and the 2008 and 2012 events in the lobster fishery are illustrations of our reduced adaptive possibilities. The rights/licensing system in the ocean further constrains adaptation; for example climate change threatens many of the benefits from river restoration. Most of the benefit will flow to individuals and companies not part of the Penobscot community.

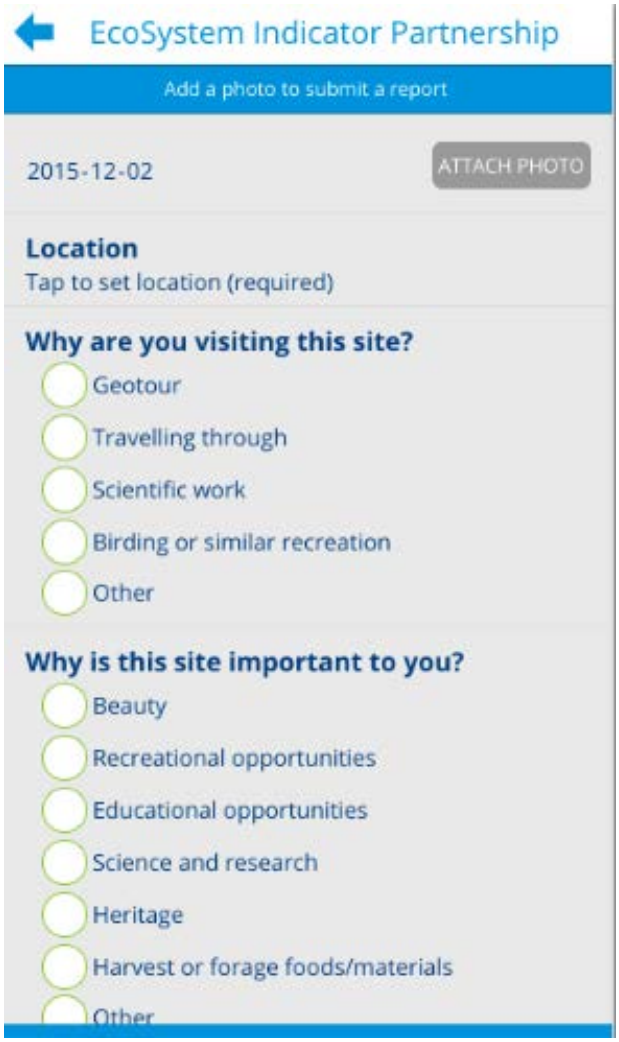
This project is supported by Robert McNeil and the Islesboro Islands Trust.

Who's monitoring the Gulf of Maine?

Christine Tilburg, Program Manager, Gulf of Maine Council/Ecosystem Indicator Partnership

The Gulf of Maine Council's EcoSystem Indicator Partnership (ESIP) was formed to look at changes in the health of the Gulf of Maine ecosystem through indicators. ESIP's initial approach to indicator development focused on seven ecosystem themes. To date, ESIP has made indicator data available online through its web tools and fact sheets. ESIP now is bringing new community members into the scientific process. More than 14,000 locations in the Gulf of Maine are currently being monitored for one or more environmental parameters. Such monitoring schema can seem overwhelming to the average citizen. The new ESIP tool helps people visualize change in the Gulf of Maine. The "I-see-you-see (ICUC)" application (available for free through the iTunes store or GooglePlay) allows users to locate information on who is monitoring what at any given location, and to contribute photographic records at designated ESIP monitoring stations around the watershed. Users provide information about their photo visit, and view trends at each station based on contributions from different users at different times.





For more information, visit ***gulfofmaine.org/esip***

Discussion points:

- Penobscot Bay is a dynamic environment with ever-changing temperature, salinity, turbidity. Likewise, the overall health of the bay is constantly changing and depends on what factors are being examined.
- Plankton, a mix of freshwater and marine species, form the base of the food web. Fish species move in an out of the system as conditions change and as species needs change (e.g., reproduction) . Recent declines in the plankton abundance may be related to an increase in fish populations in the river system feeding on the plankton.
- Humans have a reduced capacity to adapt. The instructional/biological environment reduces our adaptive options. Licensing limits us to harvesting a certain species; if that species leaves, there are reduced options.
- Are we paying enough attention to chemicals and toxic pollution? Friends of Casco Bay did some testing of storm-water, looking at chemicals such as fungicides, pesticides, herbicides and noted a problem. This is something we should be looking at.

Watershed Economy

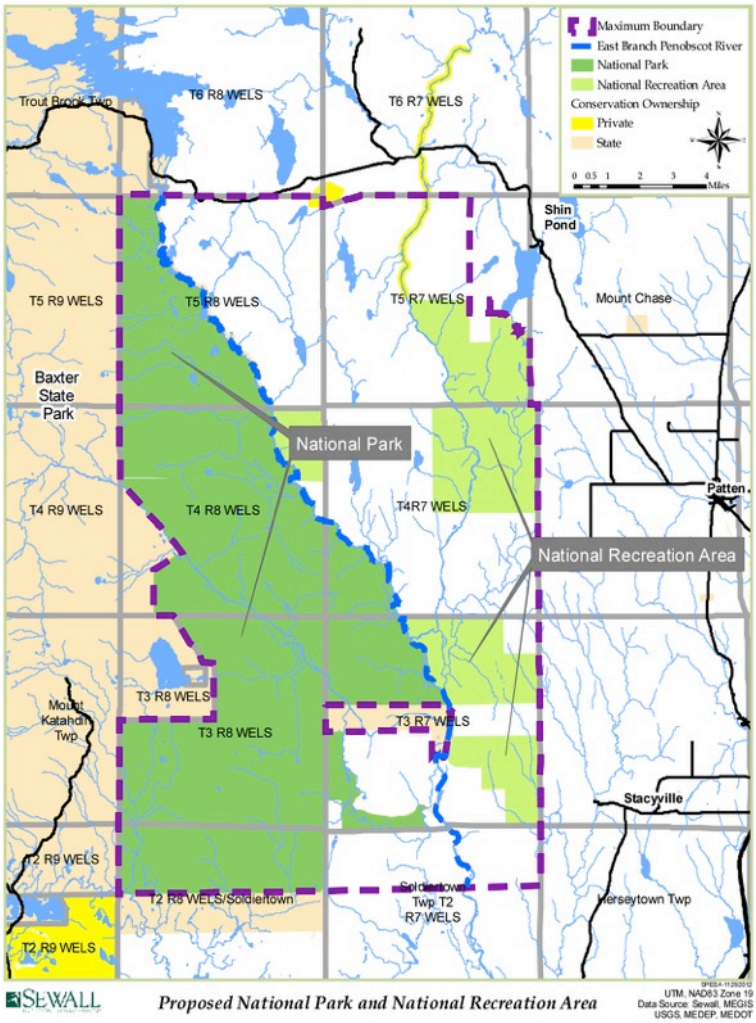
Watershed Economy: Forests, An Economic Cornucopia

hosted by Steve Miller, Islesboro Islands Trust

Proposed National Park and National Recreation Area East of Baxter State Park

Cathy Johnson, Senior Staff Attorney, Natural Resources Council of Maine

The mission of the Natural Resources Council of Maine is to protect, restore and conserve Maine's environment, now and for future generations. We have a once-in-a lifetime opportunity to create a new National Park and National Recreation Area east of Baxter. Elliotsville Plantation has proposed to donate its property around the East Branch of the Penobscot River to the American people to create a National Monument, and ultimately, a new National Park and Recreation Area. In order for the people of the State of Maine to capitalize on this historic opportunity, we need a sustained effort from dedicated people. That's where each of us comes into play. Members of Congress want to hear from us but they need to hear from a lot of us and they need to hear frequently. We want to make sure all members of the delegation understand there is massive support for this. Compared to Penobscot and Piscataquis counties, areas with national parks and recreation areas have seen greater increases in personal income and employment in the last 40 years.



Senators King and Collins have reservations mainly about access for snowmobiling and hunting that they've heard from the region, as well as air quality impacts.

Timber harvesters have legal right of way across the EPI land. There are plenty of places across America like in the West where the NPS and timber harvesting companies share roads and respect boundaries.

A combined National Park and Recreation Area together is far better than one or the other, and way better than not having either one.

Non-Timber Forest Products and the Penobscot River Watershed: Possibilities and Challenges

David Fuller, Agriculture and Non-Timber Forest Products Professional, UMaine Cooperative Extension

Non-timber forest products are a culturally and economically important part of the Maine forest, yet they are relatively unknown and under-valued. They include seeds and cones; birch sap and bark; mushrooms; maple products; balsam fir incense, pitch, and greens; fiddleheads; wild leeks; decorative branches; smoking woods like alder and maple; spruce gum and roots; basket ash; etc. Many of these products were first used and continue to be used by Native Americans, and were adopted, adapted and used by settlers for food, medicine, utility, and decoration. Maine has a cultural heritage of selling forest-related products to tourists. Historical and current knowledge of non-timber forest products provides another way to connect with the woods for both personal enjoyment and supplemental income. They offer a way to make farms more profitable, to engage youth with the woods, and to keep the woods as woods.

Non-timber forest products in Maine have an estimated value of $70 million, derived mainly from maple and balsam fir (decorative/holiday) products, while the rest is sold within a cash economy in rural places so the true market value is unknown. Maine faces competition from Chinese imports.

UMaine Cooperative Extension's Youth Entrepreneurial Program teaches about the science of the balsam fir resource, sustainable harvest techniques, how to make products, and business basics. Young people have fun, learn about the science of the Maine woods, and make money.

Other initiatives include promotion of sustainably harvested birch bark for use in Adirondack furniture, interior décor, and crafting. Bark is harvested only from trees that are about to be cut.

UMaine research on fiddleheads suggests harvesting no more than half of emerged fiddleheads in an area, no harvest of "late bloomers" and no harvest of fiddleheads smaller than a quarter.

The key is to identify what's on your woodlot, and work only with sustainable species. Always get landowner's permission to harvest, and consider raw materials vs. value added products. What will 33 million tourists, spending $1.5 billion retail dollars, purchase to remember their time in Maine?

Forest Products: an overview and update of recent developments in Maine's forest economy

Roberta Scruggs, Communications Director, Maine Forest Products Council

Maine's forest products industry faced the 1974 spruce budworm outbreak, the worst infestation ever recorded. Millions of dollars were spent on spraying thick clouds of moths flying in from Quebec. The outbreak lasted until 1985. After the spruce budworm disappeared in 1985, there was a lot of damage to standing trees along with people cutting down their trees preemptively before they were killed by budworm. The forest products industry did a terrible job as an industry communicating what happened to the legislature, who wanted better forest practices and then passed stricter forestry legislation. Currently another outbreak is occurring in Canada, and we are trying to get ahead of it. There isn't spraying for spruce budworm in Maine. The native spruce budworm population is rising, but we don't have any defoliation yet. The last terrible spruce budworm infestation started in 1975 with a huge inflight of moths that was responded to with millions of dollars of federal funding towards spraying with bomber planes in what's known as the "Battle of the Budworm." It's actually unlikely that there will be much spraying in the near future because of environmental impact, lack of funding, and comprehensive spruce budworm prevention forestry practices currently in place.

Since clear cutting wars ended (1985) no one talks about forestry. Paper industry modernized, employed fewer people. There is no more paper being made in the Penobscot River valley, mostly the result of competition from foreign imports. In 2009 China surpassed the U.S. in paper production, and Indonesia, Turkey, and the Middle East are also now producing. Growth is in tissue paper and paper towels, not what we make in U.S. China doesn't have trees for pulp; we do but it is less profitable than finished products. Pulp is now made in bigger capacity mills in Japan, Finland, and Brazil--beware a pulp glut. Some Maine mills are still making coated paper because they modernized to things like release paper, a texturizer, or Tencel, a fabric made of wood fiber. Changeover is very expensive. Globally the paper industry is increasing and Maine could get into it.

The lumber industry is doing very well – they recently invested $100 million into upgrading mills and production is incredibly high. Lumber was a $8 billion [or million?] industry in 2013, which increased to $10 billion [or million?] in 2014.

Discussion points:

- Whether we're talking about a new national park and national monument, how to best respond to spruce budworm, or economic and community development, one of the biggest challenges is that there are a lot of different perspectives, histories, and preferences to take into account. What have we learned about the best processes that help people find a common way forward on these issues without divisiveness? How can we do this better in the future?
- The Penobscot River Restoration Project provides an example of the many years of discussion required for different parties at the table to understand each other and appreciate other perspectives before a project can move forward. As recently as five years ago everyone in the Katahdin region hated the idea of a National Park. After hundreds of one-on-one meetings with local people to explain the project and hear their feedback, proponents were able to make significant changes to the proposal that has led to a huge increase in support – including the endorsement of the Katahdin Chamber of Commerce. It wasn't a big formal process, but ensuring that people are in the same room and talking together is incredibly important. We have absolutely seen a shift in perspective. One-on-one conversations have had a big impact, and the closure of the Millinocket mill has led people to realize that something different will have to happen in the region. Some are concerned that National Parks are based on the ideology of "look, don't touch," which prevents children and others from interacting with forests in a user-friendly way; but in terms of the amount of forested land in Maine, the proposed Park and Recreation Area is only 150,000 acres out of 12 million acres in northern Maine.
- Forests are a critical part of Maine's economy, culture, and heritage. Ownership and access to forested lands for products and recreation is vitally important. Economic struggles are largely related to international supply and demand dynamics. Government intervention and local decision-making power will continue to be issues in the watershed, but now we see more communication between different stakeholders and community groups about different types of forest use.

Is commercial fishing part of Pen Bay's future?

Robin Alden, Executive Director, Penobscot East Resource Center

Maine's seafood system is evolving in similar ways to Maine's agricultural shifts in recent years. How does the food system help or harm efforts to build a local fisheries economy? The Mission of Penobscot East Resource Center is to secure a future for fisheries and fishing communities of eastern Maine and beyond. Today, Maine has lobsters. Our fisheries are not diverse. Penobscot Bay lobster landings in 2015 totaled 38.5 million pounds at a value of $158 million. We are trying to build an economy based on living in the bounds of what the Bay can produce; in the long run, this means adaptive, small-scale fisheries. To succeed, we need river and marine restoration, development of land and sea connections in production and marketing, and market and transportation innovation. We engage fishermen in local observation and stewardship. Since 2010, groundfish recovery monitoring through the Sentinel Survey has found an increase in alewives from around 30,000 to 500,000, with a parallel increase in abundance of cod inshore. To build a local groundfish fishery, we need working waterfronts and access to the water, a way and a labor force to turn landings into food, refrigerated transportation, and cold storage facilities. Climate change presents a dynamic and uncertain future, requiring rapid response and product diversification.

Buyers and consumers desire consistency, yet we need to accommodate small harvests of diverse, highly perishable species landed in remote towns at the ends of long peninsulas. Fish species vary by season come in unpredictable amounts at unpredictable times. Docks play a key function in the market chain, and need to include shoreside offloading infrastructure including ice, transportation, aggregation and storage facilities, processing capacity, labor and fair labor practices. Regulatory issues come into play.

Bigger is not better in fisheries. Balancing our ability to store and transport with the need to match scale of harvest with scale of resource. There is no one solution but multiple tools: community supported fisheries, boat to table restaurants and schools, integration of aquaculture, an emphasis on marketing, and new public-private business models.

We have a chance to fish forever here in Penobscot Bay and demonstrate it for the world.

Community food councils

Ken Morse, Coordinator, Maine Network of Community Food Councils

Community Food Councils have spread rapidly across Maine. Food Councils evolve and grow to become an increasingly powerful force in revitalizing Maine's food system. The Network accelerates innovation in the drive toward food self-reliance through peer-to-peer learning and collaboration. One of the Network's projects is the Maine Food Atlas.

Agricultural trends

Sara Trunzo, Maine Farmland Trust

Land-based food systems are incredibly complex, muti-disciplinary, and messy. Farmers are key stewards of the land, and supporting them can help them make good decisions about land management. With 400,000 acres of available land, we'd like to see it continue to be farmed. Some has been lost to development or is no longer desirable for farming, but the resurgence of farming, especially vegetable farms, and young farmers in Maine is an unusual but encouraging trend.

Maine's food system has both grave problems and incredible potential. Maine Farmland Trust is integrating and innovating in the areas of farmland protection, farmland access, farm viability, and public outreach such that Maine's food system is strengthened. This work is increasingly incorporating food access and security elements, as a means of supporting community needs and creating broader markets for farmers. Veggies for All is a food access program. We are working to get young people on farmland and provide the ability to farm, keep farmland active, provide loans and services to beginning farmers.

Discussion points:

- The Intervale Institute in Vermont is an example of a local food approach. Initiatives linking land and sea are also important, but we need to have discussions about what we value, and find models that aren't exploitive.
- Tourism offers an opportunity. As people get more disconnected from their food source, they become more interested.
- Another opportunity is presented by the need to connect local producers with grocery stores and supermarkets.

Marine initiatives & innovative enterprises for the coastal economy

Richard Clime, Project Developer, Coastal Enterprises, Inc.

Coastal Enterprises, Inc.'s mission is to help create economically and environmentally healthy communities in which all people, especially those with low incomes, can reach their full potential. A Maine based rural CDFI focused on economy, environment, and social equity, CEI has proved $17.6 million in 242 marine loans, leveraged $54.75 million in investments, provided free business services and workforce solutions. Sector specialists focus on natural resources, energy, housing, tourism.

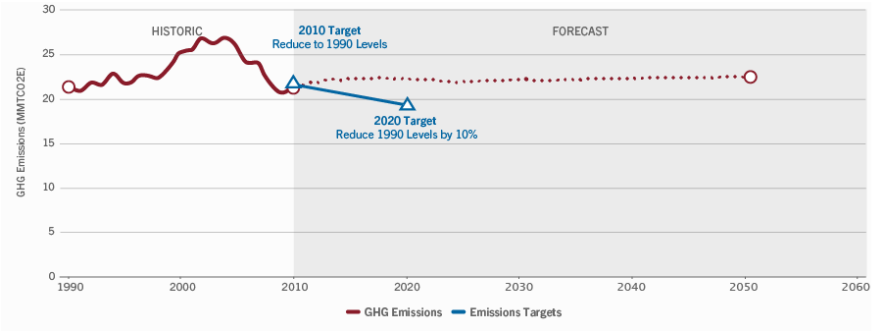
A changing climate has made some Gulf of Maine fisheries less productive (groundfish, shrimp, urchins, soft shell clams) while making productive ones (lobsters) less accessible. Fishermen are looking for ways to diversify their earnings and provide economic security to their families and communities. CEI's approach to this issue includes protecting working waterfront access, developing shellfish and sea vegetable aquaculture, business training for fishermen, research and development of a "green" lobster boat, creation of a seafood marketing tool, loaning and investing in Maine's seafood industry, contributing to a national financing fund strategy. Statewide initiatives for the marine economy include the Farm Service Agency's noninsured crop disaster insurance policy, marine jobs bond, and the Alliance for Maine's Marine Economy.

Advancing the clean energy future

Daniel Sosland, President, Acadia Center

An exciting transformation in energy technologies offers a clear path towards a consumer friendly, cleaner energy system that can put Maine and the region on the trajectory to achieving deep carbon pollution reductions while improving our economy. These changes will take place at the community level, where Maine is showcasing initial advances.

In 2014, Maine residents spent over $1.7 billion on energy ($3,000 per home); 67% of homes use heating oil, the highest percentage in the nation. Building heating released 5.5 million metric tons of carbon dioxide. Maine communities will benefit from lower energy costs, cleaner power and greater control over energy issues. Maine and the region currently have a high cost energy system that is overbuilding the wrong kind of infrastructure due to outdated rules that must be changed and new policies adopted in order to advance this shift to our communities.



Power generation is getting cleaner, with a shift in the region toward natural gas and renewables and away from oil and coal. Maine emissions are meeting near-term goals, but the trend is not on a trajectory to meet long-term goals.

Renewable costs are increasingly competitive, and energy efficiency investments have saved about 13% of regional electric consumption. Interests of consumers and a sustainable energy system have merged more than ever before. A smart and dynamic electric system should focus on giving consumers and communities greater freedom and control over their energy costs. Technology changes are causing the energy system to become increasingly decentralized. The impact of infrastructure can be reduced through deployment of customer-side energy resources; community pilot projects, such as the Boothbay local clean energy project that includes solar, are deploying local energy resources as substitutes for traditional infrastructure at lower costs. The current grid (one-way power flow) and the policies that drive investments in it (focus on utilities) aren't designed for high levels of consumer engagement or adoption of distributed, two-way energy technologies. States are indicating an interest in transitioning to a more decentralized energy system.

The Acadia Center's UtilityVision seeks to

- Align utility incentives and earnings and grid planning with consumer and environmental goals and technology advancements.
- Level the playing field for customer-side resources to ensure that the best options for the environment and consumers are selected.
- Maintain the best of what we have – energy efficiency investments, moving to clean power, reliability – while evolving to a more modern energy system.

Concerns that electricity prices are too high is nearly constant in New England. Yet, one of the key causes of increasing prices usually is ignored: the cost of moving electricity from power plants to population centers, which appears on consumers' electric bills as a transmission charge. These charges have skyrocketed in the last decade and continue a steady climb. Since 2002, about $12 billion in transmission has been built, is under construction, or is being planned in the six state New England power region. Transmission spending in New England is growing at a dramatically faster rate than in the rest of the country. These costs are passed directly on to ratepayers, leading to significant increases in overall electric prices – and higher consumer bills. Importantly, these outdated policies are inconsistent with technical advances in smaller scale, local energy technologies like rooftop solar and targeted energy efficiency, which do not rely on power being transmitted. Yet Maine is lagging behind other New England states in per capita solar installations. Maine prevents towns from adopting advanced building energy codes and no comprehensive grid modernization review is underway. Rules need to be updated as new technologies change the energy landscape.

Lessons from the Maine Brewers Guild

Sean Sullivan, Maine Brewers Guild

Maine has a legitimate claim to be craft beer's home on the East Coast. The first craft brewer, Geary's, began operations in 1986 and the guild formed in 1994. Since then we have become the industry leader, providing mentorship and a sense of community. Our mission is to promote Maine beer (e.g, events, media relations, beer trail, consumer engagement) and protect the industry through legislative advocacy and other activities.

The latest statistics from 2015 show that craft beer's share of the market (12.2% of the volume) is growing (10% since 2014), but is still comparatively small. In 2015 craft represented more than 20% of total dollars in sales, a goal set by craft beer industry insiders in 2013. Right now there are more than 4,200 breweries in the USA, up from about 2,000 five years ago.

As of today, I believe we have 71 breweries in Maine – with at least one in every county but Piscataquis.

What was laughed at three years ago is now big business for Maine with even greater opportunities on the horizon. An economic impact study is underway, but a national trade association also tracks our industry and here's what they have found:

- In 2014, Maine brewers produced and sold over $100M worth of craft beer. And our brewers employed more than 1,500 people.
- This is a share of the total $400M of craft beer total sales in Maine.
- This dollar sales volume ranks Maine as 7th in the nation for economic impact per capita for 21+ adults.

Additional tourists and visitors are helping Maine become a top USA destination for beer.
So, what is the Guild doing to support all this effort? And how can we all, as Mainers, maximize the potential of what is happening in this industry?

First, what's great about our industry is that is builds on a Maine brand that already exists: authentic, hand-crafted products, made by your neighbors, quality over quantity. Brewing is ultimately manufacturing, and anyone who has visited a brewery can attest to this. But it's manufacturing with a personal face behind it. Our facilities welcome visitors – so visitors can learn about the product, meet the people behind it. Breweries are opening and growing very quickly in every corner of the state. This is not just a metropolitan opportunity here, but for the construction, maintenance, and carpentry trades; professional services; and tourism, especially younger visitors. Rural communities are realizing benefits as people who never drank craft beer are beginning to meet their neighbors and try the product. Breweries are proving to be very good neighbors. They stay engaged with the local community and generate complimentary and increased traffic for local restaurants and other businesses as well as stimulating Maine agriculture via barley, malt, and hop production. Ingredients are sorely needed in our industry – agriculture can't keep up, but we are working to expand this part of the industry (e.g., partnerships with Maine Grains and UMaine) and incorporate concepts like "terroir" into beer.

What does the future look like? There are many new consumers who are only learning now about beer styles, flavor profiles, and the like. There are many breweries, most making good beer, with not enough shelf space or draught lines to accommodate all. Quality will be key differentiator of future. A quality assurance/quality control laboratory is under construction at USM, which will help ensure quality and sustainability of industry, train students to work in breweries, and allow brewers to meet increasing nutritional information requirements coming out from FDA.

The industry will also be more regulated; many existing regulations were written immediately following prohibition, and combined with rapid changes in the industry this presents real challenges. Managing water and waste streams are important issues. Brewers use on average about 7 gallons of water for every 1 gallon of beer they make. Many of our brewers are making efforts to improve sustainability. Guild is partnering with Manomet this year to begin a study and program call Hops360 that will help monitor and improve sustainability at breweries in Maine and nearby. Most of our brewery owners are people who left their more normal 9-5 job to start this business, and they are doing it because they are fulfilling an entrepreneurial dream. Collaboration is the hallmark of our industry and one that I think has rapidly accelerated our growth. The Guild is looking forward to continuing to build bridges around the state with other people and organizations looking to move our state's economy forward.

Maritime Heritage & Industry

Maritime Past hosted by Liz Lodge, Director, Penobscot Marine Museum and Kyle Molton, Penobscot East Resource Center

A Wabanaki perspective

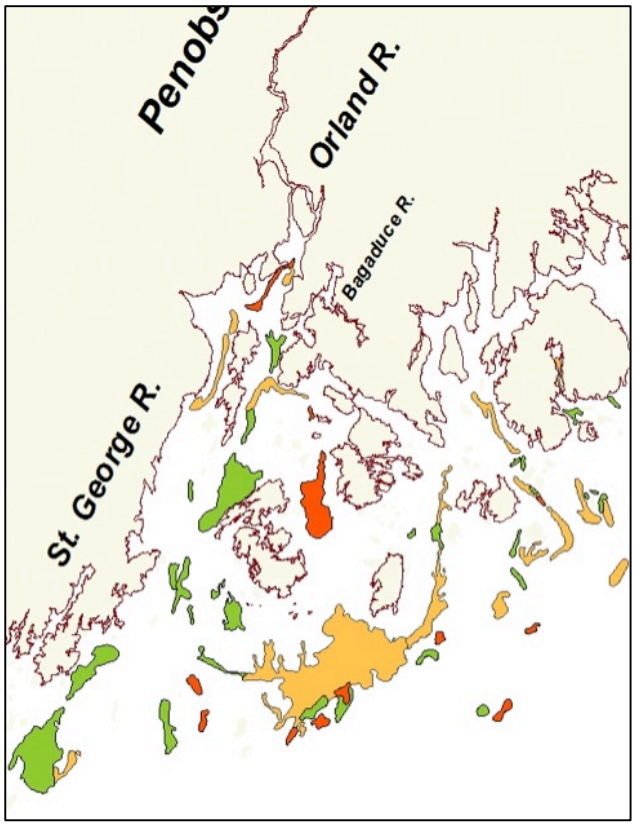
James Eric Francis Jr., Penobscot Nation

The Penobscot River is home. Sense of place cannot be separated from the identity of the people.
Waters and geology are integrated into tradition. Stories tell of the history, instructions from ancestors to future generations. Generations of stewardship within the watershed. We are still fighting in the courts to protect the river to preserve our culture, for Penobscots and for all of Maine. Colonization of the lands and removal of native people to reservations changed the locations of the native peoples. We retained the Penobscot name because that is where people survived. We are a people named for places, and that name connection promotes stewardship of the river.

The historical fisheries of the Penobscot River and Bay

Ted Ames, Penobscot East Resource Center

Penobscot Bay was once the epicenter of Maine's groundfishing industry, supported by healthy runs of anadromous fish and a healthy bay. Certain prey appear to have affected the historical distribution of cod spawning groups along the Northeast coastal shelf. Sebastien Rale presents a picture of the river from 1723: “At a particular season of the year, they repair to a river not far distant, where during one month the fish ascend in such numbers that a person could fill 50,000 barrels in a day, if he could endure the labor. They are a kind of large herring, very agreeable to the taste when fresh. Crowding one upon another to the depth of a foot, they are drawn out as if they were water. The Indians dry them for eight or ten days, and live on them during all the time that they are planting their fields.”



Penobscot Bay once had 24,160 hectares of cod spawning grounds and 35,600 hectares of haddock spawning grounds.

Popular capture methods included weirs, fish traps, and seines, or handling from dories near shore. These methods were effective throughout Penobscot Bay.

By the 1860s, dams had eradicated anadromous fish. US Fisheries Commissioner Baird reported in 1873 that the loss of alewives had triggered loss of coastal cod fishery. Good fishing continued down the bay: in 1919, Vinalhaven seiners landed 250,000 pounds of pollock in a single day. Cod and haddock continued to be caught by hook and line from sloops. But dams, pollution and overfishing were depleting the remaining upper Pen Bay fisheries.

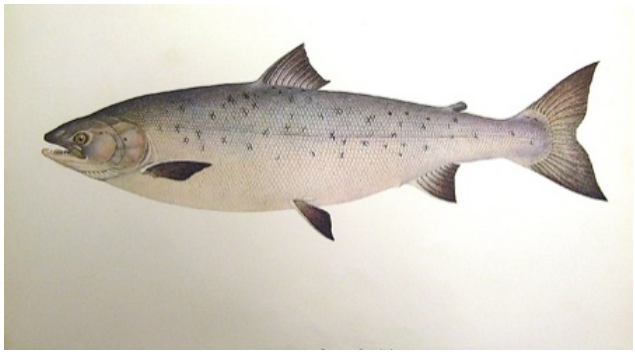
250,000 pounds of pollock landed in one day at Vinalhaven, Maine

By 1935, upper Penobscot Bay fisheries had disappeared. New technologies had entered the fishery and rapidly depleted coastal fishing grounds in the lower Bay. By 1950, cod, haddock and flounder stocks were overfished in lower Penobscot Bay, but stocks slowly recovered…only to have the entire Penobscot system collapse in the 1990s. Only Atlantic herring and lobsters remained as fisheries. A 2007 cod tagging study showed no cod from the Kennebec to the St. Croix River. Why?

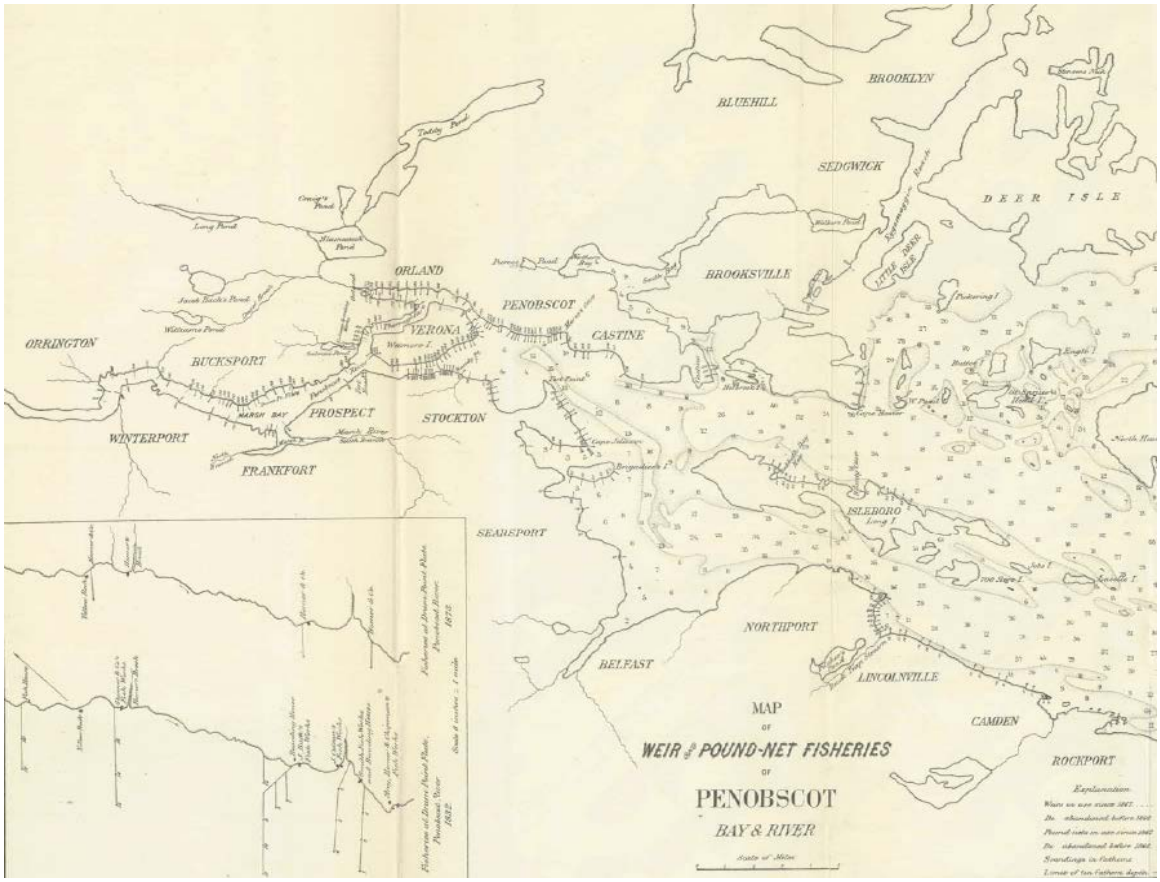
Alewives and Atlantic herring are important prey for cod, but adults are absent in winter in eastern Maine. Instead, only their progeny were left in the estuaries. If young-of-year alewives were important prey, historical data should show cod moving closer inshore in the fall. Data on alewives from the ME-NH trawl survey (2001-2015) show that young alewives appear to remain nearshore through the fall; herring were more abundant but had a similar distribution. This created local areas where both prey species were concentrated. Superimposing historic cod and haddock spawning areas shows that ripe cod and haddock were caught inside the same areas as young alewives and Atlantic herring. Groundfish remained near the combined biomass of oil-rich prey all year. The collapse of the inshore spawning sites can be linked to the loss of prey. This suggests that restoring alewife and herring populations should aid the recovery of Maine's fisheries and the return of a "fisherman's paradise" in Penobscot Bay. Aquatic and marine systems are very connected, not fully understood and more progress is needed.

Atlantic salmon of the Penobscot

Catherine Schmitt, Communications Director, Maine Sea Grant



Atlantic salmon play a major part in the history of Penobscot Bay. They are an important species to the native Wabanaki people, provided a major commercial food fishery in the nineteenth century, and supported a world-renowned sport fishery in the twentieth century. The history of salmon reflects the broader history of the Penobscot watershed.



Midcoast Maritime Past

Renny Stackpole, Retired Museum Director, Penobscot Marine Museum

A brief review of the maritime life and exploits of ship builders and ship captains of Thomaston from 1820-1865; all based upon original letters and accounts. Ship activity here connects the region to the world.
Shipbuilding boomed while wood was plentiful; as years passed and forest reserves depleted, people began to look elsewhere and did not appreciate what they had.

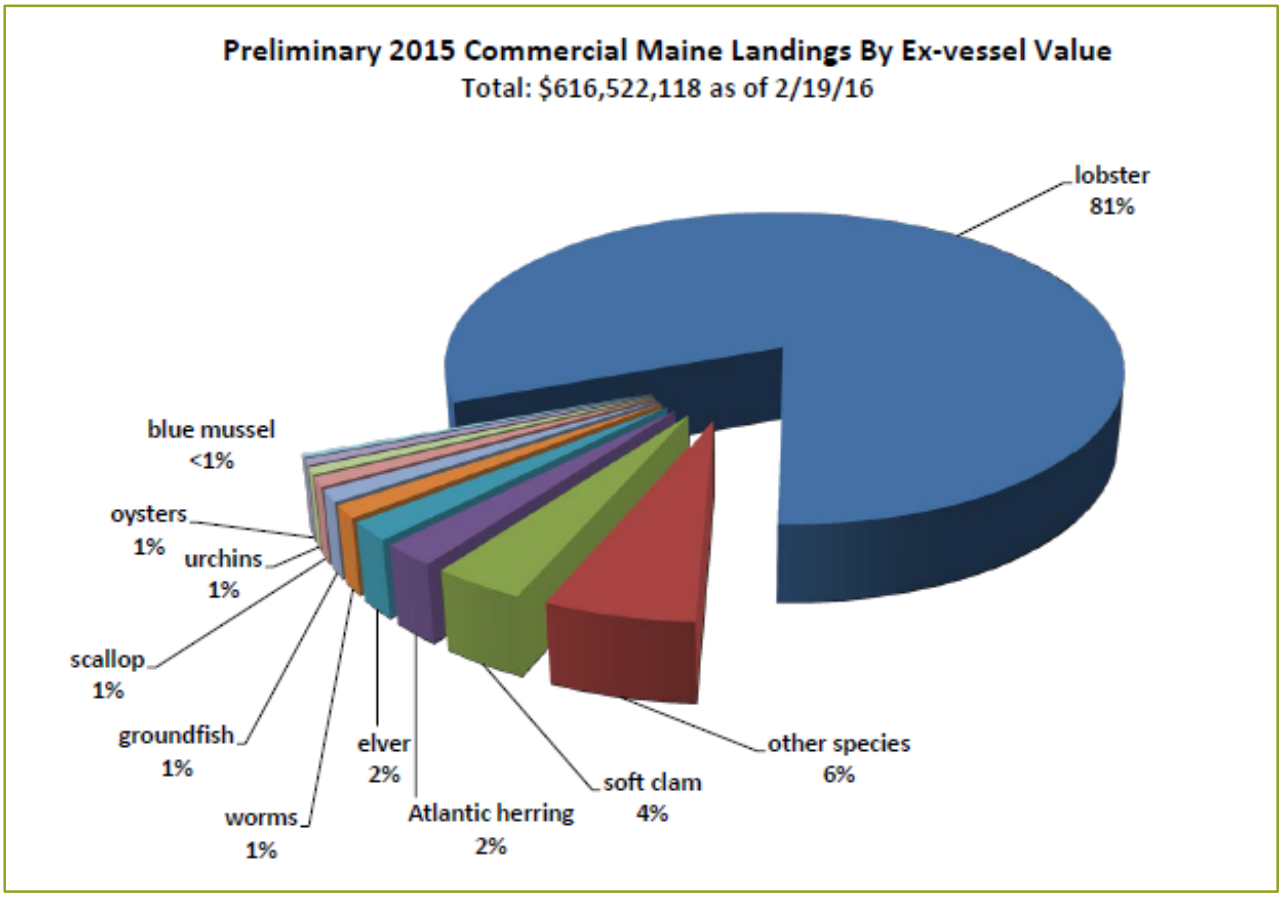
Discussion points:

- Logging was everywhere in the region and transformed the watershed. Progression of dam construction spread up the river and total number of dams impacted the fish species. Rivers were altered to move logs downstream, and past logging is still having an impact today, where sawdust has collected in the mudflats along estuary.
- Dams, too, continue to affect salmon and other fish. The Weldon or Mattaceunk dam, which is up for relicensing, has an upstream passage for salmon that may not work for other species (shad and alewives); Downstream passage is a large problem for salmon.
- Humans have altered the watershed for as long as they have existed here with varying levels of concern for the ecosystem.

Commercial scallop fishing in Penobscot Bay

Carl Wilson, Maine Department of Marine Resources

Recent state oversight of the scallop fishery has been an experiment in spatial management. Based on the success of closing areas in the federal scallop fishery (from 16 million pounds in 1994 to 57 million pounds in 2012), Maine instituted a rotating system of closed areas in 2009: 20% of coastal waters were closed to fishing for three years and then opened to limited access in 2012. Fishing was governed by a 'soft' total allowable catch. When harvest removed 30% of the estimated biomass, a closure was triggered, as informed by real-time data from port sampling, marine patrol observations, sea sampling, and seasonal surveys.



Commercial lobster fishing in Penobscot Bay

Cyrus Sleeper, lobsterman, South Thomaston

Lobstermen are seeing water up to 10 degrees warmer this year. In 2012 warmer water meant lobsters came early, when Canada was still in their season processing lobsters. Some are concerned that with the warmer temperatures this year that it could be a repeat of 2012. We're also seeing increased algae (*Desmarestia* spp.) on sea-floor. Is it potentially displacing lobsters or affecting nturient availability? Lobsters caught within this "gorilla grass" aren't as hardy. Whales are another contemporary issue. Gear configurations changed in June due to changes in whale regulations (at least 10 traps per line per trawl outside a certain dividing line). Supplies continue at record levels, and so marketing is a focus, getting perception of Maine lobster into mainstream. Since 2014 funding has supported the Maine Lobster Marketing Collaborative and a campaign, mostly targeting chefs, to create demand for "new shell" Maine lobster. The market in the Northeast alone is big enough to absorb all the lobsters caught in Maine, so that's where we've kept our focus.

Other issues include trying to get rid of latent lobster licenses and waiting list through legislation, while trying not to overload the bay with traps.

There is new interest in safety in the fishery, and an effort to put life rafts on every boat over 36'; safety courses as part of relicensing, trying to get federal funding for safety training.

Most traps (~70%) use herring for bait. Herring are doing quite well, with harvest above sustainable levels, overfishing is not occurring. A small fleet; Portland and Rockland are the biggest ports for baitfish.

Building ships and boats in Penobscot Bay

Taylor Allen, Rockport Marine

With a workforce of about 50 people, Rockport Marine maintains about 40 to 50 boats year-round, and also builds and restore vessels. We are a third-generation family business, and have recently begun a partnership with Front Street Shipyard in Belfast. Our focus mostly is the pleasure boat market, but we do have several fishing vessels in the yard during the winter. Challenges that the pleasure boat industry faces include public perception. It is hard to convince the public that Maine is still good at building boats and getting that message across has been a challenge. Boats are being purchased from European markets.

Rockport Marine does both new boat construction and repairs. Boats include the Spirit of Bermuda; Rembrandt; Arabesque; Cary Ali; White Wings; Nashua; Zebra; Boss Lady; Dream; Louise; Lynx; Godspeed; Adventure; Adventuress; Tradewind; Bolero; Bernice; Underwood; Zwerver; Spice; Albury; and Osprey.

In terms of the future, one of the things that is most heartening is that the people of Maine enjoy a world-wide reputation for delivering high-quality work for reasonable prices and fair wages for employees. Boat yards in Maine have an optimistic future with opportunities for local workers.

Windjammer fleet

Barry King, Schooner Mary Day

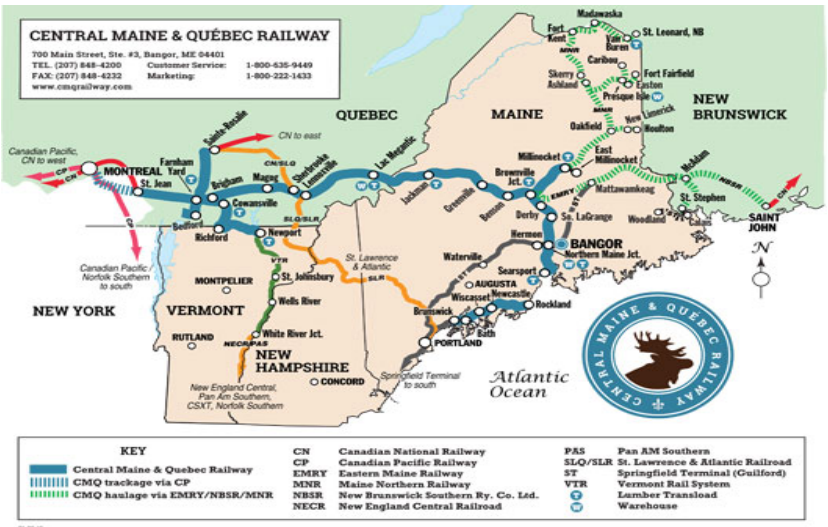
The Camden windjammer fleet includes 14 vessels equipped to make overnight trips of two to six days, part of the last and largest fleet of working vessels in the country. Approximately 8,000 passengers every summer travel between Boothbay Harbor and Bar Harbor. Nine of the vessels are historic. Maintaining the boats in "yacht" condition is the biggest part of the budget

Challenges to the business include new Coast Guard regulations that will require major costly changes to the fleet. The scale of these vessels means that only about three boatyards are capable of hauling windjammers for maintenance (North End in Rockland is one). Another challenge is that tourists tend to want Internet and "cruise like" amenities, and get concerned about "unplugging." Over half of the guests every year are returning guests. The nature of the trips has changed very little, but length has changed: they used to all be six-day trips, and now there are more options for shorter trips. We are also starting to offer more experiential cruises – nature and wildlife, sail training with school groups. Internships are available!

Current and future trends in commercial shipping on Penobscot Bay

David Gelinas, Captain, Penobscot Bay & River Pilots Association

Commercial shipping in the bay historically was related to a north-south corridor. Today, transportation runs east to west. Shipping has less of a climate change impact than transport by train, truck, or plane. Ports are located at Searsport, Bucksport, Bangor, Brewer. Instead of lumber, paper, and potatoes being exported, ports are taking in petroleum coke, road salt, oil, and natural gas, jet fuel, diesel, gasoline, wind turbine parts – at least 60% of import cargo is related to energy. Largest vessels are between 50,000 and 80,000 tons (super-max).



Every foreign vessel and every American vessel under register, with a draft of 9 feet or more, entering or departing from any port or harbor within the waters described in section 86-A (State Waters) must take a pilot/tug licensed by the State of Maine. Shipping lane charts for Deep Draft Vessels help to keep safe passage, minimize conflicts and other impacts, allows fishermen and recreational boaters to keep safe distance away, etc.Bridges limit schooner passage up the Penobscot River.

Discussion points:

- All the presentations have to do with the value of the word “Maine”- how can this be leveraged for greater benefit? The lobster marketing campaign is still underway, so time will tell. Metrics are difficult.
- Boatbuilders need to overcome the perception among political leaders that they are “building toys for rich people.” There is no question that tourism is a huge part of income in the State of Maine. Maine already has brand recognition but am not sure why on a national level Maine isn’t using more funding to get the word out. How do we keep our “Maine-ness”, maintain sense of self and culture without becoming just another bunch of t-shirt shops.

Eastern Maine Skippers Program

Todd West, Deer Isle-Stonington High School

As one of the oldest and most successful fishing areas of Maine, the communities of Deer Isle and Stonington struggle to see the value in formal education when there is an economic boom like lobster available. As a result, high school graduation rates were low. In 2012, Deer Isle Stonington High School and Penobscot East Resource Center collaborated to create the Eastern Maine Skippers Program (EMSP) to prepare graduates for future fisheries, not just prepare them for old fisheries. Now expanded to eight high schools and 80 participants. Students hear from visiting fishermen, who tell the students that the fishery needs people who have the ability and confidence to speak in public, and back up opinions with facts. They learn oceanography and ecology, safety and seamanship, financial literacy, and co-management, working with regulators and researchers. With curriculum support from the Rural Aspirations Project, EMSP provides aspiring commercial fishermen and other students interested in fisheries along the Downeast coast the skills needed to be successful in a time of rapid environmental and regulatory change.

Maine Maritime Academy

John Worth, Captain/Instructor, Maine Maritime Academy

A "quiet economic engine on the bay," Maine Maritime Academy is one of seven maritime colleges in the U.S. A small (35 acre) campus hosts 1,000 undergraduate students representing 30 states (75% are from Maine, 85% from New England). Students enter the maritime, logistics, and marine science workforce. Hands-on training, competitive Division III athletics, and Navy, Marine Corps and Coast Guard programs result in greater than 90% professional job placement. MMA's humble beginnings in 1941 have grown into three degree programs in 13 focused majors, including marine transportation operations, engineering, marine science, and business, all enhanced by MMA vessels such as the schooner Bowdoin, tug Pentagoet, and State of Maine. We are finding that many students don't want a technical career, and we're trying to be diverse and answer those concerns. There is great potential in the opening of the Arctic/Northwest Passage, and Maine Maritime Academy is a leader in ice navigation, etc. Many graduates leave Maine for money, but want to come back later.

Boatbuilding today on the Bay and challenges for tomorrow

Greg Rossel, Boat Builder, Greg Rossel Boat Carpentry

A brief overview of where boat building has been and is now on Penobscot Bay and watershed and where it may be going -- challenges and opportunities. Challenges exist for cultivating and maintaining a talented work force in the future. Boat yards are doing well, recruiting local people for different jobs, which is great for those who know what they want to do, but what about the next generation? How do we get them to feel like what's on the coast here is for them? I teach boat-building to high school students, but shop class in schools in generally in decline. Boat building is a "silent iconic type of industry" that no one talks about much. But there is a lot going on in terms of technological advances.

Searsport Maritime Magnet School

James Gillway, Searsport Maritime Magnet School

A magnet school has been proposed for Searsport to train high school students who would then go on to Maine Maritime Academy or the University of Maine. We are still developing the curriculum, but we want to provide a multi-path educational experience with high achieving student body in marine science tech and transportation fields.

Aquaculture in Shared Waters: A diversification strategy for Maine's working waterfront

Dana Morse, Marine Extension Associate, UMaine Sea Grant/Cooperative Extension

Lobster landings have been going up to record levels in recent years, but value has been limiting and declined last year, even with record volume. Although the resource appears healthy, many wonder what would happen in the event of a downturn. Aquaculture has been of interest to some fishermen, and that level of interest appears to be increasing as opportunities for commercial fishing have decreased. Several farms are now owned and operated by current or former commercial fishermen. It's not a perfect option for everyone, but there is room for development. Maine aquaculture is a $1 billion industry, dominated by salmon. Mussels are around $3 million, oysters $5-$10 million, and increasing.

We need to expand our idea of "fishermen" to include all producers of seafood—captured or cultured. The goal of the National Sea Grant-funded Aquaculture in Shared Waters Project is to mprove our understanding of the potential for integrating aquaculture and commercial fishing, including a better understanding of social and cultural dynamics. We have developed and delivered a comprehensive training program for fishermen on aquaculture of shellfish and marine macroalgae. Training consists of an 11-week course on all aspects of aquaculture business, including classroom and field classes. Students create a draft aquaculture lease application and business plan. Topics include:

- Introduction to Aquaculture
- Bivalve and Seaweed Ecology and Biology
- Introduction to Business Planning
- Site Selection
- Leasing, Licensing and the Regulatory Process
- Husbandry and Equipment: Shellfish
- Husbandry and Equipment: Seaweed and Urchins
- Financing and Financial Management
    - Sales and Marketing
    - Farm Management and Biosecurity

The first classes, held in 2013, took place in Harpswell and Corea with 12 students and resulted in one new aquaculture business. In 2015, the course was based in Harpswell only with 15 students, 8 of whom have started new businesses. The current 2016 course, in Thomaston, has 30 students. Partner organizations include Maine Aquaculture Association, Coastal Enterprises Inc., Maine Aquaculture Innovation Center, and Island Institute.

Discussion points:

- Maritime transportation and boat-building offer tremendous opportunity, but to date this opportunity remains somewhat hidden. The U.S. fleet is getting smaller, demanding more effective and efficient ports for all vessels.
- Maine seems to have a history of resistance to opportunities associated with natural resources. How do we move forward? Several areas of consensus:
- Accept that change is happening.
- Solutions are long-term, engage all stakeholders in conversations and identifying solutions.
- Work with what we already have, our existing strengths and heritage: recognize and merge diverse talents and abilities.

Recreation & Tourism in the Penobscot Watershed

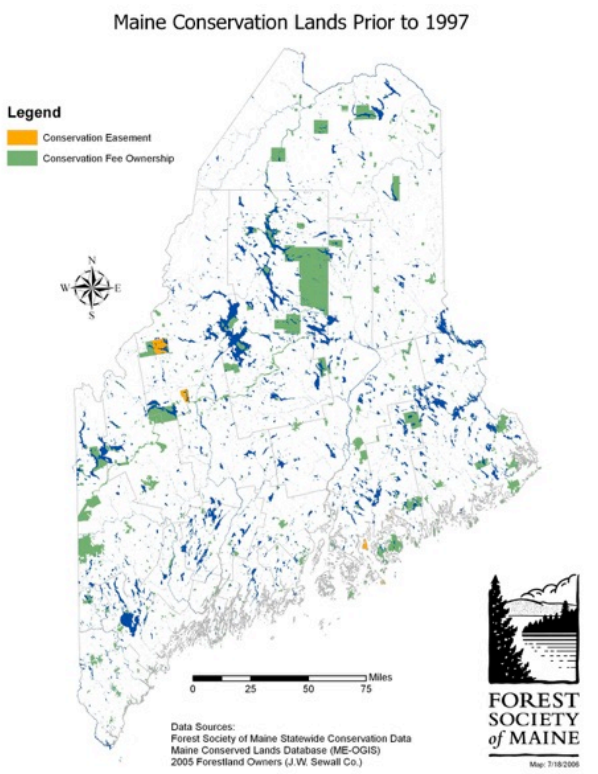
The Changing Nature of Recreational Opportunities

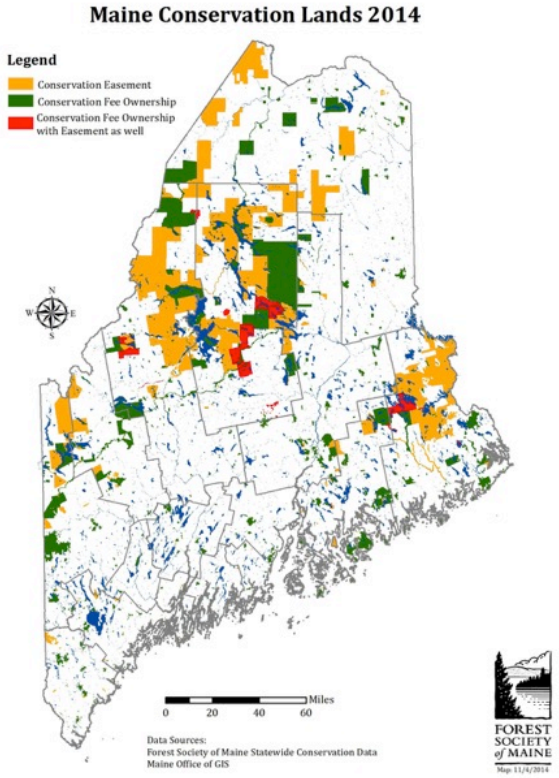
hosted by Ciona Ulbrich, Maine Coast Heritage Trust

Recreational use trends in large working forests

Erica Kaufmann, Forestland Steward, Forest Society of Maine

The Forest Society of Maine's mission is to work in partnership with landowners and communities to conserve the ecological, economic, cultural, and recreational values of the Maine woods. Our primary tool is conservation easements. We work in Maine's working forests: large blocks of privately-owned forestland with a tradition of open access and a cooperative model for managing recreation (North Maine Woods). The breakup of paper company ownerships in the 1980s and 1990s led to uncertainty about the future. In 1997, approximately 50,000-75,000 acres of Maine land were protected although few by conservation easement.. In 2014, more than 2 million acres are protected in some way, most in conservation easement.





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Recreational use of the North Woods is declining. In 2002, the number of nonresident license holders coming Maine to hunt or fish was 41,500. In 2010, the number was 27,900. In 1980, about 300,000 visitors passed through gates managed by North Maine Woods. In 2008, there were 175,000 visitors. Visitors are fewer, and older, with different trip preferences.

Yet the large conserved land base has led to new infrastructure and amenities, such as the Appalachian Mountain Club and Maine Huts and Trails. We've also seen a shift in thinking, with more communities viewing tourism and recreation as economic drivers. Communities are taking ownership of recreational assets as part of their identity, not just for tourism and economic benefit.

In the case of the Greater Moosehead Lake Region, a proposed "concept plan" development led to community engagement, more conservation, new trails and campsites, a vision for the region, and a branding initiative. Is this trend of more land being opened to recreation real or an anomaly? Changing land ownership presents a challenge. Wood markets are down, and less funding is available for conservation. Another challenge is the changing demographics of visitors, Maine's distance from metropolitan areas, competition with other areas, and lack of information available to visitors.

There are also opportunities. We need to re-think what visitors want to do, creating tours and packages that feature wildlife watching, photography, historic and cultural information. Community development work to include recreation and tourism is about more than just the money.

Baxter State Park and the Appalachian Trail

Aaron Megquier, Executive Director, Friends of Baxter State Park

An overview of current challenges and opportunities surrounding Baxter State Park and the Appalachian Trail addresses the broader challenges posed by recreation in wilderness areas. Long-distance trails create connectivity across the landscape, requiring creative partnerships and management strategies. Conservation lands in the upper watershed have different management and conflict resolution strategies, but similar big picture goals. Conservation groups are learning to partner and work together.

Baxter and Katahdin are a spiritual center for Wabanaki people. Our mission is first to protect resources and wilderness, and second to provide recreational opportunities. Many disagree. Baxter is independently managed, not managed by the state, self-funded through endowments, user fees. Baxter has a limited number of people allowed in at a time, to preserve nature experience. Overall visitor use of Baxter has declined slightly since the 1980s.

The northern terminus of the Appalachian Trail is on Katahdin. Appalachian Trail thru-hiker culture appears to be shifting, with fewer hikers seeking solitude and nature, and more hikers looking for parties, drugs, and a social experience. Thru-hiker numbers in Baxter State Park are also dramatically increasing, from 359 in 1991 to over 2,000 last year – a six-fold increase in just over 20 years. People have expressed concern that the summit is a party zone, it smells and sounds like a bar, the sticky alcohol residue attracts black bears and yellow jackets. There is no cap on numbers of people hiking the AT. Conflict and controversy raises challenge for a non-profit group. Much of public opinion is against agenda of "wilderness first, people second" at Baxter. We try to encourage hikers to finish well, and offer incentives to celebrate respectfully at the northern terminus of the AT on Katahdin.

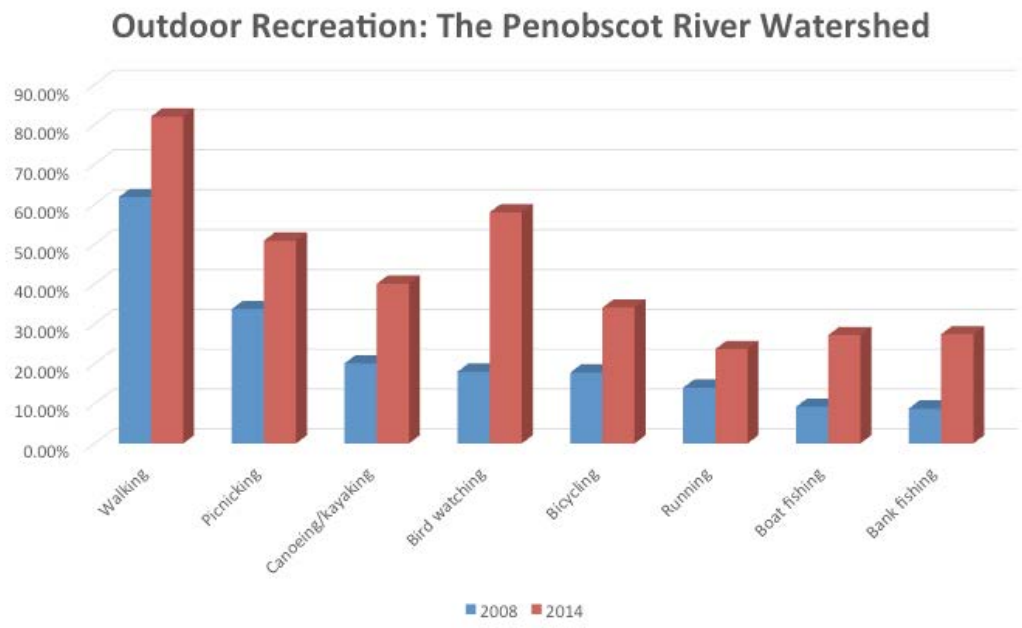
We support the creation of a National Monument/Park and Recreation Area to the east, and how we work together is important for the future.

Quality of place and outdoor recreation behavior: insights from Penobscot River resident surveys

Sandra De Urioste-Stone, University of Maine

A 2009 Penobscot River Community Survey, conducted in partnership with the School of Economics, surveyed 578 residents on household values and use, and recreation behavior. A 2014 Outdoor Recreation Survey, funded by Maine Department of Agriculture, Conservation and Forestry, with the UMaine School of Forest Resources, addressed outdoor recreation behavior, recreation constraints, Maine State Parks experiences, and attitudes toward sustainable tourism development. A 2015 survey of 807 residents in the "Bay-to-Baxter" corridor looked at quality of place, outdoor recreation behavior, community resilience, place attachment, and social capital. It was funded by Senator George Mitchell for Sustainability Solutions, Margaret Chase Smith Policy Center, and USDA.

The results of all surveys combined show increasing outdoor recreation, with walking, canoeing/kayaking, birdwatching, bicycling, and wildlife viewing the favorite activities in 2014.



Barriers to outdoor recreation include people being "too busy," the weather, and to a moderate extent costs. Respondents were fairly evenly split among recreational settings (privately owned land, land trust property, parks and open space, Baxter State Park).

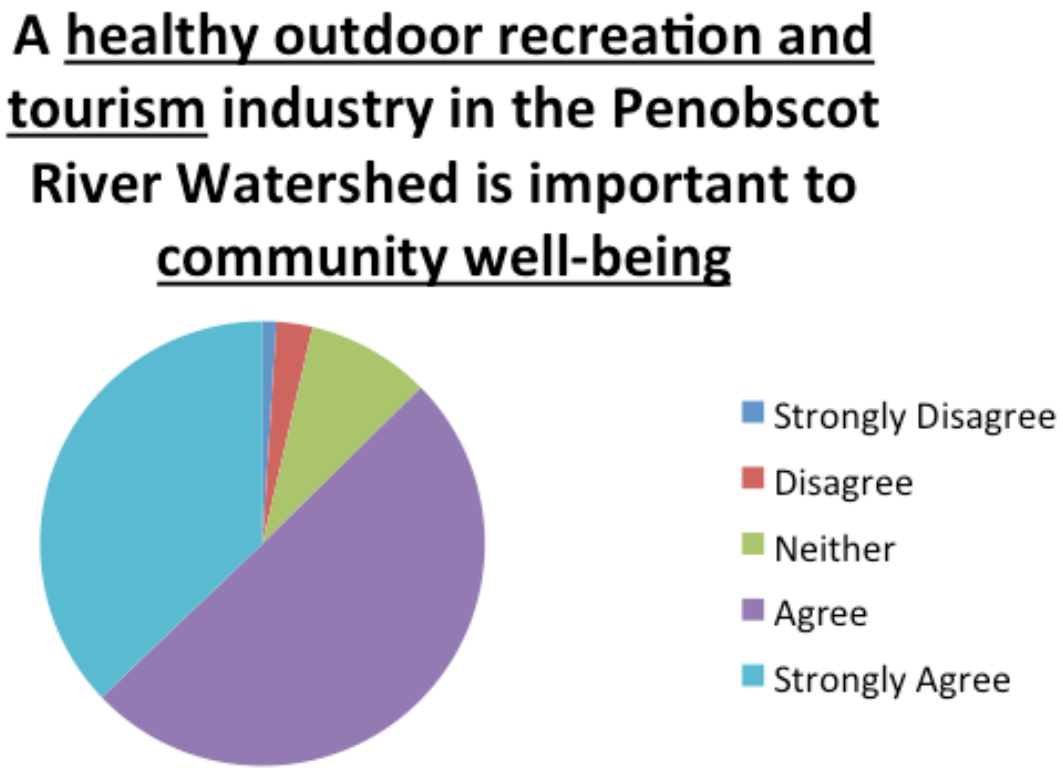
In response to being asked about the quality of the Penobscot River Watershed characteristics, people rated swimming as poor, water quality as fair to good, fishing as fair to good, views/appearance as good to excellent, wildlife abundance as good, and fish diversity as fair to good, with some shifts between 2009 and 2015.

In 2014, 46.6 % of respondents agreed and 32.8 % strongly agreed that "the ecological health of the Penobscot River Watershed is important to the economic development of my town." 45% supported dam removal efforts in the watershed (30 % were neutral).

Most agreed that both a healthy forest products sector and a healthy recreation and tourism industry are important to community wellbeing, with about half believing that recreation and tourism will surpass the forest products industry in economic importance in the future.

In conclusion, recreational activities and outdoor recreation behavior vary by education, gender, and income. Private lands, and municipal/local parks are important for recreation. The most practiced recreational activities are not water related.

Quality of place findings indicate some improvements in aesthetics and concerns about water quality and swimming opportunities. Forestry and outdoor recreation/tourism are important for community wellbeing; outdoor recreation and tourism are becoming more important.



Discussion points:

- Recreational use is decreasing, and also changing in nature. Traditional activities such as hunting and fishing are being surpassed by bird watching, biking, walking. (Baxter opened up to bicyclists in 2015.) Many people are too busy for recreation (work schedules), or it's too costly, so many people do things close to home (like walking, birding, etc.). People seem to have less time and energy to do things.

Culture-Based Recreation in the Watershed, Part I

hosted by Aleta McKeage, Executive Director, GreenWays Center for Environment and Community

The Downeast Fisheries Trail

Natalie Springuel, Marine Extension Associate, Maine Sea Grant

From Penobscot Bay to Cobscook Bay, the Downeast Fisheries Trail connects historic and active fisheries sites that illustrate the region's maritime heritage. Marine resources sustain the culture and economy of Downeast Maine. The Downeast Fisheries Trail and related initiatives build on these local resources to strengthen community life and the experience of visitors. Originating in 2000, the revamped and expanded Trail was developed through a community engagement process include local conversations (five focus groups), individual conversations with "site" managers, and a diverse and local coordinating committee. The heart of the Trail is 45 sites including

- 5 museums, 4 historical societies, 1 oceanarium
- 4 state parks, 4 town parks, 1 state lands
- 1 national park, 1 international park
- 4 scenic byways
- 4 community fisheries orgs
- 2 Native America sites
- Fish hatcheries and fisheries restoration sites
- Many working waterfronts, piers, and scenic overlooks (many with interpretive panels)

The Trail is interpreted through stories, oral histories, narrative histories, a literary journal, printed materials, kiosks and information panels, events, and involvement in local, state, and international tourism initiatives.

DOWNEAST FISHERIES TRAIL

To quote a resident and historical society member from Stonington,

"We cannot rival the sophistication of what folks have seen at our large metropolitan [areas], but we do have something special – our situation right in the middle of the 'real thing'"

Penobscot River Whitewater Nationals Regatta

James Eric Francis, Jr., Penobscot Nation

An incredibly important event for the local economy, with more than 500 paddlers, plus the people viewing the event, plus media coverage was good for the Penobscot Nation, as well as the state. The Penobscot Nation will host the Regatta for another two years. Old Town is the "Canoe City" so what better place to hold the whitewater nationals. The world class technology of the Old Town Canoe is a design that comes from the original canoes of the Penobscot Nation people. Despite conflict in other areas, the State of Maine has supported Penobscot Nation tourism efforts.

Through education will come understanding and through understanding will come respect for the Penobscot Nation. Cultural tourism allows for the exploration of views through the land, through the river. Penobscot Nation individuals learn who they are and where they came from through the river and the land and they want to share that with other people who are interested.

Extended cultural tourism trips have been occurring in Northern Canada (ie. Cree Nation), lasting longer than most trips in this area and last about 5-7 days. First Nation members are able to act as ambassadors for their culture, reinforce traditional values, as well as build a solid business to support your livelihoods and families.

Thoreau-Wabanaki Anniversary Tour

Polly Mahoney, Mahoosuc Guide Service and Jason Pardilla, Penobscot Nation

About 65 people were involved and the trip took about 16 days in total (food was distributed every 3 days, but only eight people did all 16 days. The Maine Office of Tourism participated in and supported the trip. We relied on sources about what they ate and the provisions that they had; we did know they ate a moose they had hunted. We now offer sections of this trip that individuals can sign up for.

Cultural Tourism Department for the Penobscot Nation will provide an experience for tourists that is as close to traditional experience as possible: a way to provide an experience that gives a sense of Penobscot culture and how that culture is embedded in the landscape. For instance, allowing tourists to make their own enclosures crafted in a traditional sense or instruct pottery making.

Sailing Events around the Bay

John Hanson, Jr., Maine Boats, Homes & Harbors Magazine

Sailing events around the Bay include the Eggemoggin Reach Regatta, Camden Classics Cup, Penobscot PHRF; also the Atlantic Challenge Rowing Competition and a highly developed lobster boat racing scene.

The interaction with lobster fishing is traditionally bad. Traditional boats will go over the lobster traps because the rudders are not as deep. The newer boats get stuck on lobster traps because they get tangled up. This is a big problem with getting yachts into the area because of the volume of lobster traps.

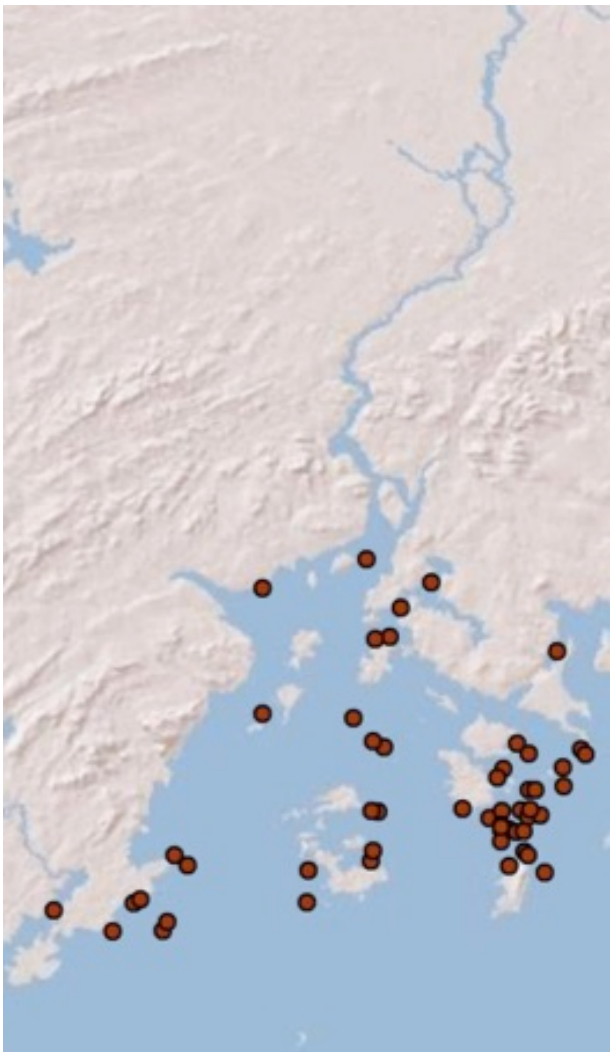
Sail travel to Bangor is challenging due to winds and currents.

Recreation in the Watershed, Part II: Envisioning a Penobscot River Trail hosted by Natalie Springuel, Maine Sea Grant

Panel Discussion

Brian Marcaurelle, Program Director of Maine Island Trail Association; James Eric Francis, Jr. and Jason Pardilla, Penobscot Nation

Marcaurelle reflected on the Maine Island Trail Association's nearly 30 years of experience in managing Maine's first formal recreational water trail. From formation to management to sustainability, he described the opportunities and potential pitfalls of water trail management in Maine. The mission of the Maine Island Trail Association is to establish a model of thoughtful use and volunteer stewardship for the Maine islands that will assure their conservation in a natural state while providing an exceptional recreational asset that is maintained and cared for by the people who use it. With more than 5,500 members and a budget of $700,000, the organization focuses on education, stewardship, and promoting access. A water trail for mostly sea kayaks (60% kayak, app. 40% power boaters). The Maine Island Trail started in 1987. There are now 217 sites from Kittery to Eastport; 160 sites are on islands. Open for day use, often near hiking, approximately half are open to camping. There is value in a water trail: our economic impact is almost $2,000,000 annually.



Francis and Pardilla contributed their experience with the Thoreau-Wabanaki Trail. They are now focusing on a Sugar Island trip, with lean-tos and traditional villages being reconstructed on the island. Last year 30 people visited the island in 19 boats. Another Thoreau-based trip is on Moosehead Lake.

Campsites/campgrounds/lodging are needed along the river (below Medway).

Need to form relationships with other trail organizations (Ice Age Trail, Mahoosuc Guides, Maine Lakes Society) and take a watershed perspective.

Nationally people want “packaged trips” that make these kinds of trips more user friendly.

Book recommendations: *Paddle to the Sea, Voice from the River, Bear and Weasel.*

A contact list was circulated for a group of interested persons to organize to further explore the idea of a Penobscot River Trail.

Partnership with the Penobscot Nation and tribal approval for a Penobscot River Trail or related camping is expected.

Collaborations in the Penobscot River Watershed

Theme Purpose: To examine the role of collaboration in achieving fish restoration and other conservation goals, both within and outside the Penobscot River watershed. These sessions examined the challenges of addressing environmental objectives, while respecting cultural, economic and community-based needs. Partnerships, funding and strategies were described, with a view toward future applications. The prospects of working at a watershed scale were discussed, as it relates to future collaborative efforts in the Penobscot watershed.

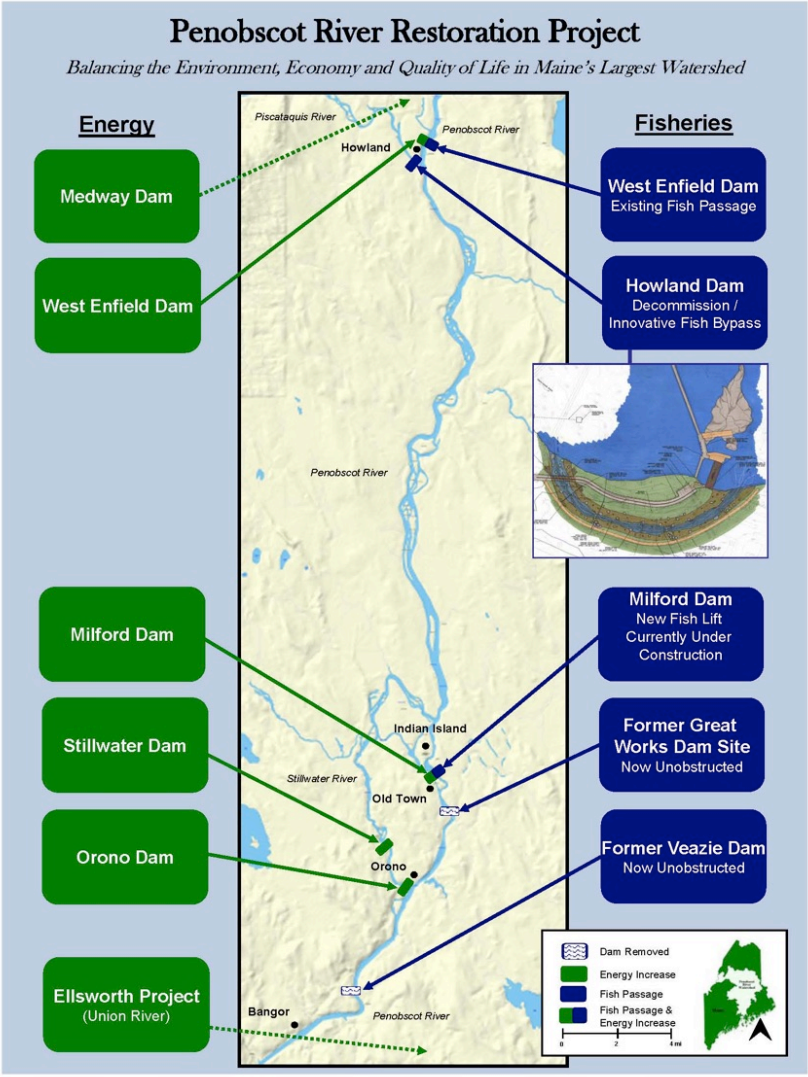
Collaborations: Restoring Fishery Health, Projects Big & Small

hosted by Gorden Russell, Lower Penobscot Watershed Coalition

Penobscot River Restoration Project

Laura Rose Day, Executive Director, Penobscot River Restoration Trust

The Penobscot River Restoration Project is one of the largest, most creative river restoration projects in our nation's history. In an unprecedented collaboration, hydropower company PPL Corporation, the Penobscot Indian Nation, six conservation groups, and state and federal agencies, are working together to restore sea-run fish to the Penobscot River, while maintaining energy production. Successful implementation of the project will revive not only native fisheries but social, cultural and economic traditions of New England's second largest river- the Penobscot. Fully implemented, the project will significantly improve access to nearly 1,000 miles of historic habitat for 11 species of native sea-run fish that were once the backbone of a robust ecosystem.



Motivated by a 1990s-era victory to stop further hydroelectric development on the Penobscot, restoration interests seized the opportunity for a watershed approach to save struggling fisheries. Catalyzed by deregulation and a new single owner of all the lower river dams, bolstered by the ESA, FPB, FERC process and other regulations, the sides sought compromise over disagreement, risk and uncertainty.

The Great Works Dam at Old Town and Bradley was removed in 2012; Veazie in 2013; and a nature-like bypass channel constructed around the Howland Dam in 2016. Milford dam is the first dam on the river. The dam continues to produce power and has been fitted with state of the art fish passage. There will be little to no change in the river at Milford Dam.

Take Home Messages:

- Seek out opportunity not opposition
- Stay at the table… compromise can happen
- Know your geography; regulatory structure
- Think big… ecosystem approach
- Think outside the box – be creative
- Partnership is key
- Private – public funding and support critical - ~ 50/50
- Work with communities
- Persistence and grit
- THEN… Win-Win-Win restoration can happen

Fish Passage Projects on Penobscot Tributaries

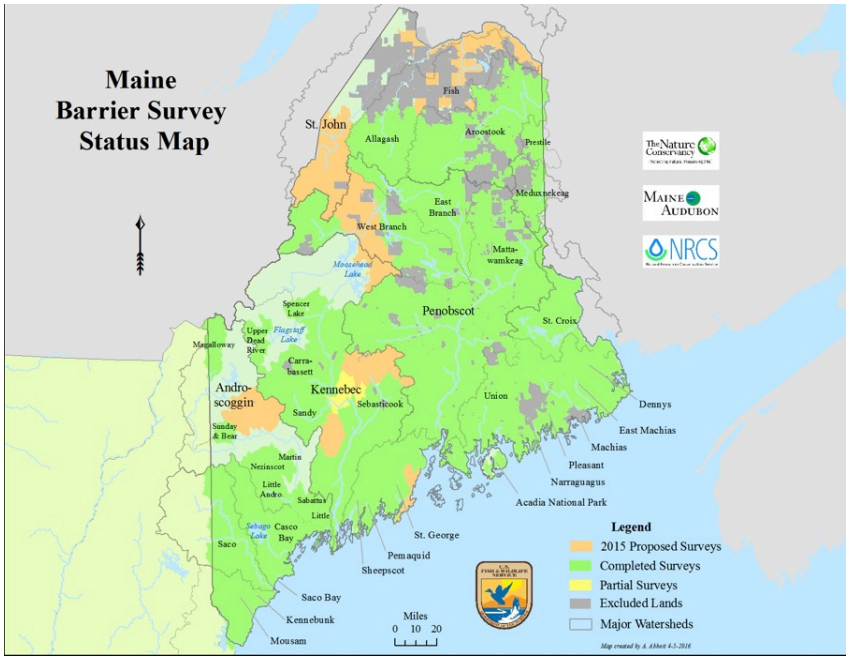
Alex Abbott, GIS & Fish Passage Specialist, US Fish and Wildlife Service

Improving connectivity by replacing inadequate stream crossings is an essential element of ecological and infrastructure resiliency and restoration in the Penobscot watershed. Yet, broad scale restoration and individual projects require collaboration from a wide variety of partners. The Penobscot is benefiting from a large group of federal, state, tribal and local government agencies, and non-governmental organizations able to create flexible, productive partnerships on projects large and small.

We have traditionally focused lots of restoration effort on dams in Maine – with great results. Most of our dams are small and very few allow fish passage. Large or small, they have been the target of much restoration work. Yet the efforts have grown in recent years to focus attention and energy on the thousands of stream crossings fragmenting streams across Maine—they disconnect and disrupt our streams and the aquatic habitats they provide.

Maine has many residents that need to move in or along streams, and which are affected by stream barriers. Resident critters include invertebrates, amphibians, mammals and economically important gamefish such as Eastern brook trout. Longer distance migrants like sea-run fish have felt devastating effects when prevented from reaching spawning and rearing habitat. Ten years ago a group of folks in Maine started looking into the incidence and effects of all stream barriers, particularly stream crossings. We developed methods, and started training people and sending them out to gather data. We've since upgraded the way we collect data, incorporating iPads to gather data digitally, including built-in cameras and GPS. And after nine years of surveys, we have lots of data with which to make important conclusions about the extent and effects of barriers. We have assessed more of our stream crossings relative to our size than any other state in the nation. A large number of sites in some watersheds have not been surveyed because we haven't been able to get access from some landowners. An even larger number of crossings are really great; they are mostly bridges that seem at least to pass fish very well. But, it is clear that well over half of the crossings in any watershed have undersized culverts that limit or completely block passage of nearly all species. Around 40% of culverts are barriers to all species and age classes at nearly all times, and another 40-50% are likely barriers for some species or age classes at some times.

Back in 2009, we realized that the magnitude of restoration needs warranted a more coordinated and comprehensive approach. So, we created the Maine Stream Connectivity Work Group. Since then, the Connectivity Work Group has provided a forum for 25 organizations working to make progress on stream restoration in Maine. Specifically, the Connectivity Work Group's mandate is to increase the pace of stream restoration in Maine. We try to achieve that by raising public awareness of restoration needs, particularly at stream crossings, and by mobilizing road owners to become restoration partners. Maine Audubon's Stream-Smart Training has been guided by the Connectivity Work Group to focus on three levels or phases of information: Phase I introduces the fundamental concepts of better crossings; Phase II presents stream survey technique important to designing better crossings; and Phase III trains outreach specialists to interpret and convey details about crossing issues and aquatic habitats to road owners. New crossing types include concrete open bottom arch culverts on pre-cast footing blocks, more complex GRS (geo-reinforced soil) bridges, and not-so-new, simple bridges, based not on new technology, but on NEW ways of assessing, analyzing and designing BETTER crossings. To have these relatively new stream restoration techniques used broadly, we need more professionals trained in their application. Some towns have failing undersized culverts on beautiful brook trout, salmon and alewife streams, and they want very much to fix them the right way. Often, by combining efforts over several years, fish passage and stream connectivity can be accomplished together. Plenty of private landowners also want to improve the connectivity of their streams. Thankfully, Maine voters approved in 2014 a bond act to fund improvements to stream crossings to protect public safety, to improve aquatic habitat connectivity, and to allow for resiliency in the face of more frequent and intense storms.



Funding opportunities and tools: The Habitat Blueprint

Matthew Bernier, Civil Engineer, ERT Contractor/NOAA Fisheries

In 2014, as part of the National Oceanic and Atmospheric Administration's Habitat Blueprint initiative, the Penobscot River watershed was selected as one of only ten Habitat Focus Areas (HFA) in the United States. The Habitat Blueprint represents an opportunity for further large scale restoration, building off the successful removal of the two lowermost dams on the Penobscot River. The Blueprint is a framework for NOAA to work strategically across programs and with partners to protect and restore habitat. A Habitat Focus Area is a priority geographic area where the Habitat Blueprint is implemented – a place where NOAA's various programs cooperatively work together to leverage each other's resources and expertise to achieve regional goals. The goals of the Penobscot Habitat Focus Area are 1. Restore multiple diadromous species including river herring, rainbow smelt and ESA listed species (i.e., Atlantic salmon, Atlantic sturgeon and shortnose sturgeon); 2. Improve the prey base for multiple offshore species including Gulf of Maine groundfish to support recreational, commercial and sustenance fishing; 3. Increase the quantity and quality of accessible habitat in the watershed; 4. Promote habitat restoration that results in indirect benefits to water quality, watershed-based recreation and the resiliency of coastal communities; 5. Increase collaboration across NOAA to meet the needs of constituents for products and information. Initial funding supported planning and restoration projects by The Nature Conservancy, and communications and outreach assistance from Maine Sea Grant.

A three-part strategy focuses on lower river habitat, alewife lakes, and headwaters. Many barriers remain in watershed (108 non-hydro dams, 31 FERC dams, ~2,100 culverts). The Nature Conservancy is developing an online barrier prioritization tool: expansion of the Maine Stream Habitat Viewer for identifying, prioritizing, reviewing and tracking restoration projects. The State of Maine *Operational Plan for the Restoration of Diadromous Fishes to the Penobscot River* (2009) identified 56 "Phase 1, 2 and 3" alewife lakes and ponds covering 74,605 acres (17.5 million adults at 235 adults/acre).

Upcoming funding opportunities include the NOAA Community Based Restoration Program, NOAA Coastal Ecosystem Resiliency Grants Program, and NOAA Atlantic Salmon Federal Funding Opportunity. Funding advice:

- Start conversations early! Many good projects take years to find funding and be implemented.
- Keep in mind that most projects follow a logical path: Feasibility study → preliminary design → final design → permitting → construction → monitoring.
- Team with multiple organizations and have an enthusiastic project manager!
- Do your homework! Look at the big picture and make the linkages to fish, habitat and ecosystems.

Discussion points: The Penobscot River Restoration Project has ended, but the restoration of the Penobscot is just beginning. There is much work still be done, carried out by partners, building on the legacy of a successful project that is serving as a national/international example. People should feel great about how this region is a leader in river restoration.

Collaborations: Lessons from Outside the Watershed

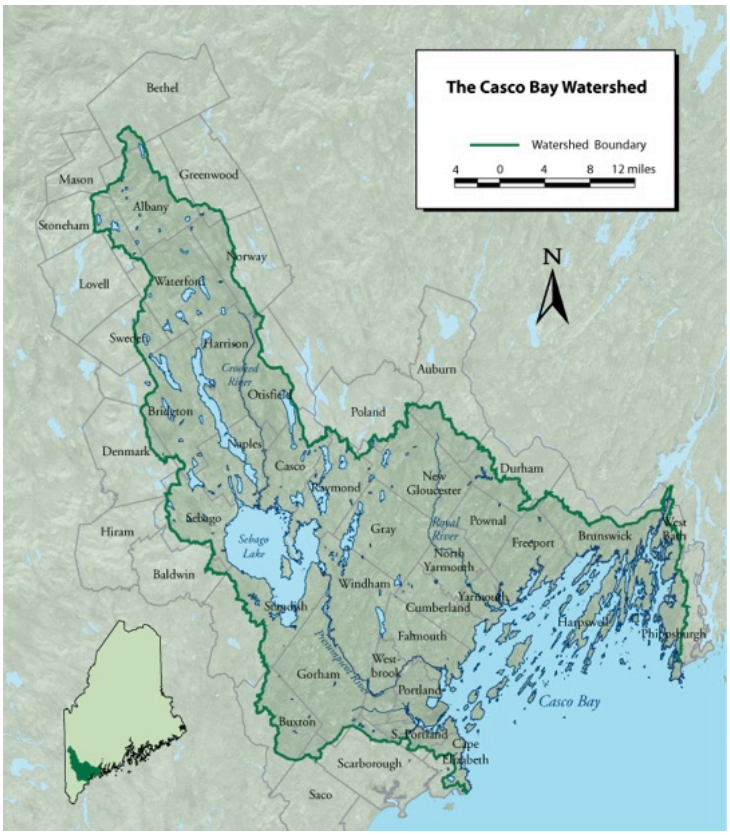
hosted by Nick Battista, Island Institute

Collaboration and the Casco Bay Plan

Curtis Bohlen, Director, Casco Bay Estuary Partnership

The Casco Bay Estuary Partnership (CBEP) is one of 28 National Estuary Programs. Locally led, principally federally funded, the Partnership provides financial, technical and other support to local efforts on behalf of Casco Bay, and is hosted by USM's Muskie School. We strive to be science based, watershed focused, locally led, and collaborative. The health of the oceans, and especially Maine's enclosed and semi-enclosed bays depends on what we do on land, so a majority of our work focuses on what happens in the Casco Bay watershed. The Casco Bay Watershed contains:

- 985 square miles
- 42 municipalities
- About 200 square miles of water
- More than 575 miles of shoreline;
- 785 islands, islets, and ledges;
- 3% of Maine's land area, but 17% of the state population.



The core components of a National Estuary Program include a locally developed Plan, a local management structure that pulls together key organizations and agencies to identify priorities and work together to solve them. National Estuary Programs are also required to report periodically on the condition of the waters they work to protect. CBEP prepared a State of the Bay report in 2015.

CBEP has recently completed an updated strategic plan for Casco Bay. The new Casco Bay Plan took nearly two years to complete. The process involved more than 10 formal stakeholder meetings, close to 50 on-on0-one interviews, dozens of committee and planning group meetings, and more than 250 participants. The plan identifies four priority areas: habitat, nutrients and water quality, communities, and collaboration.

Already, we see the benefits of a strong strategic plan both for guiding the work of CBEP's staff, but also for helping pull in collaborators. More generally, there is a broader awareness not only of what we are doing, but also of what many groups who contribute to accomplishing the goals of the Plan are doing. We are beginning to see greater clarity in use of resources, and finding that with a clear statement of priorities, new resources are being brought to bear to address those priorities.

The York River Initiative

Paul Dest, Director, Wells National Estuarine Research Reserve

A coalition of residents called the Friends of the York River worked to get a bill passed through the U.S. Congress to fund a National Park Service Wild and Scenic Rivers Study of the York River. It would be the U.S. designated scenic river established through a partnership of the communities and the Park Service. The first phase, a three-year study by a Study Committee that includes representatives from each of the four communities in the York River watershed. Phase two is a proposed designation that towns and the National Park Service must approve.

A Pacific Perspective

Jim McIsaac, BC Commercial Fishing Caucus

This discussion is about fisheries, arguably the most sustainable food source on our planet: we don't have to water or feed them, till the seabed, add fertilizer or pesticides, we just have to harvest sustainably. As the most sustainable food source fisheries are very important for food security, our families, communities and future generations. I grew up fishing the BC coast from Juan de Fuca to Portland Canal. I've grown to appreciate the diversity of the coastal communities, the people, the ecosystems, and the passion folks bring to protecting our coast.

I want to talk about fisheries, ocean governance, jobs, food and certainly the future. Science fiction writer William Gibson say the future is here, it's just not evenly distributed. Three billion people worldwide rely on protein from an ocean that is rapidly changing: warming temperatures, dropping pH, restructuring food web, evolving novel ecosystems. Our senior governments are certainly aware of the pressures. British Columbia's 2009 Coastal Strategy recognizes that coastal communities north of Campbell River are facing amongst the worst economic hardship in the province. Elements of BC's 2009 Coastal Strategy are:

- Growing and greening our ocean and coastal economy.
- Ensuring that BC's marine fisheries are a significant part of coastal BC economies.
- Protecting the health of our ocean and the benefits it provides.
- Creating a foundation for health and prosperity by planning collaboratively.

Many of the pressures on the ocean are global—climate change, user conflict, sustainable development. The Canadian Ocean Act is supposed to govern sustainable development in our EEZ, managed for the benefit of all Canadians especially for adjacent coastal communities. The strategy is to integrate ecosystem-based management across all sectors.

Fisheries policy matters to rural coastal communities. We have vastly different policies in Pacific Canada than in Atlantic Canada, where small boat commercial fishing is the largest private sector employer. We are expanding understanding about less tangible benefits known as Cultural Ecosystem Services (CES) the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience including, e.g., knowledge systems, social systems and aesthetic values.

One key example the seems to be working well: West Coast Aquatic (WCA) on the West coast of Vancouver Island created Canada's first co-management board under the Oceans Act. WCA has four levels of government and ten marine sectors, working together with a unique shared decision-making model that increases value and decreases risk by ensuring industry is an equal partner in the process and has the ability to influence decisions, work, and funding. WCA developed a unique Coastal Strategy by consensus; all governments and stakeholders have endorsed the Strategy - a first on our coast. This Strategy increases value and decreases risk by:

a) ensuring that current law and policy is reflected;

b) industry goals and objectives are captured;

c) focusing on the most important issues and areas rather than trying to do everything or focusing on things that are of little value.

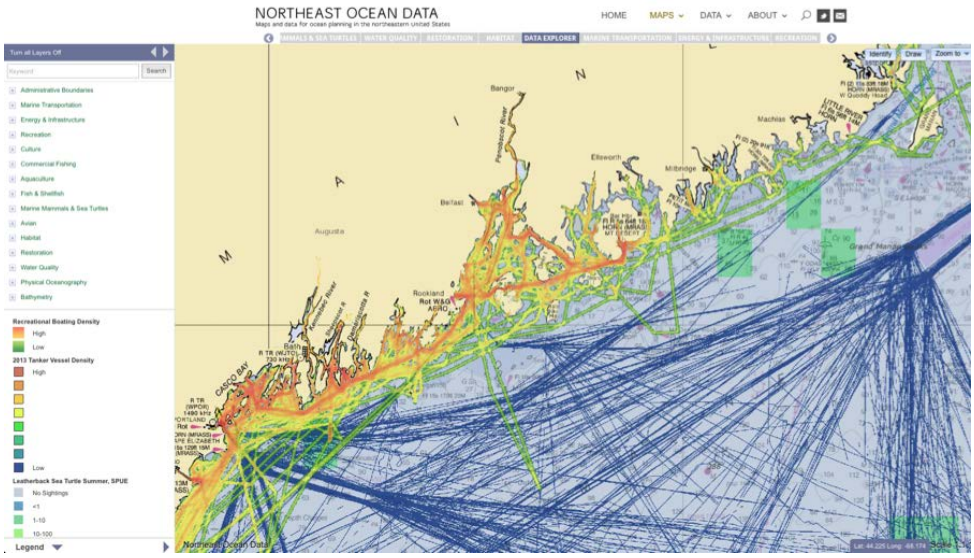
What WCA has found is that governance is key: good process leads to good results, less time, money, and frustration are used.

A vision for the future: the National Ocean Policy Northeast Regional Ocean Plan

Rebecca Clark Uchenna, Island Institute

What does it mean to have a healthy ocean? A healthy ocean may mean something different to each person in this room, but we all want one. It is what everyone strives for. But WHY? WHY do we care about the ocean? WHAT do we care about? Why do we want them to be healthy and productive? WHY healthy oceans? We RECREATE there. We LIVE there. We find PEACE and SERENITY there. We gain our LIVELIHOODS from the ocean.

The National Ocean Policy is a vision for future conservation and management for healthy oceans based on collaboration, stewardship and ecosystem-based management. At its core the NOP is about healthy oceans. It emphasizes collaborations between federal agencies that have EXISTING management responsibilities over our ocean, and seeks to identify the most pressing issues of our day and find ways to collaboratively solve them. The plan establishes voluntary regional partnerships between the federal, state and tribal governments to plan for those issues specific to their place/region together/collaboratively to reduce user conflict and increase stakeholder engagement and proactive management opportunities. The NOP was established in 2010, and is the culmination of a decade of research, outreach, stakeholder engagement and recommendations. To understand the NOP we must first look at how it came into being.



Executive Order 13547 (July 19, 2010) is a framework or umbrella under which our federal executive agencies employ a national stewardship policy, through the National Ocean Council (coordinating body), priority objectives (substance), and coastal and marine spatial planning (framework/process). The Northeast has one of five Regional Planning Bodies, a formalization of existing planning efforts at a new scale. The non-regulatory Body is charged with considering the current status of ocean and activities (commercial fishing, recreation, energy, navigation, cultural resources, conservation, aquaculture, defense, science, etc.), explore how that is changing and how we can do a better job managing for that change. A draft Regional Ocean Plan will be released in May, with data available at ***northeastoceandata.org***.

Discussion points:

- Successful collaborations tend to have an "anchor organization" that can help with grant writing, etc., yet each organization is made up of individuals and has its own culture. Local networks can collaborate with larger organizations in this way. The key is to identify shared goals and try to understand each other. Identify local needs and values, then address local vulnerability.
- Local, collaborative decision-making takes precedent above federal funding/support for projects. Is the federal government a motivator or barrier? "The government" is made up of many humans, each within their own agencies with individual cultures. To collaborate successfully, look for opportunities to minimize restrictions on the issues and people involved, while maximizing the value of the government programs. Yes, there is bureaucracy, but the government also offers a wealth of resources to projects. As long as the agency has a desire to understand what it's like to work in local communities, there's room to work together. Also understand what it's like to work for a federal agency in DC, because there's a lot of mistrust and it's very stressful.
- Collaboration at a watershed scale requires a focus on the resource shared in common–the river and the watershed, fundamental needs not being met. Maintaining such a focus over time is the challenge, and requires funding as well as volunteers and a steady stream of new people getting involved. It's also okay to change focus, to stay relevant; go where the energy is, but be clear about your purpose. Achieving goals also becomes motivation for more success.

Collaborations: Connecting Bay and Headwaters

hosted by Joshua Royte, The Nature Conservancy

"If we bring the appropriate people together in constructive ways with good information, we can create an authentic future vision and sustainable responses to issues and opportunities within our communities and organizations." -- David Chrislip

Introduction

The Penobscot River Restoration Project has brought The Nature Conservancy into many collaborations that grew from our inclusion in the Penobscot River Restoration Trust's precedent-setting inter-and intra-agency collaboration, presented by Laura Rose Day, the Trust's director. While the Conservancy has been known globally for predominantly land protection which included lakes and streams, the Penobscot opened our eyes to the need for connecting Maine's forests to our rivers and those rivers to the ocean for a wealth of ecosystem processes for migratory fish and human communities all along the way. The Penobscot Project led the Conservancy to develop a Conservation Action Plan (CAP) with knowledgeable partners from Trout Unlimited, Maine DMR, I&FW, and USFWS and NOAA. Through the CAP process, we realized what many folks already understood: that there were other larger challenges and opportunities for connective rivers and ponds to the ocean. There were in fact many people around the state interested in addressing the same threat with various strategies. There are many collaborations, some of them quite large, to increase land protection and restoration of aquatic networks up and down the Penobscot River's *and* Bay's watershed, including partnerships to increase the sustainability of fisheries in the associated Gulf of Maine. These outcomes of these collaborations further influence conservation and restoration strategies around the state which benefit from work initiated in the Penobscot. Those lessons are shared nationally and globally. The many collaborative efforts that developed around this river and watershed have brought many diverse parties together to solve complex problems while finding balance among terrestrial, riverine, and marine ecosystems, while not forgetting the energy needs and the communities that love and prosper from all of these healthier connections.

For river restoration efforts alone we have multiple distinct although occasionally overlapping collaborations listed below which do the following;

a) collect meticulous data, statewide, on aquatic habitat and potential stream barriers;
b) prioritize restoration work in places with the most or highest quality gains for ecosystems and community infrastructure;
c) educate contractors, planners, and restoration practitioners about the problem with most road-stream crossings, how to fix them and who can help;
d) convene forest land owners together to learn together how to solve their unique road-stream crossing problems;
e) bring regulators, biologists, towns and state roads people together to also learn together about the issues and help find and implement solutions;
f) gather restoration practitioners from NGO's, state and federal agencies to find solutions for specific projects that are being implemented;
g) encourage partner groups around the Penobscot, around the state and around the world to raise awareness about fish passage issues and solutions;
h) developed a state Water Bond and the support to pass it at the polls to provide $5.5 million to create jobs while helping towns with culvert upgrades.

The speakers in this session addressed collaborations we can all learn from. These extend from Ian's work among the mountains of the greater Camden and Ducktrap region, to Anne's work in the marine realm and the communities that depend on the lands from Penobscot Bay to Eastport, and Ben's work with restoration practitioners around the state with a strong emphasis on restoring stream connectivity around the Penobscot Basin.

Panel discussion

Ben Naumann, USDA Natural Resources Conservation Service

We are using a cooperative, voluntary approach to restore stream connectivity, and providing financial assistance. Stream-smart crossings allow critters to pass through naturally, and facilitates safe passage for humans.

Ian Stewart, Coastal Mountains Land Trust

Ducktrap Watershed Coalition: Ten organizations came together (now up to 26), gathered data, developed a strategy map, targeted conservation efforts for a buffer along the mainstem and the three tributaries. To date, 83% of the river has been conserved – largest amount of conserved watershed of any salmon river in Maine.

Bald & Ragged Mountains project represents a huge recreational asset for the community, but needed a much broader coalition – mountain biking groups, hospital, trail running groups, high school, etc.

Anne Hayden, Manomet

The mission for the Downeast Fisheries Partnership is that communities in eastern Maine can sustain themselves through fishing, forever. The Downeast Fisheries Partnership is an example of a network, which allows the partners to focus on the mission and not the organization, focus on building trust and not on control. But networks can also be difficult to fund and keep energized (as the Lower Penobscot Watershed Coalition has found), although there is value in information exchange.

Challenge is how to think at a watershed scale, yet not interfere with local planning driven by local values that takes its own direction, shape and form.

Have conversations with people you don't normally talk to, about things that you don't normally talk about.

Governance & Policy Issues

Mitigating and Coping with Climate Change hosted by Lisa Pohlmann, Executive Director, Natural Resources Council of Maine

Reducing CO2 emissions through the Clean Power Plan and state programs

Dylan Voorhees, Clean Energy Director, Natural Resources Council of Maine

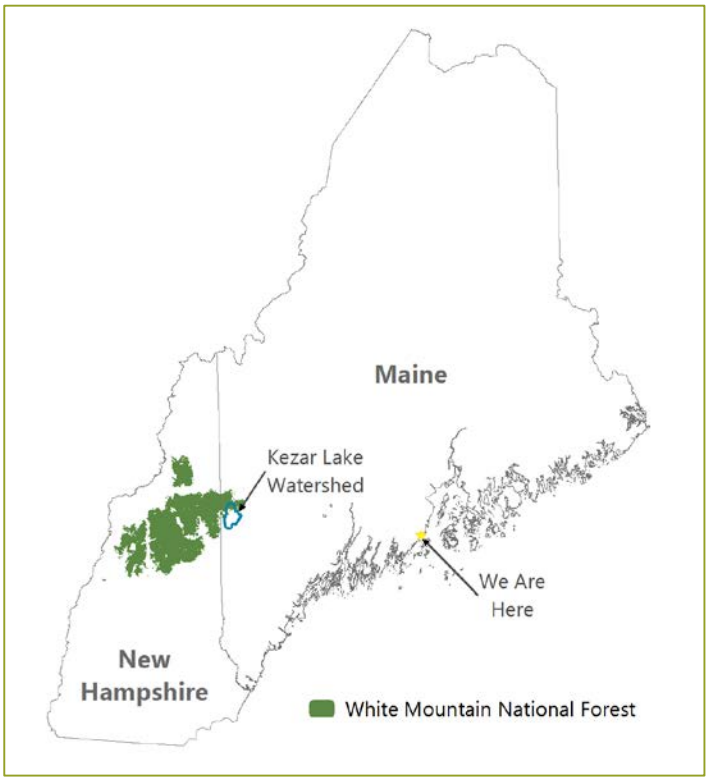
Maine has numerous opportunities to address climate change and advance a clean energy economy through local, state, regional, and federal initiatives. In particular, Maine's participation in a regional climate initiative is a foundation for national and international progress on climate change.

Several innovative options and loans are available for residential solar. You need to qualify with a credit check and most loans are for about 10 years, but they are available and affordable. Net metering is also a way to help implement solar technologies. Maine has "lagged" behind other states in terms of implementing solar technology because of the lack of offering incentives. Without incentives, it may not be economic to implement solar. There are also programs that allow homeowners and businesses to lease solar panels. These are great, but policy needs to follow to make a difference. Other opportunities exist for municipalities and schools, as well as other buildings (i.e. Fire Stations). Solar panels can be implemented in virtually every place, even landfills. Currently, the economic challenges for installing solar are very challenging. However, at the small/local level (micro level), solar can be implemented and is a benefit to rate payers.

Kezar Lake: climate change monitoring and municipal action in a rural Maine lake community

Forrest Bell, FB Environmental

Kezar Lake provides a case study for regional efforts motivated by expected climate change. Local climate monitoring stations (e.g., North Conway, NH) show patterns of increasing extreme precipitation events (more than one inch of rainfall in a four-day period), episodic low-pH events, a longer ice-free period, and a decrease of 25 inches of snowfall since 1959. These patterns have implications for water quality in the watershed, particularly pH, which is a strong regulator of ecosystem health. Kezar Lake has a 56-square-mile watershed, one-quarter of which lies within White Mountain National Forest. The lake is nine miles long with three main basins. Water is clear and cold. Kezar Lake Watershed Association took action in 2013 to establish a Climate Change Observatory (CCO) based on sound science, but also local interests and values (water quality, recreation, land and wildlife, collected via a community forum). Funding sources include Manomet, UMaine Climate Change Institute, US Forest Service, Plymouth State University, and Greater Lovell Land Trust. The Observatory's mission is to observe, measure, and analyze climate data, address climate change impacts on water, land and wildlife, develop standards for data collection and analysis, and produce a template or model that can be exported. To date we have produced a website, annual report, lake ice analysis, water quality monitoring, lake level monitoring, 221 culvert assessments, and brook trout studies.



Recommendations from the Legislative Committee on Ocean Acidification

Richard Nelson, Lobsterman and Captain, F/V Pescadero

There are troubling signs in the fishing industry lobster: shell disease and stock collapse in Long Island Sound and Southern New England, warming waters, extreme weather events, loss of oysters and scallops in aquaculture settings, and non-productive clam flats, leading to the advent of the term "multiple stressors." Ocean acidification (OA) is an unwelcome addition to these stressors. We have known that the ocean is a major carbon sink, but now seek answers to how and what is going on, and its effects on the ecosystem. What is the extent of OA's effect on the ocean at large and the species that are commercial valuable to the State of Maine? Inquiring minds wanted to know. In recognition of the uniqueness of the Gulf and vulnerability of our marine economy, the legislature formed the Commission to Study the Effects of Coastal and Ocean Acidification and its Existing and Potential Effects on Species that Are Commercially Harvested and Grown along the Maine Coast. The Commission's report includes the state of the science, research and monitoring priorities, goals and recommendations, and proposed legislation: Ongoing Council LD 493 voted not to pass but with support from Marine Resources Committee and agencies (DMR, DEP, DACF) to continue with the volunteer Maine Ocean and Coastal Acidification (MOCA) Partnership; Research and Monitoring Bond proposal; LD 998.

To view an animated video of ocean acidification by Maine-based O'Chang Studios, visit
youtube.com/watch?v=ZimEBFw1Q7c

The Ocean Acidification Commission report can be found at ***maine.gov/legis/opla/Oceanacidificationreport.pdf***

Confronting Holtrachem's Toxic Legacy: Mercury Contamination in the Penobscot Estuary hosted by Nick Bennett, Natural Resources Council of Maine

Legal efforts to clean up mercury contamination in the Penobscot Estuary

Mitch Bernard, Chief Operating Officer, and Jared Thompson, Natural Resources Defense Council

A citizen suit was brought against Mallinckrodt by Maine People's Alliance and NRDC concerning mercury contamination in the Penobscot estuary.

Mercury contamination in the Penobscot Estuary

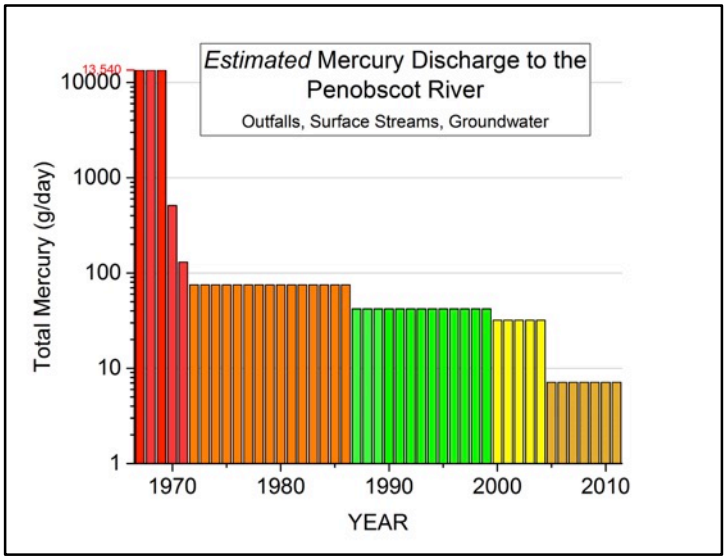
Dianne Kopec, Research Biologist, Penobscot River Mercury Study

Key findings from the nine-year Penobscot River Mercury Study include mercury sources and cycling in the environment, the load of mercury discharged by HoltraChem in the lower Penobscot, mercury accumulations in river and marsh sediment and estimates of the time until natural recovery, mercury biomagnification in the food web, and the concentrations and consequences of mercury in wintering ducks, breeding marsh birds, fish and lobster.

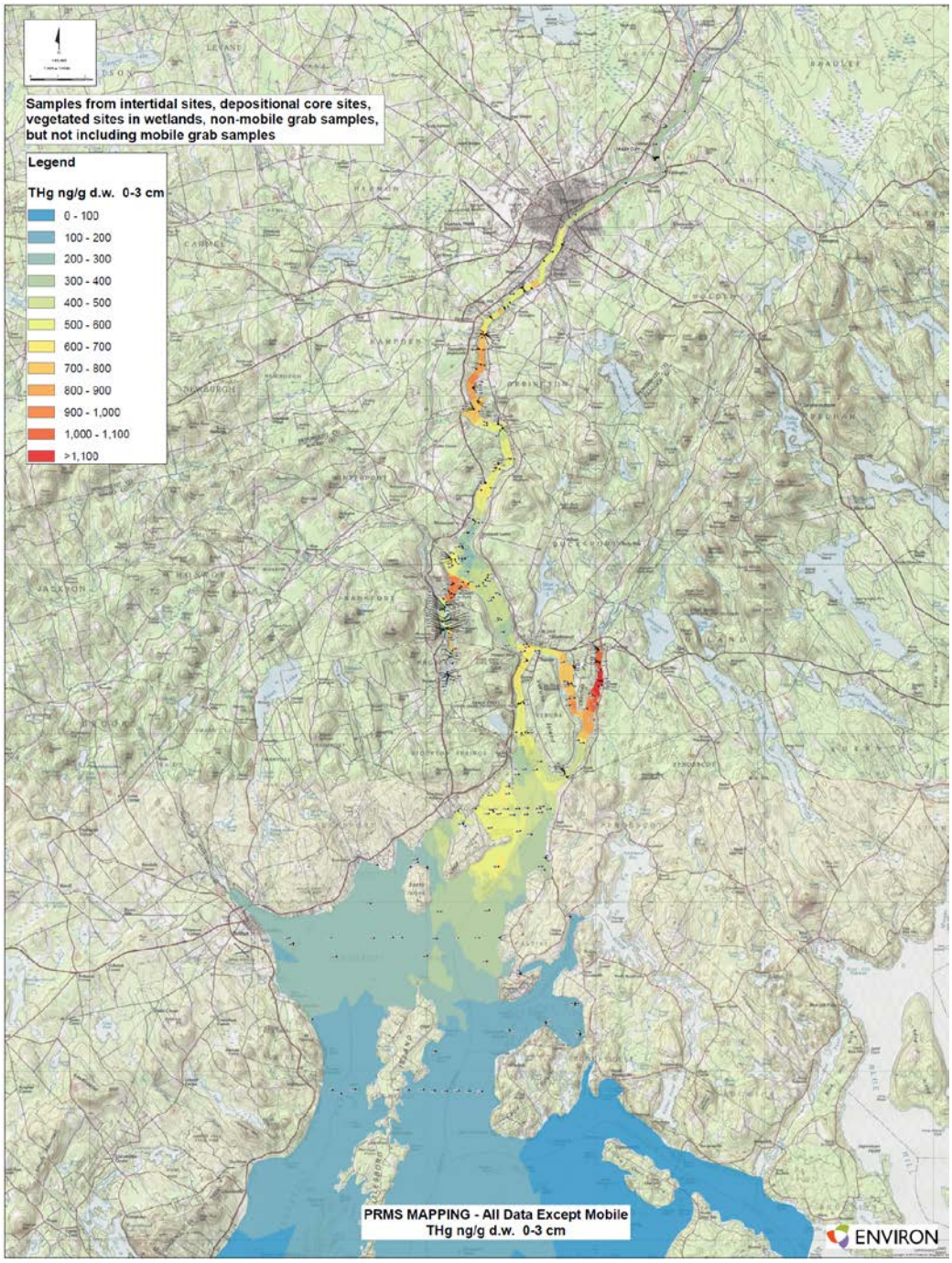
- 1967-1970: unrestricted discharge of mercury into the river
- 1971-1972: discharges came under state and federal control
- 1973-2000: permitted and accidental discharges of Hg into the river
- 2000-2010…today? still the greatest mercury source in the Penobscot watershed.

Total mercury discharge is estimated between six and 12 tons.

Mercury in the sediment below Veazie is five times that above the former dam site. In marsh sediments below Orrington, mercury is eight to 15 times greater than "background." Natural recovery will take a minimum of 100 years. The marshes of the estuary are production zones for methylmercury, the form that bio-accumulates and moves through the food web. Elevated levels of methylmercury occur in American black ducks, Nelson's sparrow, red-winged blackbirds, rainbow smelt, American lobster.



In September 2015, US District Court Judge Woodcock ruled that remediation would occur and be paid for by the responsible party, Mallinckrodt (the sole surviving former owner of the plant). The court will retain control of the work, to be performed by Amec Foster Wheeler. Long-term monitoring will also resume in 2016.



Discussion points:

- The remediation plan intends to avoid causing any further problems. It is not an academic exercise, but to give real information about how to reduce mercury in ecosystem, the sources of mercury, and concentrations in food species (not a human health study). The data and reports are available on the DEP website.
- What about dredging? Any time dredging takes place it can possibly disturb buried sediment it is important to avoid resuspension. There have been large advances in the process of dredging over the years. The engineering firm has been charged with finding the best remedy and looking at whether or not there is the risk of making things worse. Mercury buried at depth may not stay there forever, slough channels at low tide can reach/expose layers of contamination and will shift over time.

Opportunities for a Healthier Watershed: Penobscot Nation Issues hosted by John Banks, Penobscot Nation

Panel Discussion

Daniel Kusnierz, Water Resources Program Manager, Penobscot Nation

Sherri Mitchell, Indigenous Rights Attorney/Land Peace Foundation

Michael Stover, Indian Program Manager, US Environmental Protection Agency

Comments from Michael Stover

The cornerstone of EPA's relationship with the Penobscot Nation, as well as all of the federally-recognized tribal nations across the country is our trust responsibility to the tribes. The US government's trust responsibility is a well-established legal obligation that originates from the unique, historical relationship between the United States and Indian tribes.

One of EPA's authorities granted by Congress resides in the Clean Water Act, which establishes the national goal that water quality should provide for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water.

Under the Act, if a state has been delegated the authority to administer a water quality standards (WQS) program, it is generally the state's role to establish WQS for waters under their jurisdiction that protect these goals, including designated uses and criteria to protect the uses. It is EPA's role to approve or disapprove a state's water quality standards, and to promulgate standards if necessary to remedy any disapprovals.

Until 2015, EPA had never approved any Maine WQS for waters in Indian lands. In 2014, the state of Maine sued EPA to make approval or disapproval decisions on all backlogged WQS. In response to this suit, EPA analyzed relevant federal and state statutes, including the Maine Indian Claims Settlement Act, addressing the state of Maine and the four federally recognized Indian tribes located in Maine. In a February 2015 decision, EPA concluded that the statutes grant Maine the authority to establish WQS for waters in Indian lands. This is a very unusual and unique jurisdictional arrangement – typically, states do not exercise Clean Water Act jurisdiction over Indian reservation waters.

In its February 2015 decision, EPA also concluded that the applicable settlement statutes provide for tribal sustenance fishing and that such sustenance fishing constituted a designated use for waters in Indian lands and waters outside of Indian lands that are subject to sustenance fishing rights.

In this February 2015 decision, as well as subsequent decisions, EPA ultimately approved the majority of the State's WQS for waters in Indian lands. EPA did disapprove certain state human health criteria designed to protect public health because they were not based on the best available evidence of a fish consumption rate that represented a tribal sustenance use of their waters, a use which is provided for by both state and federal law.

In each of the decisions EPA issued to address the State's WQS involved in Maine's suit against the Agency, EPA made it clear that it is the Agency's strong preference that the State take the lead in developing a response to EPA's disapprovals. The EPA is currently under litigation with the State of Maine involving our decisions regarding water quality standards in waters on Indian lands.

The CWA imposes on EPA an obligation to promptly propose federal WQS if a state has not revised its WQS to address an EPA disapproval within 90 days following that disapproval. Since issuing the disapprovals, EPA has continued to express to the State EPA's preference that the State take the lead in developing protective standards, and to date, the EPA has not received proposed standards from the State to address the disapprovals. Therefore, EPA is continuing the process of proposing federal WQS to address these disapprovals and fulfill its statutory duty.

Water quality of the Penobscot River has been and will continue to be a major priority for EPA, as we strive to work with the State and the Penobscot Nation in setting protective water quality standards for a healthier Penobscot River watershed for the benefit of all.

Comments from Daniel Kusnierz and Sherri Mitchell

The State of Maine and the Penobscot Nation differ in their interpretations of the 1980 Indian Claims Settlement Act.

The Tribe has been frustrated at their inability to protect water. The State of Maine continued to permit discharges in spite of PIN requests to stop. In response, the Tribe decided to develop their own water quality standards that would minimize degradation and provide for drinking water, cultural or ceremonial uses, aquatic life support and wildlife habitat, cold-water fisheries, and sustenance fishing.

Recent rulings in Penobscot Nation v. Mills separated the river from the people and isolated the tribe from the islands, disregarding 9,000 years of history and past recognitions of tribal sovereignty. While some have tried to cast this lawsuit as a water quality or water access or economics issue, it is a territorial taking case. Maine's previous state Attorney General recognized the tribal connections to the river and their rights within the waterway. The 2012 statement from Governor LePage's Attorney General Janet Mills ignored this history, and was influenced (perhaps financially) by outside corporate interests (Exxon Mobil?) seeking to build a pipeline/East-West Corridor through Maine to carry oil from the Alberta Tar Sands.

The Tribe viewed the 2012 statement as an act of aggression and a taking of tribal land.

What can people do?

- Write letters to the Attorney General's office and legislators indicating that the State is not acting on your behalf.
- Understand the history of federal trust responsibility toward the Tribes, outlined in the U.S. Constitution, 1983 Indian Policy, and Maine v. Johnson.
- Find a way to change our language from one of commodity to different values of nature.